

METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

1932

JUNE

Part 6

I.—PROPERTIES OF METALS

(Continued from pp. 289-293.)

The Effect of Cold-Work on the Physical Properties of Aluminium, with Special Reference to its Specific Electrical Resistance. Gilbert Greenwood (*Z. Krist.*, 1931, 80, 481-494).—[In English.] The electrical resistance of aluminium is increased by cold-working. The normal value is resumed on re-annealing, 10 minutes at 250° C. being sufficient. Annealing at higher temperatures causes another increase in the resistance, probably due to recrystallization of the metal accompanied by the production of cracks. The breaking-stress of aluminium is increased by cold-working and decreased by annealing. Little decrease is obtained by annealing above 250° C. X-ray photographs showed that the fibrous texture of cold-drawn aluminium wire is the more marked the greater the amount of cold-working. Recrystallization sets in when the wires are annealed at about 250° C., although it is far from complete in wires annealed at 350° C. The fibrous texture is very persistent and can be detected in wires annealed at 350° C. Further cold-working of the recrystallized wires breaks up the large grains and produces a new fibrous texture in which the micro-crystals are arranged with the [100] direction parallel to the fibre axis (instead of [111] as formerly). The production of this new texture is more marked the higher the temperature of annealing. X-ray photographs confirm previous observations that the cold-working of aluminium does not cause blurring of the doublets, but lattice distortions approximating to the vitreous phase of Beilby may occur.—E. S. H.

Effects of Strain-Hardening on the Mechanical Properties of Aluminium and its Alloys. W. C. Aber (*Metal Stampings*, 1932, 5, 169-172, 204-205).—The various factors which effect the strain-hardening of aluminium and aluminium alloys and the influence of strain-hardening on their mechanical properties are described and illustrated by graphs. An example of the effects of cold-working on the mechanical properties of this class of material is as follows:

Temper.	Approximate Reduction of Area by Cold-Working %.	Tensile Strength. Lb./in. ² .	Yield-Strength. Lb./in. ² .	Elongation on 2 in. %.	Brinell Hardness.
<i>Commercially-Pure Aluminium (99%).</i>					
Soft	0	13,000	4,000	35	23
Half-hard	37	17,000	14,000	7	32
Hard	75	24,000	21,000	5	44
<i>Aluminium-Manganese Alloy (1.25% Mn).</i>					
Soft	0	16,000	5,000	30	28
Half-hard	37	21,000	18,000	6	40
Hard	75	29,000	25,000	4	55

—J. H. W.

Beryllium. Alfred Stock (*Electrochem. Soc., Preprint*, 1932, Apr., 451-468).—A short account of recent work on the development of the Siemens & Halske process for the production of metallic beryllium and on its properties, alloys, and analytical chemistry.—A. R. P.

Bismuth: Its Recovery and Uses. Anon. (*Metallbörse*, 1931, 21, 2025-2026, 2057, 2089-2090, 2138).—A review of the metallurgy, properties, and uses of bismuth.—A. R. P.

The Atomic Heat of Bismuth at Higher Temperatures. L. G. Carpenter and T. F. Harle (*Proc. Roy. Soc.*, 1932, [A], 136, 243-250).—The following respective values of C_p and C_v , the atomic heats (cals.) of solid bismuth (purity 99.986%) have been found at the respective temperatures stated (in ° abs.) to be: 300°, 6.15, 6.08; 350°, 6.31, 6.22; 400°, 6.46, 6.35; 450°, 6.60, 6.48; 500°, 6.73, 6.60; 540°, 6.83, 6.70. Values found for C_p for liquid bismuth are as follows: 545.6°, 7.217; 546.2°, 7.200; 558.0°, 7.172; 576.8°, 7.148; 577.6°, 7.203; 600.2°, 7.119; 601.2°, 7.076; 643.1°, 6.971; 644.1°, 6.995. The value of C_v exceeds the Debye maximum (3R) at all temperatures above about 260° abs. At the melting point this excess is more than 10%. The variation of C_p with temperature is, for solid bismuth, very nearly linear above about 300° abs.—J. S. G. T.

Hardness of Chromium as Determined by the Vickers-Brinell, Bierbaum, and Mohs Methods. Richard Schneidewind (*Trans. Amer. Soc. Steel Treat.*, 1931, 19, 115-132.—See *J.*, this volume, p. 67, and following abstract.—S. G.

Discussion on Schneidewind's paper on "Hardness of Chromium as Determined by the Vickers-Brinell, Bierbaum, and Mohs Methods." W. Blum. C. Bierbaum (*Trans. Amer. Soc. Steel Treat.*, 1931, 19, 132-140).—Cf. preceding abstract. W. Blum points out that there is no simple relation between any hardness measurements and resistance to wear. Although, since wear implies abrasion, the scratch test should be a better criterion than the Brinell, even the former is not an accurate indicator of wear-resistance. Herschmann's results on deposited chromium are quoted. C. Bierbaum contests many of the author's points. He lays particular stress on the fact that the testing of hardness by indentation methods depends on the production of symmetrical impressions, their application to purely homogeneous material, and the recognition of the effect of crystal orientation. B. does not agree that chromium plate softens when heated to 525°-555° F. (275°-299° C.). Several contributors point out that none of the present methods of testing the hardness of such plate is really reliable.—W. A. C. N.

On the Transformation of Cobalt. G. Wassermann (*Metallwirtschaft*, 1932, 11, 61-65).—Cold-rolled cobalt (containing nickel 1.94, iron 1.84, manganese 0.64%) has a rolling texture corresponding with that of other hexagonal metals, the hexagonal axes of the crystallites being in the plane of the normal to the sheet and the direction of rolling at an angle of 20° to the normal with considerable scattering. Above 450° C. hexagonal cobalt changes into the cubic modification which remains stable on cooling, and can be converted back into the hexagonal form only by rolling or recrystallization. X-ray examination on single crystals shows that the transformation takes place by simple displacement in the following way: slip plane $[0001] = (111)$; direction of slip $[10\bar{1}0] = (112)$, degree of slip = 0.7055. Thus from a single cubic crystal hexagonal crystals may be produced in 4 positions which are regularly grown into one another. The second transformation point at 1015° C. reported by Hendricks, Jefferson, and Shultz could not be confirmed.—v. G.

Cracking of Specimens of Copper [Sheet] for Furnaces in Hot-Bending Tests. W. O. Hagen-Torn (*Metallurg (The Metallurgist)*, 1931, 6, (2), 168-173).—[In Russian, with photomicrographs.] The causes of numerous failures of copper sheets to pass the hot-bending tests are examined. The standard method of testing is to notch at the edge of the sheet a narrow specimen strip, which is thus subjected to the same thermal treatment as the rest of the metal, and then separated and tested for cold- and hot-bending. Although the former test is almost invariably satisfactory, numerous cases of cracking occur in the hot test. This is considered to be due solely to the defective and uneven application of heat-treatment to the specimen strips, which are not regarded as representa-

tive of the main mass of the sheet. This conclusion is based on determinations of the distribution of antimony and cuprous oxide, since a sufficiently high content of these is known to cause cracking, and also on examinations of the microstructure.—M. Z.

Investigations on the Rigidity of Copper. I. E. Gorshkov and W. O. Hagen-Torn (*Metallurg (The Metallurgist)*, 1931, 6, (2), 173-176).—[In Russian.] At constant temperature the rigidity of copper increases linearly with the cuprous oxide content up to 2.5%. The effect of temperature on the rigidity is greater than that of oxygen; thus the rigidity of copper may alter by as much as 20-25% between the commencement of the rolling process (930° C.) and its end (about 650° C.), although the most rapid rise in rigidity is between 1000° C. and 930° C. Copper with 0.28% of cuprous oxide requires as much power in rolling at 750°-770° C. as copper with a low oxygen content at 650° C. Fractures in the rolled sheet are definitely ascribed to temperature effects, and not to the presence of cuprous oxide.—M. Z.

Solution Velocities on Different Faces of Single Copper Crystals. R. Glauner and R. Glocker (*Z. Krist.*, 1931, 80, 377-390; *C. Abs.*, 1932, 26, 1840).—Various faces of copper crystals were exposed to the action of different solvents (chiefly inorganic and organic acids) and the relative quantities of material dissolved were determined. For most solvents the (111) face has the greatest, and the (100) face the least solubility. In the homologous series acetic-propionic acid, the (111) face is the least soluble. The influence of impurities is discussed.—S. G.

The Rate of Diffusion of Copper in Gold. W. Jost (*Z. physikal. Chem.*, 1932, [B], 16, 123-128).—Copper wires were gilt electrolytically, then annealed under various conditions and the change in the lattice constants of the surface was determined by means of X-rays. The results show that the diffusion constant, D , in c.g.s. units varies with the temperature, T , according to the expression: $D = 91e^{-27400/RT}$.—v. G.

The Surface Tension of Gold Lamellæ. G. Tammann and W. Boehme (*Ann. Physik.*, 1932, (v), 12, 820-826).—Electrolytically prepared gold foils were stretched between 2 rods and their shrinkage on heating was determined. Shrinking becomes noticeable at 200° with foil 0.2 μ thick and at 600° C. with foil 0.8 μ thick. The shrinking temperature of gold foil prepared by heating is 200° C. higher owing to its different structure and probably also to a content of 2% silver. At constant temperature shrinkage proceeds rapidly at first, then more slowly, and finally ceases after about 15 minutes. The initial rate of shrinkage increases with rise of temperature and with decreasing thickness. From determinations of shrinkage under different loads the surface tension of gold is calculated as 1.23 gm./cm. at 700° C., 1.18 gm./cm. at 850° C., and (by extrapolation) 1.12 gm./cm. at the melting point, i.e. about 1% higher than that found by Sauerwald and Krause for molten gold.—v. G.

On the Supposed Allotropy of Lead. Washiro Eda (*Kinzoku no Kenkyu*, 1932, 9, (3), 125-130).—[In Japanese.] See abstract from English source, *J.*, this volume, pp. 211-212.—S. G.

Thermoelectric Forces of Lead and Tin at Liquid Helium Temperatures. W. H. Keesom (*Pontificia Acad. Sci. Nvri Lymcaei, Sci. Nuncius Radio-phonica*, 1931, (7), 5-6; *C. Abs.*, 1932, 26, 1843).—[In Latin.] The c.m.f. between lead and silver is 0 at 1.7° K., and the c.m.f. between tin and silver is 0 at 4.8° K. At these temperatures the Thomson effect for lead and tin decreases and rapidly reaches zero.—S. G.

Determination of the Heat of Dissociation of Fluorine and of the Latent Heat of Vaporization of Lithium. Manohar S. Desat (*Proc. Roy. Soc.*, 1932, [A], 136, 76-82).—Using data relating to the absorption spectrum of lithium fluoride and employing Born and Franck's equation, the value 29.4 kilo-cal./gram. atom is found for the latent heat of evaporation of lithium.—J. S. G. T.

The Evolution of Gas from Nickel on Heating (Experimental Part). S. W. Pfitzryn and L. M. Fink (*Zhurnal eksperimentalnoy i teoreticheskoy Fiziki (Journal of Experimental and Theoretical Physics)*, 1931, [A], 1, (5), 251-258).—[In Russian.] See also Grinberg, J., this volume, p. 343. The relation between the rate of gas evolution and the duration and temperature of heating and the thickness of the specimen have been studied for the case of nickel heated in a vacuum. The heating time is directly proportional to the logarithm of the volume of gas evolved, the resulting curves being termed the "vacuum characteristics." The velocity of degassing, i.e. the angle of these curves, is inversely proportional to the square of the thickness of the specimen and depends on the temperature of heating.—N. A.

Changes in the Electrical Resistance of Magnetostrictive Metals in Magnetic Fields—II. [Nickel.] Tullio Gnesotto (*Atti R. Istituto Veneto Sci., Lettere, Arti*, 1931, 90, 1153-1163; *Chem. Zentr.*, 1932, 103, I, 1882).—In the first section (*ibid.*, 1929, 89, II, 31) it was shown that the electrical resistance of nickel in a transverse magnetic field first falls to a minimum at 200 gauss, then rises to a maximum at 700 gauss, and finally falls abruptly to a value below that in zero field at above 900 gauss. In the present paper the effect of a longitudinal field has been investigated. The change in resistance, $\Delta R/R_0$ is 0.013383 Ω at 550 gauss and 0.020727 Ω at 2200 gauss; the rising and falling curves in cyclic magnetization do not intersect, i.e. hysteresis effects occur. The behaviour of iron has also been investigated.—A. R. P.

Influence of Mechanical Deformation on the Curie Point of Nickel, and on the Relation between its Magnetization and Temperature. V. I. Gaponov (*Vestnik Eksptl. teoret. Elektrotekh.*, 1930, (2/3), 29-33; *C. Abs.*, 1932, 26, 1488).—[In Russian.] The displacement of the Curie point under a pull of 38 kg./mm.² is smaller than 0.3°, which is obviously in contradiction to Weiss' formula. A series of curves is given showing the effect of deformation on the relation between magnetization of nickel and temperature.—S. G.

Some Thermomagnetic Effects in Nickel and Iron. Shih-Chen T'ao and William Band (*Proc. Phys. Soc. (Lond.)*, 1932, 44, 166-170).—Relates to the production of an e.m.f. in nickel and iron wires by the simultaneous application of a longitudinal magnetizing field and a temperature gradient. This e.m.f. has been measured for various fields and temperatures.—S. G.

Reactions at the Surface of Hot Metallic Filaments. I.—The Reaction $\text{CO}_2 + \text{H}_2 \longrightarrow \text{H}_2\text{O} + \text{CO}$ on Platinum. B. S. Srikantan (*J. Indian Chem. Soc.*, 1929, 6, 931-947; *Brit. Chem. Abs.*, 1930, [A], 550-551).—With the object of accounting for the imperfect reproducibility of the results of Prichard and Hinshelwood (*J. Chem. Soc.*, 1925, 127, 806), the reaction between carbon monoxide and hydrogen at the surface of a hot platinum wire has been reinvestigated, using better temperature control and testing the drift in the activity of the wire. The reaction starts with a high velocity, but this falls rapidly to a low and steady value, owing to the poisoning of the more active centres on the surface by the carbon monoxide formed thereon. Heating the wire in a vacuum for a long time almost eliminates the initial fall in reaction velocity, but the wire is very considerably deactivated. The granular parts of the surface, containing the active centres, are probably sintered during this process, leaving a less active surface. Comparative experiments with platinum wire scratched with emery show that a rough surface is more active than a smooth or sintered one. Nitrogen acts merely as an inert diluent, and does not affect the reaction rate. The velocity coeff. of the reaction rises by about 2.5 times for a rise of temperature of 80° C. at about 1000° C., indicating a heat evolution of about 38,000 gm.-cal.—S. G.

Reactions at the Surface of Hot Metallic Filaments. II.—The Reaction $\text{H}_2 + \text{CO}_2 \longrightarrow \text{CO} + \text{H}_2\text{O}$ on Platinum-Iridium Alloys. B. S. Srikantan (*J. Indian Chem. Soc.*, 1929, 6, 949-958; *Brit. Chem. Abs.*, 1930, [A], 551).—A

platinum-iridium alloy containing 30% iridium is the most catalytically active of these alloys for the carbon dioxide-hydrogen reaction, but the activity cannot be correlated with the composition of the alloys because a 5% alloy is more active than either a 10% or 15% alloy. The heat of activation is 36,000 grm.-cal. with a 5% alloy between 870° and 930° C., whilst with a 15% alloy it is 83,000 grm.-cal. over the range 895°-935° C. and 43,000 grm.-cal. between 935° and 975° C. As in the case of platinum wires, after prolonged high-temperature treatment the alloy wires become sintered and lose their activity considerably. With higher proportions of iridium (25% and 30%) there is superimposed on this effect a strong and irreversible adsorption of the carbon monoxide on the surface; with a 20% alloy this can be partly expelled from the surface by heating in a vacuum.—S. G.

Reactions at the Surface of Hot Metallic Filaments. III.—The Reaction $\text{CO}_2 + \text{H}_2 \rightarrow \text{H}_2\text{O} + \text{CO}$ on Platinum Coated with Barium Oxide. B. S. Srikantan (*J. Indian Chem. Soc.*, 1929, 6, 959-967; *Brit. Chem. Abs.*, 1930, [A], 551).—The active catalyst in the reaction between carbon dioxide and hydrogen on a platinum wire coated with barium oxide is a complex of barium carbonate and barium oxide. The temperature coeff. of the reaction is 1.18 over the temperature range 612°-769° C., and 1.08 over the range 769°-826° C., the corresponding energies of activation being 27,000 grm.-cal. and 15,000 grm.-cal., respectively. The reaction is unimolecular. Carbon dioxide is readily adsorbed by the surface, and the rate of reaction rises with the carbon dioxide present up to a partial pressure of 300 mm., whereas excess hydrogen diminishes the rate of reaction. With either gas in excess the velocity of reaction increases gradually to a certain point, after which constant velocity coeff. are obtained. No explanation is offered for this circumstance.—S. G.

Rhenium. William F. Meggers (*Sci. Monthly*, 1931, 413-418).—A review.—S. G.

Some Experiments with TiN. Usaburō Kawaguti (*Kinzoku no Kenkyū*, 1932, 9, (3), 131-138).—[In Japanese.] Dried ammonia has been passed over metallic titanium and its dioxide at the range of temperature 800°-1200° C. The reaction product was analyzed chemically and from the result it has been proved that TiN is formed. By fusing the nitride thus prepared with a fusing mixture, it has been found that soluble cyanide is formed in spite of the absence of free carbon. It seems that TiN acts as a reducing agent in the fusion above mentioned. TiN begins to be oxidized by heating in the open air at about 450° C. to form its dioxide.—S. G.

Reactions at the Surface of Hot Metallic Filaments. IV.—The Reaction $\text{CO}_2 + \text{H}_2 \rightarrow \text{H}_2\text{O} + \text{CO}$ on Tungsten and Thoriated Tungsten. B. S. Srikantan (*J. Indian Chem. Soc.*, 1930, 7, 745-757; *Brit. Chem. Abs.*, 1930, [A], 1531).—The reaction between carbon dioxide and hydrogen at a tungsten surface maintained at 965° C. has a unimolecular velocity coeff. of 0.00046 at a total pressure of 204 mm. The temperature coeff. of the reaction falls from 1.18 at 965°-1080° C. to 1.03 at 1100°-1280° C., and the heat of activation from 54 to 9.7 kg.-cal. The reaction velocity increases rapidly with increase of the hydrogen pressure from 100 to 500 mm. At pressures below 200 mm. the tungsten surface becomes saturated with carbon dioxide, and increase of the carbon dioxide pressure beyond this point does not influence the velocity of the reaction, except in as far as a slight displacement of hydrogen from the surface occurs. The reaction is brought about by the independent adsorption of the two gases, and involves the rapid consecutive reactions: $\text{CO}_2 + 4\text{H}_2 \rightarrow \text{CH}_4 + 2\text{H}_2\text{O}$, $\text{CH}_4 + \text{CO}_2 \rightarrow 2\text{CO} + 2\text{H}_2$, and possibly also in the presence of an excess of hydrogen the slow reaction $\text{CO} + 3\text{H}_2 \rightarrow \text{CH}_4 + \text{H}_2\text{O}$, since methane is found among the products to the extent of about 8% towards the end of the reaction. The tungsten surface becomes pitted during the reaction, due probably to volatilization of tungsten as

carbonyl, but it is possible that surface complexes are formed and subsequently decomposed.—S. G.

The Burning-Out of Filaments Heated in Vacuo. Leopold Pránsnik (*Z. Physik*, 1932, 75, 417-420).—The theory developed in a previous paper is extended [*Z. Physik*, 1931, 72, 86-94; see *J.*, this volume, p. 3] and applied to the numerical calculation of factors relating to the burning-out of tungsten wires heated *in vacuo*.—J. S. G. T.

The Effects of Heat-Treatment on Fine Metallic Suspensions [used in Galvanometers, &c.]. N. N. Zirbel (*Physics*, 1932, 2, 134-138).—The equilibrium position of a system suspended by a fine wire changes slowly for a long time after the load is applied. The equilibrium position also changes with temperature. It is found that both these undesirable disturbing factors can be eliminated by suitable heat-treatment of the wire. Observations have been made of the effect of heat-treatment in the case of wires of tungsten and platinum-iridium alloy suitable for use in the Eötvös torsion balance.—J. S. G. T.

Fault-Like Translation of Zinc Crystals. E. Schmid and M. A. Valouch (*Z. Physik*, 1932, 75, 531-538).—The extension of pure zinc crystals under comparatively small loads, so that the extension is of the order of up to about 10%, is found to be a discontinuous phenomenon, the tension-extension curve being characterized by a number of step-like discontinuities. The phenomenon is conceived to be of the nature of a relaxation effect, and is dependent on the inclination of the crystallographic axis (basic) to the direction of application of the load. The effect is not observed at the temperature of liquid air, and is not a surface effect.—J. S. G. T.

Suitability of Zinc and Zinc Alloys for Chemigraphical Purposes. R. E. Bartuska and E. Zalesiński (*Przegląd Techniczny*, 1931, 70, (35-36), 540-546).—See abstract from another source, *J.*, this volume, p. 148.—Z. J.

Influence of Small Amounts of Impurities on the Properties of Refined Zinc. O. Bauer [and P. Zunker] (*Met. Ind. (Lond.)*, 1931, 39, 613).—Abstract of a paper read before the Deutsche Gesellschaft für Metallkunde. See this *J.*, 1931, 47, 260, 514.—J. H. W.

Crystalline Metal. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1932, 8, 33-34).—A comment on practical misconceptions of the nature of metals and questions concerned with fatigue.—R. G.

Chemical and Mechanical Actions. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1932, 8, 50-51).—A discussion of recent discoveries, pointing out that in every mechanical action which is known to result in the ultimate destruction or deterioration of structures or machines, it becomes important to look for possible chemical factors, and that there is the prospect of eliminating such factors for the improvement of the durability of metals.—R. G.

Regularities in Fatigue Fracture. A. Thum and H. Oschatz (*Z.V.d.I.*, 1932, 76, 132-134).—The fracture in failure by fatigue runs along a perpendicular to the stress lines at the point at which they converge. This rule has been confirmed by observations on several differently shaped constructional parts.—v. G.

Structural Variations [of Metals] on Complete Fracture. U. Dehlinger (*Light Metals Research*, 1931, 1, (3), 14-16).—A translation from *Metallwirtschaft*, 1931, 10, 26-28. See this *J.*, 1931, 47, 196.—J. C. C.

Recent Researches on Plasticity.—II. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1932, 8, 35-37).—A continuation of the review of the subject, dealing with the theory of von Mises, the work of Nádai, and of Taylor and Quinney. Cf. *J.*, this volume, p. 216.—R. G.

Structure, Strength, Stability. W. Kuntze (*Mitt. Material, Sonderheft* 17, 1931, 48-52).—See this *J.*, 1931, 47, 328.—S. G.

The Time-Law of the Softening of Deformed Metals. F. Sauerwald [with W. Scholz and W. Globig] (*Z. Elektrochem.*, 1931, 37, 531-534; discussion,

534).—Abstract of paper read before the Deutschen Bunsen-Gesellschaft für angewandte physikalische Chemie. See *J.*, this volume, p. 6.—J. H. W.

On the Attack of Metals by Insects.—II. O. Bauer and O. Vollenbruck (*Mitt. Material, Sonderheft 18*, 1931, 1).—See this *J.*, 1931, 47, 330.—S. G.

Occlusion of Hydrogen in Metals. T. Franzini (*Pontificia Acad. Sci., Novi Lyncei, Sci. Nuncius Radiophonicus*, 1931, (4), 5; *C. Abs.*, 1932, 26, 1843).—[In Latin.] Hydrogen occluded in metals is ionized.—S. G.

On the Problem of the Evolution of Gas from Metals during Heating. G. A. Grinberg (*Zhurnal eksperimentalnoy i teoreticheskoy Fiziki (Journal of Experimental and Theoretical Physics)*, 1931, [A], 1, (5), 245–250).—[In Russian.] The diffusion of adsorbed gases and their evolution from a surface have been studied in the case of the plate and the cylinder. Expressions have been deduced from experimental data for the calculation of the coeff. of diffusion of gases through metals. See also Ptitzyn and Fink, *J.*, this volume, p. 340.—N. A.

The Electrical Properties of Thin Metal Layers Obtained by the Method of Cathode Dispersion. J. Maslakovetz (*Zhurnal Tehnicheskoy Fiziki (Journal of Technical Physics)*, 1931, [B], 1, (5), 410–427).—[In Russian.] Thin films obtained by cathode dispersion have a porous structure due to occlusion of gas, which causes intumescence of the films and formation of ridges on contact with liquids. Heating removes the gases, and the films then no longer intumescence, but undergo a change in their electrical and mechanical properties. The sharpest changes occur at 165°–175° C., when a vigorous evolution of gas takes place with an increase in density. The experiments were carried out with platinum, gold, silver, copper, and nickel.—N. A.

Mechanism of the Removal of Gases in Metals and Alloys. Hideo Nishimura (*Suiyokai-Shi (Transactions of the Mining and Metallurgical Alumni Association)*, 1931, 6, 503–510, 605–615, 691–692; *C. Abs.*, 1932, 26, 1553).—[In Japanese.] N. makes 2 classifications of the gases absorbed in metals, i.e., the actual gases dissolved in metals and the combined forms as oxides, nitrides, &c. Gases which do not dissolve completely in metals are effective for removing the gases in metals, and the deoxidizing elements must form volatile compounds or immiscible liquids to remove the combined gases. N. discusses the chemical affinity of gases for metals from a thermodynamical point of view. Such a calculation, without experiment, is insufficient to show the mechanism of the removal of gases in metals and alloys.—S. G.

On Melting Under Pressure and a Contribution to the Value of Interpolation Formulæ. Ernst Jänecke (*Z. Physikal. Chem.*, 1931, [A], 156, (3), 161–175).—According to Tammann, when a metal is melted under gradually increasing pressure the change in volume on melting and the latent heat tend to become zero, but do not reach this value simultaneously. Van Laar has shown, however, that at an infinitely high pressure and at a definite limiting temperature both these functions become zero. J. has constructed pressure-melting point curves based on the work of Bridgman and Simon; these curves are considered as equilateral rectangular hyperbolæ and give the required limiting temperature. Pressure-change of volume on melting curves can be extrapolated to zero, but pressure-change of latent heat curves can be only arbitrarily extrapolated to zero.—B. Bl.

Needs of Refiners for Metals at High Temperatures.—I–II. E. S. Dixon (*Nat. Petroleum News*, 1931, 23, (26), 51–54; (27), 51–52, 54; *C. Abs.*, 1932, 26, 288).—See this *J.*, 1931, 47, 423.—S. G.

Diamagnetism of Free Electrons in Metal. P. Y. Chou (*Sci. Rep. Nat. Tsing Hua Univ.*, 1931, [A], 1, 1–7; *C. Abs.*, 1932, 26, 1507).—[In English.] The paper is entirely mathematical. The assumptions are made that (1) when there is no external magnetic field, the electrons in a piece of metal move about freely without mutual interaction except elastic reflection from the walls of the metal, and (2) when there is an external homogeneous magnetic

field the electrons move in quantized orbits. The Sommerfeld-Wilson quantum conditions are used to obtain the energies of these stationary states, and Boltzmann's law of distribution is applied. It is shown that "the diamagnetic susceptibility of free electrons inside a metal is zero."—S. G.

Further Experiments on the Magnetostriction of Cold-Drawn Wire. J. S. Rankin (*J. Roy. Tech. Coll. (Glasgow)*, 1932, 2, 587-589).—A continuation of earlier experiments (see this *J.*, 1931, 47, 264) and deals in more detail with the magnetostriction of wires, particularly mild steel wires, which have been subjected to progressive degrees of wire-drawing.—J. W. D.

Measurements Employing Liquid Helium. XIII.—Contact Resistance between Super- and Non-Super-Conductors. R. Holm and W. Meissner (*Z. Physik*, 1932, 74, 715-735).—The effect of surface contamination of metals is particularly marked at very low temperatures. Platinum can be practically freed from such contamination by heating *in vacuo*. Thereafter, a platinum contact behaves even at the very lowest temperatures in a purely metallic manner. A super-conducting contact can be effected between super-conductors of the same or different metals without the necessity for welding. This result was established for tin and lead. The incidence of the super-conducting state is marked by disappearance of the resistance attributable to surface contamination.—J. S. G. T.

Magnetic Permeability of Thin Iron Wires and of Iron Compounds in High-Frequency Weak Fields. K. Volkova (*Z. Physik*, 1932, 74, 388-395).—Measurements of the axial permeability of fine iron wires, powdered magnetite, ferro-silicon, and ferro-titanium in weak high-frequency electromagnetic fields of wave-lengths 90-111 m. indicate a linear relationship between the real and imaginary parts of the complex permeability characterizing the materials in such fields.—J. S. G. T.

The Dependence of the [Magnetic] Permeability of Iron Wires on the Field at High Frequency. Max Wien (*Physikal. Z.*, 1932, 33, 173-175).—Read before the Deutschen Physikalischen Gesellschaft. Experimental results relating to the dependence of the magnetic permeability of iron wires on the field strength and on the frequency of the field are briefly discussed.

—J. S. G. T.

The Calculation of the Magnetic Permeability of Wires, and the Origin of Apparent Bands in Magnetic Spectra. W. Arkadiew (*Z. Physik*, 1932, 74, 396-417).—Formulae for the calculation of the alternating current resistance and self-induction of ferromagnetic wires, applicable to the calculation of their true and apparent permeability and absorption of energy in alternating fields are obtained.—J. S. G. T.

Law of Change of the Hall Effect in a Magnetic Field. C. Bellia (*Z. Physik*, 1932, 74, 655).—The dependence of the Hall effect in metals on the strength of the magnetic field applied is deduced theoretically, and satisfactory agreement is found between the respective orders of magnitude of the effect derived from the theory and from experimental results.—J. S. G. T.

Change of Resistance and Magnetization at the Curie Point. Erno Englert (*Z. Physik*, 1932, 74, 748-756).—Experimental results relating to pure nickel (Curie point 359° C.) and nickel alloyed with about 10% manganese (Curie point 209° C.) indicate that, in the neighbourhood of the Curie point, the change in electrical resistance due to a magnetic field is proportional to the square of the intrinsic magnetization produced by the field, *i.e.*, is proportional to magnetic energy produced. There is a close relationship between the decrease of resistance at the Curie point and the decrease produced by spontaneous magnetization at lower temperatures.—J. S. G. T.

Thermoelectric Properties and Ferromagnetism. J. G. Dorfman, R. I. Jaanus, K. W. Grigorow, and M. G. Czernichowski (*Zhurnal eksperimentalnoy i teoreticheskoy Fiziki (Journal of Experimental and Theoretical Physics)*, 1931,

[A], 1, (4), 155-163).—[In Russian.] Cf. this *J.*, 1931, 47, 479. A mathematical expression in an earlier paper and the deductions drawn therefrom are corrected.—N. A.

On the Interpretation of some Ferromagnetic Phenomena. Francis Bitter (*Phys. Rev.*, 1932, [ii], 39, 337-345).—In abstract. An account of recent work on ferromagnetism with special reference to the effect of temperature on the magnetization of iron, nickel, cobalt, pyrrhotite, and magnetite.—W. H.-R.

Barkhausen Effect: Orientation of Magnetization in Elementary Domains. Richard M. Bozorth (*Phys. Rev.*, 1932, [ii], 39, 353-356).—In abstract. A summary of the work of B. and Dillinger (*Phys. Rev.*, 1930, [ii], 35, 733; see this *J.*, 1930, 44, 475; *Phys. Rev.*, 1931, [ii], 38, 192; see *J.*, this volume, p. 74) and its interpretation in view of Akulov's theory (*Z. Physik*, 1931, 67, 794; this *J.*, 1931, 47, 265).—W. H.-R.

Further Experiments on the Propagation of Large Barkhausen Discontinuities. K. J. Sixtus and L. Tonks (*Phys. Rev.*, 1932, [ii], 39, 357-358).—In abstract. The authors' formula (*Phys. Rev.*, 1931, [ii], 37, 930; see this *J.*, 1931, 47, 371) for the time of penetration of a large travelling Barkhausen discontinuity has been recalculated on the assumption that at each point on the discontinuity in the wire the resultant of the impressed field H , and the eddy current field is the critical field H_0 . The equation then reads $\delta t = 3.94 \times 10^{-8} a^2 \Delta I / \rho (H - H_0)$, where a is the radius of the wire, ΔI the change in induction, and ρ the specific resistance. This is not confirmed experimentally, but if $0.031 a$ is substituted for a^2 the equation is fairly satisfactory. The behaviour of etched wires has been examined as regards the propagation of discontinuities, and for a circular field which was applied by sending a current through the wire under torsion with and without tension. In each case variations were observed and are probably the result of surface cracks.

—W. H.-R.

Magnetization and Thermal E.M.F.'s. S. R. Williams (*Phys. Rev.*, 1932, [ii], 39, 368).—Brief abstract. Temperature readings by thermocouples in magnetic fields may be misleading, because a number of metals are displaced in the thermo-electric series by a magnetic field. The results in connection with the thermal e.m.f. between transversely and longitudinally magnetized wires have been published by Seass (*Phys. Rev.*, 1931, [ii], 38, 1254; see *J.*, this volume, p. 73).—W. H.-R.

Magneto-Strain and Magneto-Resistance. L. W. McKeehan (*Phys. Rev.*, 1932, [ii], 39, 368-371).—In abstract. At temperatures far below the Curie point, the magneto-strain and magneto-resistance effects in ferromagnetics are anisotropic, and it is concluded that the effects are due to the re-orientation of elements of atomic or sub-atomic dimensions. In the neighbourhood of the Curie point, the conspicuous magneto-strains and magneto-resistances are isotropic. By assuming the atoms of the ferromagnetic metal to have as nearly as possible the symmetry of their crystals, a scheme of magnetization is suggested, and illustrated diagrammatically.—W. H.-R.

On the Verification of the Theory of Magnetization of Single Crystals. Francis Bitter (*Phys. Rev.*, 1932, [ii], 39, 371-375).—In abstract. Cf. Bitter, *Phys. Rev.*, 1931, [ii], 38, 534. The results of the theoretical equations for the magnetization curves of single crystals are compared with observations for iron, cobalt, and pyrrhotite. The conclusion reached is that the theory represents the main features of the deviation effect in crystals, but that certain departures from symmetry are found in some substances. Studies of magnetization of single-crystals in large fields in the region of the axes of difficult magnetization should supplement studies of initial susceptibility, since both quantities depend on the distribution of magnetized regions among minima of $E_{0,H}$ (the potential energy per unit volume) differing only slightly in depth.

—W. H.-R.

Theory of the Exchange Problem and the Phenomenon of Remanence Exhibited by Ferromagnetic Materials. F. Bloch (*Z. Physik*, 1932, 74, 295-335).—A wave-mechanics theory of hysteresis and remanence phenomena, based on Slater's treatment of the problem of many bodies, is developed.

—J. S. G. T.

Secondary Electronic Emission from Nickel and Ferromagnetism. P. Tartakowsky and W. Kudrjawzewa (*Z. Physik*, 1932, 75, 137-142).—A discontinuity is observed in the secondary electronic emission from nickel at the Curie point (358° C.). This result associates the phenomenon of ferromagnetism with the conducting electrons.—J. S. G. T.

Theory of the Magnetization Curves of Isotropic Ferromagnetic Materials in Medium and Strong Fields. R. Gans (*Physikal. Z.*, 1932, 33, 15-17).—Heisenberg's theory of magnetization is developed and applied, in this preliminary communication, to determine the form of the magnetization curve of isotropic materials in medium and strong fields. The theory is applied to determine the "anisotropy point" discussed by Akulov (*Physikal. Z.*, 1931, 32, 107-108; see this *J.*, 1931, 47, 198) with satisfactory results in the case of nickel which is characterized by a face-centred cubic lattice.—J. S. G. T.

II.—PROPERTIES OF ALLOYS

(Continued from pp. 294-299.)

The Ternary System Aluminium-Magnesium-Silicon. L. Losana (*Metalurgia italiana*, 1931, 23, 367-382; *Chem. Zentr.*, 1932, 103, I, 1425).—The ternary system has been investigated by thermal analysis of 150 alloys using 99.79% aluminium, 99.74% magnesium, and 99.40% silicon. The ternary eutectic contains 5.5% magnesium, 14% silicon at 559° C. The limiting solid solubilities at the melting point are: in aluminium, 10% magnesium and 1.8% silicon; in magnesium, 5-6% aluminium and 1.5% silicon; in silicon 5% aluminium and 5-6% magnesium. All these solid solutions decompose with fall in temperature. Silicon increases slightly the hardness of magnesium-rich alloys and even as little as 0.5-1% magnesium makes alloys of the Silumin type brittle.—A. R. P.

A Corrosion-Resistant Aluminium Alloy [Aluminium AW 15]. Hans Wolf (*Chem. Fabrik*, 1931, 4, 493-494).—The following table shows the properties of the alloy "Aluminium AW 15" compared with those of commercial aluminium:—

	Aluminium AW 15.		Commercial Aluminium.	
	Hard-worked.	Annealed.	Hard-worked.	Annealed.
Tensile strength, kg./mm. ²	26.0	11.8	19.5	8.0
Elongation on 2 in., %	3.0	27.0	2.4	34
Brinell hardness, kg./mm. ²	59	32	42	24
Reaction value Mylius oxidizing salt test	0.13	0.48	0.7	0.93

The alloy for which the above figures were obtained consisted of 99.5% aluminium with 2% manganese; when made from 99.8% aluminium the figures in the Mylius test were 0.05 for hard and 0.1 for soft metal. The alloy can be welded as readily as aluminium and in sheet form is suitable for deep-drawing, stamping, and pressing.—A. R. P.

Silumin [Alpax] Containing Copper. Namio Kawashima (*Suiyokai-Shi (Transactions of the Mining and Metallurgical Alumni Association)*, 1931, 6, 585-592; *C. Abs.*, 1932, 26, 1556).—[In Japanese.] The influence of copper up to 4% on the mechanical and chemical properties of Silumin has been studied. The hardness, density, and tensile strength of Silumin increased and the elongation decreased with increase of copper content. Copper gave good results in the testing of salt-water corrosion. When the alloy was quenched from 500° C. and 550° C., hardening was not marked at room temperature, but the mechanical properties were improved by ageing at 100°-150° C.—S. G.

Effect of Heat-Treatment on the Electrical Resistance and Mechanical Strength of Aluminium-Silicon Alloys Containing up to 2.5% of Silicon. L. Guillet and M. Ballay (*Aluminium Broadcast*, 1930, 2, (44), 5-13).—Translated from *Rev. Mét.*, 1930, 27, 398-403. See this *J.*, 1931, 47, 74.—J. C. C.

The Equilibrium Diagram of the Aluminium-Rich Aluminium-Tin-Nickel System. Shotaro Kato (*Suiyokai-Shi (Transactions of the Mining and Metallurgical Alumni Association)*, 1931, 6, 529-533; *C. Abs.*, 1932, 26, 1556).—[In Japanese.] The constitution of the aluminium-tin-nickel alloys containing tin up to 5% and nickel up to 10% was investigated by thermal and microscopic analyses to confirm their constituents. In the equilibrium diagram thus determined K. found a binary eutectic line liquid \rightleftharpoons Al + Al₃Ni, and a ternary eutectic point liquid \rightleftharpoons Sn + Al + Al₃Ni to occur at 270° C. at the tin corner.—S. G.

Experiments on the Ageing and Tempering of Duralumin. R. Hay (*J. Roy. Tech. Coll. (Glasgow)*, 1932, 2, (4), 601-608).—A series of experiments was carried out in which changes in resistivity and Brinell hardness of Duralumin at different temperatures were investigated, the determinations being made at close intervals of time. During age-hardening at least two independent phenomena occur. At low temperatures a gradual but uniform change in the properties takes place, which is accounted for by the deposition of the particles of the separating phase in a highly disperse state, and as the separating phase consists of aggregates of several molecules, diffusion must have occurred, and all the observed phenomena can be accounted for by the concentration of the separating phase at the grain boundaries without actual precipitation occurring. The changes at higher temperatures involve either the gradual coalescence of the disperse particles or the gradual precipitation of the concentrated phase at the grain boundaries, and the experiments on tempering show that the latter factor takes place in a series of steps, rapidly attaining a stable condition for each tempering temperature. This stepped equilibrium is more difficult to explain by the coalescence theory than by the precipitation-at-the-grain-boundary theory. According to the latter, the increased temperature produces more rapid diffusion of the solute phase to the grain boundary, and so causes excessive concentration and precipitation of the excess material until a state of equilibrium is again attained, and a further increase in temperature upsets the balance, causing more solute to go to the boundaries and resulting in further deposition. During the first stage of tempering from 15° to 250° C., the separating phase is Mg₂Si and the rate of tempering is much greater than for the second stage, in which CuAl₂ is the separating phase. It is also shown that the tempering curves for Duralumin are similar to those found for steels and can be expressed by the same general equation.—J. W. D.

Elastic and Tensile Properties of Some Light Alloys. G. Colonnetti and G. M. Pugno (*Metallurgia italiana*, 1930, 22, 963-975; and (abstract) *Light Metals Research*, 1931, 1, (5), 15-17).—Elastic hysteresis curves were determined for the aluminium alloys Lualtal, Avional, and Anticorrodal, both in the rolled or drawn condition and after heat-treatment. Lualtal resembles nickel steel in its elastic behaviour, but the hysteresis curves for Avional and Anti-

corroding show anomalous features. During the first cycle, the deformation curve passes through a point of inflection, being at first concave, and later convex, to the axis of deformation. Then, as the force is decreased, the curve is concave instead of convex to this axis. During a second cycle, normal curves are obtained. Working restores the material to its original condition, removing excess deformation.—J. C. C.

Some Mechanical Properties of the Light Metals and Criteria for their Application. G. Guzzoni (*Light Metals Research*, 1931, 1, (11), 17).—An abstract from *L'Ingegnere. Riv. Tec. de sin. Naz. Fascista Ingegneri*. Comparisons are made between various aluminium, magnesium, and copper alloys and soft steels on the basis of (a) tensile strength-sp. gravity ratios; (b) elastic limit-sp. weight ratios; (c) elastic limits; (d) limiting creep tests; (e) moduli of elasticity (with particular reference to the buckling strengths of columns).—J. C. C.

The Notch Strength of Some Aluminium Alloys, Especially at Low Temperatures. W. A. Güldner (*Light Metals Research*, 1931, 1, (4), 2-8).—Translated from *Z. Metallkunde*, 1930, 22, 257-260, 412-416. See this *J.*, 1930, 44, 481-482.—J. C. C.

A Dilatometric Study into the Structural Changes in Light Alloys Due to Heat-Treatment. Albert Portevin and Pierre Chevenard (*Aluminium Broadcast*, 1930, 2, (41), 12-27).—Translated from *Rev. Mét.*, 1930, 27, 412-437. See this *J.*, 1931, 47, 73.—J. C. C.

Improvements in Properties and Treatment of Metallic Alloys. Léon Guillet (*Aluminium Broadcast*, 1930, 2, (44), 14-17).—A lengthy résumé of the section on aluminium alloys, of a paper published in *Rev. Mét.*, 1930, 27, 449-466. See this *J.*, 1931, 47, 79-80.—J. C. C.

D.V.L. Research [on Aluminium Alloys]. Anon. (*Light Metals Research*, 1931, 1, (6), 14-18).—The results of investigations on light alloys concluded during 1930 by the Deutsche Versuchsanstalt für Luftfahrt, Aldershof, are briefly summarized. (1) The mechanical and corrosion-resisting properties of Avional and K.S. Seewasser sheets were investigated. (2) The mechanical properties of Allautal were found to be little inferior to those of pure Lantal. (3) Short periods of heating at 140° C. were found to reduce the elongation while increasing the tensile strength of "improved" Duralumin. After heating for 24 hrs. the original values were re-attained. (4) The effect of length of test-piece in the tensile testing of sheet was determined. (5) Corrosion tests on Duralumin, Lantal, and Allautal, were carried out, the effect of artificial ageing of Lantal being determined, and other corrosion tests made on Elektron benzene tanks, riveted test-pieces, light metal pumps, and light metals protected by various anodic oxidation processes, by vulcanite, and by cadmium.—J. C. C.

Aluminium, Its Alloys and Some Applications. Anon. (*Metallurgia*, 1932, 5, 203-206).—The ores, methods of extraction, and properties of aluminium are briefly discussed. The various alloys of aluminium with copper, zinc, and silicon, together with the "Y" alloy, and the "R.R." alloys are considered in detail, and the composition of such alloys together with their sp. gr., yield-points, ultimate stresses, elongations, and Brinell hardnesses are given: some applications of the various alloys are considered, including body building and panelling in automobile work, the manufacture of pistons for engines, the use of steel-cored aluminium conductors in electrical work, the development of suitable alloys for ornamental work, the application of foil and sheets for protective purposes, and the increasing use of aluminium paint.—J. W. D.

Allautal (Alclad) and its Advantages. Anon. (*Light Metals Research*, 1931, 1, (3), 17-18).—A summary of a booklet issued by V. L. W., Bonn. The properties of the various grades of Allautal (aluminium-clad Lantal) are outlined, and notes given on forming, machining, and jointing it.—J. C. C.

Birmabright Aluminium Alloy. Anon. (*Aluminium Broadcast*, 1930, 2, (42), 19).—The mechanical properties of Birmabright, an alloy claimed to be particularly resistant to corrosion under marine conditions, are tabulated.

—J. C. C.

An X-Ray Investigation of the Bismuth-Antimony Alloys. E. G. Bowen and W. Morris-Jones (*Phil. Mag.*, 1932, [vii], 13, 1029-1032).—Annealed alloys of bismuth and antimony prepared in the usual manner are a mixture of 2 constituents, but Cook (see this *J.*, 1922, 28, 421) showed that they can be made homogeneous by maintaining them at a temperature above the melting point for a considerable time and then cooling very slowly. This conclusion is confirmed by an X-ray study of the crystal structures of the complete series. The change of lattice edge with composition is almost linear over the whole range of compositions.—J. S. G. T.

Calcium Improves Iron and Lead. C. L. Mantell and Charles Hardy (*Metal Progress*, 1932, 21, (4), 60-65).—Calcium is discussed as a deoxidizer (as in iron and steel production), a degasifying and reducing agent (as with copper), and as an alloying ingredient and bismuth-eliminator (as in the case of lead). The lead-calcium bearing alloys, with Pb_3Ca as the hardening constituent, are discussed, and the age-hardening lead-calcium cable-sheathing alloys are described. Since calcium in certain proportions produces light alloys of great brittleness, a method for the production of metal powders is available. The properties and production of metallic calcium are described.—P. M. C. R.

Alloys of Iron Research. X.—The Chromium-Iron Constitutional Diagram. [With Appendices: I.—X-Ray Examination of Chromium-Iron Alloys. H.—Mechanical Tests of Chromium-Iron Alloys.] Frank Adcock (with G. D. Preston and C. E. Webb) (*J. Iron Steel Inst.*, 1931, 124, 99-146; discussion, 147-149).—See *J.*, this volume, p. 13.—S. G.

Dilatometric Study of Chromium-Nickel-Iron Alloys. Vsevolod N. Krivobok and Maxwell Gensamer (*Min. and Met. Investigations Carnegie Inst. Technology, Bull. No. 102*, 1931, 1-23).—Reprint of *Amer. Inst. Min. Met. Eng. Tech. Publ. No. 434*, 1931, 1-23. See *J.*, this volume, p. 13.—S. G.

On the Copper-Rich Copper-Nickel-Silicon Alloys. E. Crepaz (*Metallurgia italiana*, 1931, 23, 711-716; *Chem. Zentr.*, 1932, 103, I, 1426-1427).—The solubility of silicon in copper is 6.7% at 750° C. and 2.7% at room temperature. The solid solubility of nickel and silicon in copper and the hardness of quenched and tempered copper-rich ternary alloys have been determined; there is a sudden increase in hardness when the atomic ratio of nickel to silicon is 2 : 1.

—A. R. P.

On the Chemical Composition of Prehistoric Bronzes. John Sebelien (*Chem.-Zeit.*, 1931, 55, 972-974).—Analysis of many ancient Egyptian and Babylonian "bronzes" are given; the oldest specimens are entirely free from tin, and S. considers this to be evidence that the "Bronze Age" was preceded by a "Copper Age" which began at about 4000 B.C. Tin is first found in bronzes of the XIIth Dynasty (circa 1200 B.C.).—A. R. P.

Special Brasses. (Conclusions). Léon Guillet (*Cuivre et Laiton*, 1932, 5, 31-32).—A summary of conclusions from a general study of the brasses. These conclusions differ but little from those which are well known to workers who are acquainted with the general trend of recent researches. It is pointed out that much work still remains to be done on the influence of deoxidants, the variation of mechanical properties with temperature, the influence of pressure on mechanical properties, the possibility of hot-working of certain α -brasses, and the relation which exists between corrosion and the mechanical and thermal treatment.—W. A. C. N.

The Reduction in Grain-Size of Aluminium Bronze by the Addition of Iron. Anon. (*Cuivre et Laiton*, 1932, 5, 41).—It is stated that iron, when present in small proportions in an aluminium-bronze alloy, promotes the formation of

fine crystal grains. The explanation given is that the aluminium causes a dissociation between the iron and the carbon, the copper eliminates the latter, leaving a ternary alloy which is very homogeneous and of extremely fine structure.—W. A. C. N.

Special Aluminium Bronzes Containing Zinc, Silicon, and Antimony. Armel Sévaut (*Aluminium Broadcast*, 1930, 2, (44), 3-4).—Translated from *Compt. rend.*, 1930, 190, 431-434. See this *J.*, 1930, 43, 457-458.—J. C. C.

Al-dur-bra [Aluminium Brass]. Anon. (*Aluminium Broadcast*, 1930, 2, (46), 7).—An abstract of a pamphlet issued by C. Clifford and Son, Ltd., Birmingham. See this *J.*, 1930, 44, 532.—J. C. C.

Nickel Bronzes. Anon. (*Nickel Bulletin*, 1932, 5, 49-56).—An account is given of the effect on the mechanical properties of adding up to 3 or 5% nickel to gear bronzes (upwards of 85% copper), "G-bronzo" (upwards of 82% copper, and 3.5-4% zinc), "Red Brass" (copper 81-84, zinc about 5, and lead about 6%), leaded bearing bronze (copper 75-78, lead 11.5%) and high-lead bearing bronze (copper 67-70, lead 20-25%). In general, the chief effects of adding nickel to these alloys are to increase their strength and toughness, and slightly to increase their melting points, fluidity, and density. It also tends to grain refinement and reduces segregation caused by lead-sweat. The applications of these alloys are set out and the mechanical properties of high-nickel bronzes are described.—J. H. W.

Galvanic Potentials of Lead-Gold Alloys. Franz Griengl and Robert Baum (*Sitzungsber. Akad. Wiss. Wien*, 1931, [2b], 139, 847-858).—See this *J.*, 1931, 47, 377.—A. R. P.

Iron-Mercury and Nickel-Mercury. Rudolf Brill and Walter Haag (*Z. Elektrochem.*, 1932, 38, 211-212).—As a continuation of the experiments described in Eva Palmäer's paper [*ibid.*, 1932, 38, 70; see *J.*, this volume, p. 298], the results of the following further experiments are published. When iron pentacarbonyl, $\text{Fe}(\text{CO})_5$, is slowly added to mercury at 300° C., a butter-soft, silver-white paste is formed, and, on continued exposure to light, this becomes covered with a dark skin consisting mainly of iron. The paste normally contains a maximum of 10% iron. Centrifuging raises the iron content to 12%, and distilling the mercury in a high vacuum results in the formation of a strong and hard but unstable mass with a bright silver fracture and containing 15.2% iron. In all these products, as with amalgam of low iron content, most of the iron is present, as shown by X-ray analysis, as α -iron, such as a suspension of α -iron in mercury. Similarly, if nickel carbonyl, $\text{Ni}(\text{CO})_4$, is added to mercury, a hard, brittle, matte-grey mass results, containing 8.83% nickel and which is stable in air. It has a cubic lattice, different from that of pure nickel.—J. H. W.

Magneto-Elastic Phenomena in Relation to the Elastic Limit [of Nickel-Iron Alloys]. G. Guzzoni and D. Fuggiani (*Metallurgia italiana*, 1931, 23, 1029-1035; *Chem. Zentr.*, 1932, 103, I, 626).—Tests on various steels and on ferro-nickels have shown that the true elastic limit does not coincide with the maximum in the magneto-elastic curve, but that there must be a relation between the change of magnetic parameter with increasing load and the deformation suffered by the metal. Wires which have been stretched up to the yield-point show a negative, and those which have been stretched beyond this point a positive, residual hysteresis.—A. R. P.

A Relation between Virginal and Remanent Magnetizations. [Permalloy; Perminvar.] Heinrich Kühlewein (*Physikal. Z.*, 1932, 33, 348-351).—Experimental results relating to the alloys Permalloy and Perminvar indicate that the virginal B-H curve for ferromagnetic alloys can be derived from the B-H curves obtained after saturation. Thus if ordinates of the virginal curves be denoted by c , and if the alloy be put through the hysteresis cycle as follows: (1) B is increased from zero to B_{sat} , then decreased to zero and again increased

to B_{sat} , the ordinates of this last part being denoted by a ; (2) the hysteresis cycle is continued and completed by B increasing from zero (H negative) to B_{sat} , the ordinates of this last part being denoted by b ; then $c = (a + b) / 2$.

—J. S. G. T.

Hardenable Nickel. W. Kroll (*Metallwirtschaft*, 1932, 11, 31-32).—Nickel alloys with up to 1% magnesium and up to 0.9% carbon can be age-hardened. Alloys with 0.5-0.6% magnesium and 0.1-0.2% carbon work well, and after quenching from 1100° C. and ageing for 24 hrs. at 500° C. attain a Brinell hardness of 270-370 kg./mm.² and a tensile strength of 120-130 kg./mm.² with an elongation of 3.3%. The figures before ageing are 100-130, 60-70, and 40, respectively. Monel metal containing small quantities of magnesium and carbon can also be improved by heat-treatment to show a tensile strength of about 100 kg./mm.². Smaller age-hardening effects have been observed in a large number of nickel alloys containing carbon and a third constituent. The resistance to corrosion of magnesium-carbon-nickel alloys of the above type is practically equal to that of pure nickel.—v. G.

Platinum-Iridium Alloys. — Thews (*Metallbörse*, 1932, 22, 66).—A brief summary of the properties of platinum alloys with up to 40% of iridium.

—A. R. P.

Iridium Substitutes. Anon. (*Metallbörse*, 1931, 21, 2122).—An alloy of platinum 70, palladium 25, iridium 5% is a satisfactory substitute for the more expensive 25% iridium-platinum. Platinum may also be hardened by addition of palladium and gold in a ratio exceeding 3 : 1; two recommended alloys are platinum 81, palladium 14, gold 5%, and platinum 95.3, palladium 0.8, gold 3.9%.—A. R. P.

On the Silver-Copper Alloys. W. Broniewski and S. Kostacz (*Compt. rend.*, 1932, 194, 973-975).—Fifteen parameters, of which only 5 have previously been studied, of the silver-copper alloys have been investigated. Thermal analysis was carried out by very slow heating and cooling with photographic recording, after annealing. The equilibrium diagram indicates a eutectic at 779° C. for 71% silver. Solid solutions, determined by the diagram and micrographically, appear to extend to 7% on the silver side and to 6% on the copper side, these figures being rather less than those that Stockdale gives. The physical and mechanical properties were studied on wires drawn out to 5 mm. from castings in graphite crucibles, after annealing for 12 hrs. at 650° C. in carbon dioxide. The curves for the electrical conductivity, temperature coeff. of electrical resistance and hardness differ somewhat from those given by Kurnakow, Puschin, and Senkowski, and the curve of e.m.f. of solution differs from that given by Herschkowitsch at the copper end. The curves of the mechanical properties, such as the Brinell hardness, resistance to drawing, elastic limit, percentage elongation, and total elongation to fracture, show that all the alloys are improved by heat-treatment consisting of simple cooling in air after annealing. This is probably due to the deposition of very small crystals, which results from the partial decomposition of the solid solution. All the alloys prepared in a reducing atmosphere are malleable; those prepared in an oxidizing atmosphere are found to contain copper oxide, which is soluble in the metal, and considerably modifies the physical and mechanical properties of the alloys.—J. H. W.

Tin Bearing Metal. Anon. (*Metallbörse*, 1931, 21, 1961-1962, 2026-2027).—A review of the properties of bearing metals. Alloys with a tin base are preferable to those with a lead base, as they are more mobile in the liquid state, can cover larger bearing surfaces in thinner layers, have a wider range of melting and casting temperatures, have a smaller tendency to segregation and a smaller shrinkage on solidification, and are less brittle in spite of their greater hardness. Their yield-point is scarcely affected by prolonged heating

up to 100° C., and they have a better thermal conductivity and a higher sp. heat. Many examples of tin-rich alloys are given and their properties discussed.—A. R. P.

A Study of the Constitution of the Iron-Tin Alloys. C. A. Edwards and A. Prece (J. Iron Steel Inst., 1931, 124, 41-66; discussion, 67-69).—See J., this volume, p. 22.—S. G.

The Diffusion of Tin into Iron with Special Reference to the Formation of Columnar Crystals. C. O. Bannister and W. D. Jones (J. Iron Steel Inst., 1931, 124, 71-93; discussion, 94-97).—See J., this volume, p. 22.—S. G.

Zinc-Manganese Alloys. N. Parravano and V. Caglioti (Atti. R. Accad. Lincei (Roma), 1931, [vi], 14, 166-169; Chem. Zentr., 1932, 103, I, 732-733).—Cf., this J., 1931, 47, 378. Alloys with 12-33% manganese have been examined by means of X-rays. The ϵ -phase exists at room temperature in alloys with 24-33% manganese and at 350°-400° C. in alloys with 12.5-24% manganese; it is hexagonal $a = 2.75 \text{ \AA}$. The γ -phase extends from 8.09 to 22.26% manganese. The η phase in alloys with up to 1% manganese is unstable and breaks down on ageing with the formation of a eutectoid of zinc with another apparently cubic phase the lines of which may be detected in the roentgenograph of aged alloys containing up to 11% manganese.—A. R. P.

Measurements, Employing Liquid Helium. XVI.—Investigations Relating to Superconduction in the Case of Carbides, Nitrides, Borides, and Silicides. W. Meissner, H. Franz, and H. Westerhoff (Z. Physik, 1932, 75, 521-530).—The following are found to become superconducting at the respective temperatures stated (in ° abs.): titanium carbide, just below 1.15°; zirconium carbide, between 4.1° and 2.1°; tantalum carbide, between 9.5° and 7.6°; titanium nitride, very appreciable decrease of resistance between 6° and 5.3°, resistance nil at 1.34°; zirconium nitride, about 9.45°; zirconium boride, between 3.2° and 2.82°; tantalum silicide, about 4.25°. The following were found not to exhibit the phenomenon of superconduction: hafnium carbide, iron carbide, hafnium boride, titanium boride, and solid solutions of silicon in iron and nickel, respectively.—J. S. G. T.

On the Chemistry of Alloys. A. Westgren (Angew. Chem., 1932, 45, 33-40).—A lecture to a joint meeting of several German scientific societies pointing out structure analogies and anomalies in intermetallic compounds and illustrating the use of X-rays in the detection of compounds in alloys.—A. R. P.

On the Paper by Genders on "The Macrostructure of Cast Alloys : Effect of Turbulence Due to Gases." W. O. Hagen-Torn (Metallurg (The Metallurgist), 1931, 6, (2), 165-168).—[In Russian.] Cf. this J., 1930, 43, 187. H.-T. agrees with Genders on the part played by the temperature gradient between the molten metal and the walls of the mould, but differs in the explanation of the mechanism of the setting. The effect of a fatty lubricant is analyzed; the volatile constituents, volatilized by the heat, in escaping through the cooling metal may cause blow-holes and gas pockets. With a rate of pour of 15-18 mm./second, the gases usually have time to escape and a perfect casting is obtained. With a higher rate (25 mm./second) there is a tendency for gassing to occur towards the top of the casting, the exact point being determined by the temperature. Finally with a rate of 40 mm./second a perfect casting can be obtained only at very high temperatures, e.g. 1200°-1230° C. for brass, so that the gases have time to escape completely before the metal sets. The phenomena which take place in the mould during casting are examined; the first portions of the metal in striking the layer of lubricant break it up and are rapidly chilled, particles of carbon being occluded. The relatively low degree of insulation at first causes the formation of a columnar structure, which is thus confined to the bottom of the casting; then, as the mould becomes fuller, and its wall temperature rises, the metal solidifies with an

equiaxed crystal structure. With a dry lubricant, the degree of insulation is very much lower, so that a steep temperature gradient exists, resulting frequently in columnar crystals. This effect may be minimized by using a low rate of pouring and a certain degree of over-heating.—M. Z.

Cold-Treating Metallic Alloys. H. S. Rawdon (*Metal Progress*, 1932, 21, (2), 29-33).—Low-temperature treatment is now easily applied, since both liquid air and solid carbon dioxide are commercially available. Such treatment is now extensively used in "expansion fitting"; a more recent application is the retarding, or in some cases the acceleration, of structural changes by chilling. Duralumin can thus be kept relatively soft for any given period; certain high nickel-chrome steels show profoundly modified structures on cold-treatment.—P. M. C. R.

Phase Equilibria in Binary Systems with Continuous Ranges of Mixed Crystals. E. Kordes (*Z. physikal. Chem.*, 1931, [A], 152, 161-196).—The conditions of phase equilibrium in binary systems with continuous solid solution ranges are given by the following empirical equations:

$$\frac{b'}{a'} = \frac{b + a\left(\frac{T_x - T_a}{T_a}\right)}{a + b\left(\frac{T_x - T_b}{T_b}\right)} \text{ and } \frac{b}{a} = \frac{b' - a'\left(\frac{T_x - T_a}{T_a}\right)}{a' - b'\left(\frac{T_x - T_b}{T_b}\right)}, \text{ where } a \text{ and } b \text{ are the con-}$$

centrations of the liquid phase, a' and b' those of the solid solutions, T_x the absolute temperature of the beginning of crystallization, T_a and T_b the absolute melting points of the two pure components. The equations apply to numerous binary systems and even to non-ideal solutions. It is presupposed that the two components are miscible in all proportions in the liquid state, and that, in passing from one state to the other, the number of particles is unchanged. The equations are applied to the following metallic systems: iron-nickel, copper-palladium, nickel-palladium, copper-gold, gold-palladium, and gold-nickel, and by the use of them the solidus curve may be calculated from the liquidus curve and vice versa. They apply also to the equilibrium between 2 solid phases and between an anisotropic and anisotropic liquid state as well as to the determination of molecular weights in the systems.—B. Bl.

Contribution to the Thermodynamics of Concentrated Solutions. I.—Communication: Eutectic Systems. E. Kordes (*Z. physikal. Chem.*, 1931, [A], 158, 1-34).—The empirical equation for the position of the eutectic in binary systems previously given (this *J.*, 1927, 37, 483; 38, 430; 1928, 39, 507; 40, 532) is combined with van't Hoff's expression for the depression of the freezing point. The resulting equation agrees with the experimental results in the case of certain systems in which the number of particles remains unchanged during melting or in which the relative proportions of the two components in the liquid and solid phases are the same. K. shows on theoretical grounds that the melting point and composition of the eutectic are fixed first, by the melting points and latent heats of fusion of the two components and, secondly, by the forces between the molecules of the two constituents in the liquid state and by the miscibility of the constituents in the solid state.—B. Bl.

Transport and Transport Potentials in Metallic Solutions. Karl Schwarz (*Z. physikal. Chem.*, 1931, [A], 154, 245-257).—From theoretical considerations based on the possibility of a mass transport when a current is passed through a metal solid solution it follows that polarization potentials appear, and therefore on thermodynamic grounds there are relationships between c.m.f., concentration, transport number, and atomic conductivity. These relations are deduced. The transport numbers in some cadmium amalgams calculated from the measurements of the transport potentials are in good agreement with the experimental results.—B. Bl.

Existence of Electromotive Forces in Closed Metallic Circuits of Uniform Temperature. O. Scarpa (*Z. physikal. Chem.*, 1931, [A], 156, 225-226).—S. claims the discovery in 1929 of an e.m.f. in circuits of uniform temperature consisting solely of metallic conductors. The appearance of the e.m.f. depends on the formation of solid solutions or intermetallic compounds. A bibliography of the previous work of S. (in Italian) is appended. (See preceding abstract.)—B. Bl.

Transport and Transport Potentials in Metallic Solutions. Karl Schwarz (*Z. physikal. Chem.*, 1931, [A], 156, 227-231).—A continuation of earlier work on mass transport in dilute amalgams (see preceding abstracts).—B. Bl.

Contribution to the Investigation of the Cathodic Disintegration of Alloys. L. Belladen (*Gazz. chim. ital.*, 1931, 61, 952-958; *Chem. Zentr.*, 1932, 103, I, 1200).—Experiments have been made on the cathodic sputtering of alloys in an atmosphere of hydrogen at 0.5 mm. pressure, with electrodes 40 mm. apart and with a potential drop of 650 v. Copper-nickel alloys with less than 30% copper sputter readily and the deposited metal has the same composition as the cathode; with more than 30% copper the composition of the deposited alloy differs from that of the cathode. Disintegration of cadmium-antimony alloys is at a maximum with CdSb; the deposited metal contains more antimony than the original, especially when the latter contains 10-30% antimony. Disintegration of copper-antimony alloys is a maximum at 10% antimony and a minimum at 35% antimony; with less antimony than corresponds with Cu_2Sb the dust formed by disintegration contains more antimony than the cathode alloy, but with alloys richer in antimony no change in composition occurs.—A. R. P.

Magnetic Susceptibility of some Binary Alloys. Francis L. Meara (*Physics*, 1932, 2, 33-41).—The magnetic susceptibilities of 8 series of alloys: tin-thallium, antimony-thallium, thallium-cadmium, zinc-cadmium, lead-antimony, tin-antimony, cadmium-antimony, and zinc-antimony have been investigated by Gouy's method. The existence of compounds $SnSb$, $CdSb$, and $ZnSb$ is definitely indicated by an abrupt change in the slope of the susceptibility-concentration curves; the existence of the compound Sn_2Tl is less definitely indicated. There is a nearly linear relation between the susceptibility and the concentration of one of the constituents where these form simple heterogeneous mixtures. This result is best illustrated by the zinc-antimony series of alloys.—J. S. G. T.

III.—CORROSION AND PROTECTION

(Continued from pp. 300-306.)

CORROSION

Aluminium and Chloride of Sulphur. R. M. Ungar (*Aluminium Broadcast*, 1930, 2, (50), 23).—An abstract from *India Rubber J.*, 1930, November 29. The corrosion-resistance of aluminium to chloride of sulphur is discussed. It has been claimed that aluminium sheet has been used in vaporizing-ovens with only slight pitting. On the other hand, U. has noted material decomposition. Tests on aluminium sheet immersed in a 2% solution of chloride of sulphur in naphtha showed a loss of weight of 38% after half an hour.—J. C. C.

Corrosion of Aluminium and Light Metals. A. von Zeerleder (*Aluminium Broadcast*, 1930, 2, (46), 2-6).—A brief review of corrosion tests for aluminium and its alloys. Accelerated tests which give valuable relative indications are: (1) heat test in which the maximum temperature reached, after 20 c.c. of hydrochloric acid at 20° C. are poured on the test-pieces, is recorded; (2) gas volume test in which the time taken for 50 c.c. of hydrogen to be evolved from a known quantity of 10% hydrochloric acid is observed; (3) solution test in which the amount of aluminium oxide formed after immersion for 24 hrs. in

1% aqueous sodium chloride solution containing 3% hydrogen peroxide is determined. Curves are given to show how the results are affected by time and temperature of heat-treatment. The effect of heat-treatment temperature on the solution potential of aluminium-copper alloys is also illustrated.

—J. C. C.

The Corrosion of Metals and Alloys used in Aircraft. G. Guzzoni and E. Nardi (*Light Metals Research*, 1931, 1, (15), 25).—An abstract from *L'Aerotechnica*, 1931, 11, (1). The methods for protecting steels, aluminium alloys, and magnesium from corrosion are reviewed, and an account is given of an investigation into the corrosion-resistance of magnesium alloys in which the effects of structure and the addition of other elements were determined.—J. C. C.

Accelerated Weathering Tests of Soldered and Tinned Sheet Copper. Peter R. Kosting (*U.S. Bur. Stand. J. Research*, 1932, 8, 365-379; *Research Paper No. 422*).—The pitting and furrowing of tinned and soldered sheet copper, which sometimes happen when weathered, were duplicated in the laboratory by exposing the copper to a humid atmosphere rich in sulphur dioxide and carbon dioxide at 50° C. or above. The progress of corrosion was followed by means of losses in weight, and tensile and bending tests. Extensive pitting and furrowing occurred only after the tinned and soldered specimens had been heated to high enough temperatures to cause the formation of complex copper-tin alloys. Furrowing reduced the strength of soldered joints and markedly impaired the fatigue properties of the copper as measured by the number of bends needed for failure. Spilt flux may cause pitting of copper, but the pits thus formed occur under deposits of copper salts. A red deposit of cuprous oxide was found under these salt deposits if the copper originally was oxidized. A selected bibliography of 21 references is appended.—S. G.

[Copper] Pipe Corrosion. Anon. (*Burn's Eng. Mag.*, 1932, 26, 166).—A case is described of electrolytic attack on copper pipes, due to the rusting of iron tanks through over-alumination of the water after chlorination, and corrective methods are suggested.—P. M. C. R.

The Chemical Resistance of Some Non-Ferrous [Copper] Alloys. W. Claus (*Metallbörse*, 1932, 22, 97-98, 129-130).—The rate of corrosion in 3% ammonia, 5% hydrochloric acid, 3% potassium hydroxide solution, sea-water, and 2% and 4% sodium sulphate solution has been determined for hard-worked and annealed specimens of copper alloys containing: (A) 6.05% tin, (B) 9.79% tin, (C) 6.9% tin and 4.42% zinc, and (D) 9.58% tin and 5.94% lead. In ammonia and hydrochloric acid the rate exceeded 100 grm./m.²/day, in potassium hydroxide it varied from 2 to 15 grm./m.²/day, and in the other solutions it was less than 1 grm./m.²/day. Annealing had little effect.—A. R. P.

Corrosion Structure, Mechanism of Corrosion, and Tammann's Resistance Limits. X-Ray Investigation on Gold-Copper Single Crystals. L. Graf (*Metallwirtschaft*, 1932, 11, 77-82, 91-96).—Single crystals of gold-copper alloys were exposed to the action of various reagents and the surface films formed by corrosion were examined by X-rays. They had the same orientation as the ground-mass. In strongly oxidizing solutions (e.g. nitric acid) the film consisted of pure gold, in more feebly oxidizing solutions (e.g. picric acid), of gold-rich solid solution. The resistance limit in the first case was 50 atomic-% gold and in the second case 25 atomic-%. The differences observed are ascribed to the different mobility of the atoms of the noble element during corrosion; in the presence of feeble reagents only a small movement is possible by lattice forces, but in the presence of a powerful reagent ionization of the atoms of the noble element occurs. At high temperatures attack by gases is modified by diffusion of the atoms in the lattice.—v. G.

Contamination of Water by Lead and Copper. Anon. (*Met. Ind. (Lond.)*, 1932, 40, 380).—A brief account of a case investigated by the Copper and Brass Extended Uses Council, in which water from a well in red sandstone, and con-

taining 3.6 parts per 100,000 free carbonic acid was conducted to a house, the cold service through lead pipes and the hot through copper ones. The cold water was found to have dissolved 0.12 part per 100,000 lead and to be unsuitable for domestic purposes; the hot water was found to have dissolved 0.18 part per 100,000 copper, which is not a dangerous amount.—J. H. W.

The Chemical Corrosion of Lead in the Presence of Phenol. Ettore da Fano (*Giorn. Chim. ind. appl.*, 1932, 14, 18–21; *Chem. Zentr.*, 1932, 103, I, 1948).—Tar used for the protection of lead cables should contain neither too much oil nor too much pitch to avoid danger of the coating flowing off or cracking. Phenol in the coating seems to accelerate corrosion by taking part in a cyclic process in which phenolate is formed and decomposed by the action of moisture and carbon dioxide; if the coating is impermeable and firmly adherent, the presence of phenol in the coating is immaterial, as air and moisture are excluded from contact with the lead, so that the later stages of the cyclic process cannot occur.—A. R. P.

Chemical Problems of the German Post Office. [Corrosion of Lead Cables.] Otto Haehnel (*Z. angew. Chem.*, 1931, 44, 973–976).—The corrosion products found on lead cables buried in the earth, in walls, or in concrete consist of the normal and basic carbonate, the hydroxide or litharge. The presence of lead chloride indicates corrosion by stray currents which may extend as far as 100 m. from the source of leakage. Addition of 1% antimony or 3% tin prevents intercrystalline breakdown of cable sheathing by vibrational stresses. Rise of temperature may cause coarse crystal growth, but this is also prevented by addition of antimony, tin, or 0.1% copper.—A. R. P.

The Determination of the Porosity of Tin Coatings on Steel. D. J. Macnaughtan, S. G. Clarke, and J. C. Prytherch (*Iron Steel Inst. Advance Copy*, 1932, May, 1–16).—It was found that when tin-coated steel is kept for some time in hot water of high purity, sharply localized and strongly adherent spots of iron rust appear over its surface. To secure the maximum number of spots, the water must be of high purity, its hydrogen-ion concentration should be approximately p_H 4.5–7, the temperature not less than 95° C., and the time of immersion 6–8 hrs. or 3 hrs. plus an additional 18 hrs. in water at room temperature. It is concluded that the number of rust spots indicates the porosity of the coating, because: (1) during the test, an exceedingly thin film forms on the surface of the tin coating; (2) the compound, $FeSn_2$, is unaffected by the test, so that rust spots can appear only at actual breaks in the coating, but exceedingly fine pores produce visible amounts of rust; (3) the conditions of the test strongly favour anodic attack of exposed steel. A comparison of this test with the ferricyanide test reveals that: (1) the figures for porosity obtained with the latter test are lower than those given by the hot-water test; (2) the figures are liable to be still lower if the concentration of sodium chloride is more than 4–5%; (3) the addition of acid to the ferricyanide solution causes an attack on the tin coating. The test of applying paper soaked with a solution of 1% potassium ferricyanide and 0.5% sodium chloride gives results comparable with those of the hot-water test. The results of a number of tests on samples of various grades of tinplate and electro-deposited tin coatings on steel by the hot-water test and the improved ferricyanide paper test are given. The latter test is unsatisfactory for testing cold-worked tinplate, but the former gives good results with this material. Preliminary tests show that pores in other cathodic coatings on steel—such as nickel, chromium, and copper—are also revealed by the hot-water test.—J. H. W.

Corrosion Phenomena on Tinplate. O. Carrasco and E. Sartori (*Giorn. Chim. ind. appl.*, 1931, 13, 557–564; *Chem. Zentr.*, 1932, 103, I, 1948–1949).—The e.m.f. of tin-iron couples in dilute acid solutions has been determined; the protective action of tin prevents dissolution of iron in non-oxidizing acids. In the presence of oxidizing substances tin becomes more electronegative

towards iron; sulphur and hydrogen sulphide have a similar action on tin, but make iron more electropositive. In citric acid solution the e.m.f. at constant p_H is depressed by addition of chlorides, especially alkali chlorides. Stirring of the electrolyte in the neighbourhood of one of the electrodes reduces its anodic behaviour, so that in certain circumstances iron can become less noble than tin. Varnishing the tin reduces its basic character. In electrolytes containing copper salts iron is always electropositive towards tin. It seems to be necessary to varnish the inside of preserving-cans when the contents have a p_H of less than 4.5 corresponding with a citric acid content of 0.5%.—A. R. P.

Rate of Dissolution of Some Zinc-Silver Alloys in Acids. M. Centnerszwer and M. Straumanis (*Z. physikal. Chem.*, 1931, [A], 156, 23-37).—Earlier work does not clearly show whether the rate of dissolution of zinc is increased or retarded by addition of silver. C. and S. now find that the rate is increased only if other accelerating impurities are present. Silver increases the rate of dissolution of Kahlbaum's zinc but not that of re-distilled zinc. During the dissolution of zinc ("Kahlbaum")-silver alloys in hydrochloric and sulphuric acids of various concentrations Boguski's velocity constant increases with the dilution of the acid, *i.e.* in the same sense as the molecular conductivity in accordance with the theory of local elements.—B. Bl.

Intensifying the Interference Colours of Thin Oxide Films. A. Günther-Schulze and F. Keller (*Z. Physik*, 1932, 75, 597-598).—It is found that the interference colours exhibited by a thin oxide film of aluminium can be considerably intensified by the deposition of a gold film of thickness of the order 50 μ on the surface of the film. In the case of illumination at normal incidence there occurred no appreciable colour displacement owing to the presence of the film; this was not, however, the case when the illumination was incident obliquely. A similar procedure can be used to intensify the interference films exhibited by antimony. The method, applied to thin oxide films of tantalum, bismuth, and tungsten did not cause any appreciable intensification of the interference colours which were initially very bright.

—J. S. G. T.

Metals and Milk. Loomis Burrell (*Milk Plant Monthly*, 1932, 21, (1), 37-42; *C. Abs.*, 1932, 26, 1672).—The electrolytic theory of the corrosion of metals is discussed in relation to the corrosion of dairy equipment. It is pointed out that aluminium and aluminium alloys may in the future find greater use in the dairy industry than at present. The effects of various metals on the flavour of milk are discussed. Such physical properties as heat conductivity and malleability are considered in relation to the fabrication of dairy equipment.—S. G.

Corrosive Influences as Affecting Dairy Equipment. L. W. Hostettler (*Milk Plant Monthly*, 1932, 21, (1), 35-36; *C. Abs.*, 1932, 26, 1673).—Corrosive influences in the dairy other than those of milk are discussed in their relation to the corrosion of the so-called 18-8 chromium-nickel-steels.—S. G.

Scaling and Corrosion of Steam Turbines. C. N. Ridley (*Colliery Eng.*, 1931, 8, 329-330; *C. Abs.*, 1932, 26, 1998).—Priming is caused by dirty feed water, overloading of boilers, oil or high concentration of the boiler water. Base-exchange treatment after the lime-soda removes both residual calcium and magnesium, but only a slight excess of soda should be used. Condensate steam contains dissolved gases and organic acids that corrode. R. advises 80% condensate and 20% treated water. With little condensate sodium aluminate should be used and enough soda or lime in the make-up water to neutralize the condensate acids.—S. G.

Corrosion by Potential Differences and Its Prevention. Erich K. O. Schmidt (*Z. Flug. u. Motor.*, 1931, 22, 177-178; *Physikal. Ber.*, 1931, 12, 2581).—Contact of light metals with screwed-in brass armatures results in serious corrosion

of the light metal, and therefore insulating materials are inserted between the two metals. Corrosion tests have been made on Silumin, Elektron AM 503, and Elekron AZM with brass petrol cocks screwed in through a layer of Havex or Bakelito A; the specimens were immersed for 13 days in 3% sodium chloride and then examined. Silumin was only slightly attacked, and AM 503 was more attacked than AZM, although both withstood the test well. Without the insulating layer all three light alloys lost about one-third of their thickness. Severely worked metal, e.g. the edges of cuts or holes, withstood the salt water well, but the surrounding areas were badly corroded.—A. R. P.

[Contribution] to the Knowledge of the Rate of Dissolution of Metals in Acids. Contribution to the Theory of Local Elements. W. Guertler and B. Blumenthal (*Z. physikal. Chem.*, 1931, [A], 152, 197–234, and (in abstract) *Z. Metallkunde*, 1931, 23, (4), 118–119).—Experimental details are given of a method for measuring the rate of dissolution of metals in acids excluding the resistance capacity. The rate of dissolution of zinc in 0.2*N*- and 0.1*N*-hydrochloric acid is not nearly proportional to the electrolytic conductivity of the reagent. Ericson-Aurén and Palmær's assumptions on the hydrogen overvoltage at the cathode are incorrect, as the effect of current density must be taken into account. G. and B. find that in natural local elements the hydrogen overvoltages are very high, especially at the beginning of the dissolution and become smaller as it proceeds. The change of overvoltage essentially determines the increase in the rate of dissolution. Changes in the resistance capacity seem to be of minor importance. The dissolution of zinc in hydrochloric acid is to be interpreted by the theory of local elements even if the rate is not nearly proportional to the electrolytic conductivity of the acid. G. and B. also investigated the general course of the dissolution of iron, copper, and nickel in 0.1*N*-hydrochloric acid at 99.6°–99.7° C. and determined the conditions for reproducibility of the dissolution of a single specimen.—B. Bl.

On the Theory of Metal Dissolution.—II. (Also a Reply to A. Thiel.) M. Straumanis. A. Thiel (*Z. physikal. Chem.*, 1931, [A], 153, 107–111, 112).—Cf. this *J.*, 1931, 47, 383. The interpretation of the "difference effect" and its linear dependence on the current density is possible only if it is assumed that the anodic potential in the local elements becomes more positive.—B. Bl.

Electric Instrument Measures Corrosiveness of Soil. Anon. (*Compressed Air Mag.*, 1932, 37, 3773).—Soils high in soluble salts, exerting a marked corrosive action on underground piping and cable sheaths, possess a low electrical resistance. A portable instrument designed by E. R. Shepard of the U.S. Bureau of Standards is described, for the rapid measurement of this, and for the detection of local corrosive areas in the soil. Such testing facilitates the selection of protective coatings.—P. M. C. R.

Prevention of Corrosion of Metals by Sodium Dichromate as Affected by Salt Concentrations and Temperature. B. E. Roetheli and G. L. Cox (*Indust. and Eng. Chem.*, 1931, 23, 1084–1090).—Experiments are described in which the effects of additions of soluble chromates to distilled water and sodium chloride solutions, at room temperature, on the corrosion rates of steel, wrought iron, zinc, galvanized steel, copper, brass, aluminium, and lead, were investigated. The effects of increasing the temperature were also investigated in the cases of steel, wrought iron, and zinc. Aluminium was almost completely protected in the presence of chromates at room temperature in dilute solutions and but slightly locally corroded in strong solutions. Chromates afforded incomplete protection of copper, brass, galvanized steel, lead, and zinc in distilled water and salt solutions at room temperature. Severe pitting occurred in wrought iron, steel, zinc, and aluminium when the chromate concentration was too low. Corrosion of non-ferrous metals increased with increase in salt concentration, necessitating larger quantities of chromate to obtain the degree of protection obtainable in the more dilute solutions. Increased temperature

produced similar results. In the case of zinc the corrosion rate reaches a maximum before the boiling point of the solution is reached. The fact that in some cases protection is incomplete is attributed to differences in the structures and uniformity of the primary reaction products, which laboratory experiments have shown to be thin and almost invisible skins which cover the metal surface to which they are cathodic.—F. J.

Minimizing Corrosion in Condensers. A. E. Pew (*Oil and Gas J.*, 1931, 29, (48), 112; *J. Inst. Petrol. Tech.*, 1931, 17, 365A).—Corrosion of condensers on the water side may be due either to (a) mechanically suspended matter, such as mud, sand, &c., or (b) soluble salts in the cooling water, particularly if sea-water is used. On the oil side of the condenser, corrosion is usually caused by (a) sulphur and its gaseous derivatives, or (b) salts and their acid derivatives in the water associated with the crude oil. In the case of corrosion by water, it does not appear at first sight to be practical to treat the large quantities of water necessary for cooling. If, however, cooling towers are used, the condenser water can be recirculated, only sufficient water to make up (usually 5%) being added subsequently. Treatment of this water then results in considerable economies of equipment, water requirements, elimination of corrosion, &c. The p_H value of treated water should be maintained at 10 or higher to reduce tendency to corrosion. Much of the corrosion trouble is due to electrolytic action between dissimilar metals, particularly in the presence of dissolved oxygen. In the case of corrosion on the oil side, hydrochloric acid and sulphuric acid are the two main corroding agents. The former chiefly originates from magnesium chloride, and is usually combated by the introduction of anhydrous ammonia or caustic soda. The former is, however, rather expensive, whilst also there is danger of plugging due to ammonium salts. Caustic soda is frequently successful, but if used in large quantities affects the ash content of the fuel oil, with deleterious results owing to the subsequent scale deposition in boilers and on firebrick, &c. Hydrogen sulphide is best removed by hydrated lime and by the circulation of caustic soda solutions through the condenser. The use of triethanolamine as an absorbent has also been suggested, this material being non-corrosive, non-inflammable, able to absorb 100 vols. of hydrogen sulphide, and easily recovered by heating to 212° F. (100° C.). Indications are given of the types of alloy found most suitable for condensers for different types of crudes. Attention is directed to the advantages of removal of water from crude by electrolytic dehydration instead of distillation, the salts being also removed. Tables are given showing the chloride content of various typical crudes, with descriptions of methods of determining the chloride content. Figures are also given of the conventional shell and tube type of condenser, and of a preferred design in which there are no shell surfaces in a horizontal position and no baffles, whilst the bottom head may be protected with cement, &c.—S. G.

PROTECTION

Determination of Adhesion of Films to Metal. Erich K. O. Schmidt (*Farben-Z.*, 1931, 37, 376-377; *C. Abs.*, 1932, 26, 1458).—A small block of wood is attached to the film with warm glue and after drying is pulled off. The adhesion is calculated as the force per cm.² required to pull off the block.—S. G.

Corrosion Prevention. L. C. Milburn (*J. Soc. Automotive Eng.*, 1931, 29, 148-157).—See *J.*, this volume, p. 29.—S. G.

The Production of Aluminium Oxide Films on Aluminium and Its Alloys by Anodic Oxidation. H. Siebeneicher (*Chem.-Zeit.*, 1932, 56, 149).—If more concentrated solutions of chromic acid than those recommended by Bengough and Stuart are used for the anodic oxidation of aluminium the metal becomes

covered with a bluish-black film of oxide which has good corrosion-resistant properties and may be further treated in the same way as films produced in the more dilute chromic acid solution.—A. R. P.

Surface Protection of the Light Metals. T. Leib and F. Kolke (*Light Metals Research*, 1931, 1, (8), 15–20).—Translated from *Korrosion u. Metallschutz*, 1931, 7, 3–11. See *J.*, this volume, p. 29.—J. C. C.

Coating, Protecting from Oxidation, and Colouring Aluminium. Herbert Kurrein (*Light Metals Research*, 1931, 1, (1), 2–5).—Translated from *Metallwirtschaft*, 1930, 9, 1009, 1031–1032, 1049–1050. See this *J.*, 1931, 47, 146.

—J. C. C.

Calorizing, and its Applications. Walter Smith (*Metallurgia*, 1932, 5, 207–208).—The diffusion of finely-divided aluminium into the surface of metal parts produces a non-oxidizing and non-scaling surface due to the oxidation of the aluminium-rich surface resulting in the formation of a firmly adherent envelope of alumina resistant to further oxidation and sufficiently close in texture to prevent penetration of oxygen or other destructive media. This surface is capable of withstanding high-temperature service conditions and the process has industrial application for parts used in the heat-treatment of metals, furnace fittings, cement kilns, ore-roasting furnaces, and drying plant. Calorizing of the heat-resisting alloys of the nickel-chromium or nickel-chromium-iron classes gives adequate protection against sulphur attack, to which such alloys are susceptible, and it is stated that alloys so treated can be subjected to temperatures up to 1150° C. with little deterioration when compared with untreated alloys.—J. W. D.

Mottled Tinplates. J. C. Jones (*J. Iron Steel Inst.*, 1931, 124, 13–23; discussion 24–39).—The two chief factors on which the formation of mottle depends are: (1) the steel base and (2) the tinning pot conditions. Different types of steel tinned under identical conditions exhibit these markings in varying degrees. The substitution of such salts as ammonium or aluminium chlorides for zinc chloride as a flux results in striking improvements, and it is suggested that this is mainly due to alterations in the physical characteristics of the flux, such as viscosity and the presence of small gas bubbles. The depth and purity of the envelope of the steel bar also probably affect these differences. In the discussion, it was suggested that the steels selected did not provide conclusive evidence that mottle was dependent on the steel base, and that the use of clean zinc chloride would also effect the desired improvement. One of the actions of a flux was dehydration and long time of contact would assist this. It was also stated that Bessemer plates gave practically no mottling, whilst open-hearth tinplates had distinct markings. An explanation of the mechanism of the flux, dependent on the formation of gas-bubbles was put forward and confirmed by J.—J. H. W.

Hot-Galvanizing with Zinc and Cadmium. Anon. (*Chem.-Zeit.*, 1931, 55, 225–226).—The hot-galvanizing process is described and hints are given for avoiding and overcoming difficulties. The best quality of zinc gives the best results; if aluminium is added to the bath it should be kept below 3%, and preferably at about 0.25%. The bath should be maintained at 430° C. for large articles, 450° C. for medium-sized articles, 470° C. for steel, and 490° C. for thin wire. Cadmium galvanizing baths work best at 360° C. under a cover of glycerol and zinc chloride; the bath lasts longer than a zinc bath, as it does not become contaminated with large quantities of iron. An alloy bath containing 29% cadmium and 71% zinc may be used at 220° C.; the alloy melts at 180° C. Cf. following abstract.—A. R. P.

Hot-Galvanizing with Zinc and Cadmium. Anon. (*Chem.-Zeit.*, 1931, 55, 648).—Cf. preceding abstract. A letter to the editor. The curve showing the amount of zinc taken up by iron from molten zinc baths containing aluminium falls with increasing aluminium content of the bath to a smooth

minimum at 0.6% aluminium. This would therefore appear to be the best composition of the bath; 420° C. is the most satisfactory temperature. Cadmium in the bath also reduces the take-up of zinc, a minimum being reached at 3% cadmium. The take-up is nearly as low with 1.5% cadmium, and the galvanizing coating has a better appearance. The lowest take-up of all is obtained with 0.6% aluminium and 1.5% cadmium together in the bath; comparative figures are 1.1% for this bath, 3.6% for commercial zinc, 2.7% for the 0.6% aluminium alloy, and 1.75% for the 1.5% cadmium alloy.

—A. R. P.

Brittleness of Zinc-Coated Steel. J. S. Adelson (*Heat-Treating and Forging*, 1932, 18, 180–183).—The brittleness which makes its appearance in steel under certain conditions is influenced by: (1) the presence of the zinc coating; (2) the amount of cold-work in the steel; (3) heating to the "critical temperature" of 750°–950° F. (400°–510° C.) during or after galvanizing; (4) prolonged heating; (5) strain during heating; (6) heterogeneity.

—J. H. W.

Metallic Coatings for Steel. Marvin J. Udy (*Min. and Met.*, 1932, 13, 173–174).—Discusses briefly the merits of zinc, cadmium, copper, nickel, and chromium protective coatings on steel.—A. R. P.

Chromium Plating Brass. W. E. Warner (*Canad. Mach.*, 1931, 42, (26), 184–185).—The gradual relief of internal stresses of brass causes fissures to develop in plating thicker than 0.001 in. Brass is best treated by coating with: (1) copper; (2) nickel; and (3) chromium; after (2) occluded hydrogen is removed by washing in warm, and then rinsing in cold water.—P. M. C. R.

Stainless [Steel] Versus Chrome Plate. John G. Mapes (*Metal Progress*, 1932, 21, (3), 43–46).—The present low cost of brass, together with improved plating technique, have made chromium-plated brass the cheapest material for bright fittings. Chromium-plated aluminium, or sheet steel plated with copper, nickel, and finally chromium, is found economical for radiator shells. The stainless nickel-chrome-iron alloys, however, although regarded by some manufacturers as too expensive for wide use, are being increasingly used by others in preference to chromium-plated work, on account of their greater durability, although the difficulty of upsetting and screw-cutting remains a drawback.

—P. M. C. R.

On Artificial and Natural Formation of Protective Coatings in Water Pipes. L. W. Haase (*Gas- u. Wasserfach*, 1931, 74, 572–576).—M. H.

[**Sprayed Metal Coatings.**] Anon. (*Machinery (Lond.)*, 1930, 36, 791).—A note on the adherence of sprayed coatings of zinc, copper, and lead, which have remained intact on shells which have been fired through a target.—H. F. G.

[**Rubber as Protective Coating for Aluminium Alloys.**] Anon. (*Machinery (Lond.)*, 1930, 36, 775).—Note on the protection of aluminium alloys against corrosion by applying a thin coating of rubber, either from solution in naphtha, by electrodeposition, by spraying latex on the surface and vulcanizing, or by cementing with rubber solution.—H. F. G.

Surfacing Metal with Rubber by Air Spray. Anon. (*Compressed Air Mag.*, 1932, 37, 3708).—Rubber latex is now shipped largely in fluid form, and finds frequent application for lining or covering various types of chemical engineering plant, notably acid containers. The Nordac process builds up such a coating on prepared metallic surfaces by 6 or 8 successive sprayings followed by vulcanizing.—P. M. C. R.

Paints, Pigments, Varnishes, and Resins. G. C. Atfield, S. Marks, L. R. Hickson, and W. Singleton (*Ann. Rep. Prog. Applied Chem.*, 1931, 16, 386–424).—A summary of progress during 1931 in the fields indicated by the title, with full references.—H. F. G.

IV.—STRUCTURE

(Metallography ; Macrography ; Crystal Structure.)

(Continued from pp. 306-308.)

A Metallographic Investigation of Native Silver. (Sir) H. C. H. Carpenter and M. S. Fisher (*Bull. Inst. Min. Met.*, No. 330, 1932, 1-22).—The structure and behaviour on heat-treatment of numerous specimens of native silver from 14 different localities have been investigated micrographically. The results indicate that silver recrystallizes at room temperature in the course of geologic ages, but recrystallization is always incomplete and the structure does not become homogeneous. The normal recrystallization temperature of silver is about 200° C., so that native silver with a recrystallized structure must either have been deposited from solutions above this temperature or have subsequently been subjected to heat. The Widmanstätten structure of a native alloy of 85.6% silver, 12.1% antimony, 0.6% arsenic, and 1.2% bismuth is ascribed to the slow decomposition of a solid solution of the alloying metals in the silver, but attempts to reproduce the structure by heat-treatment of a synthetic alloy of the same composition failed.—A. R. P.

A Method of Illustrating the Magnification of Photomicrographs. D. C. Sharpstone (*Econ. Geol.*, 1931, 26, 777-782; *C. Abs.*, 1932, 26, 1529).—Cross rulings are superimposed on photomicrographs by the use of celluloid masks inserted between the plate or film and the sensitized paper during printing of the picture. A series of masks is made up by drawing fine lines with India ink on ordinary filmpack film which has been cleared in hypo. The distances between the lines represent unit screen openings magnified to the same degree as the objects in the photomicrograph.—S. G.

The Formation of Superlattices in Alloys of Iron and Aluminium. A. J. Bradley and A. H. Jay (*Proc. Roy. Soc.*, 1932, [A], 136, 210-231).—[Note by Abstractor.—In certain ranges of solid solutions of iron and aluminium, segregation of the aluminium atoms into definite positions is found to occur. Such segregation produces what is called a "superlattice."] A quantitative examination has been made of the intensities of lines of a series of powder X-ray photographs of alloys of iron and aluminium in the range Fe-FeAl. All the alloy structures are primarily based on a simple body-centred cubic lattice like that of α -iron, but a detailed examination of alloys in the annealed and quenched states gave widely differing results. Alloys quenched from 600° C. and above show a random distribution of atoms up to 25 atomic-% of aluminium. Between 25% and 26% aluminium there is an abrupt change in structure, and cube centres differ in composition from cube corners. In the quenched alloys with ordered arrangement, one set of positions is occupied by iron atoms only, but the other set contains both iron and aluminium atoms in varying proportions, depending on the alloy composition. Annealed alloys with less than 18% aluminium have a random distribution of atoms, and from 40% to 50% aluminium they have the FeAl type structure exactly like the quenched alloys in this range. At intermediate compositions a new type of structure of the type Fe₃Al appears. In the Fe₃Al arrangement the aluminium atoms lie on a face-centred cubic lattice forming a superlattice with dimensions twice those of the small body-centred cube. There is no precise composition at which the Fe₃Al structure begins or ends, and the structure is not completely realised even at the theoretical composition.—J. S. G. T.

On X-Ray Investigations of the Age-Hardening Process of Duralumin at Room Temperature. J. Hengstenberg and G. Wassermann (*Mitt. Material., Sonderheft 17*, 1931, 34-38; and (translation) *Light Metals Research*, 1931, 1, (9), 7-10).—See this J., 1931, 47, 347.—S. G.

On the Lattice Structure of NaTl and Its Relation to Structures of the β -Brass Type. E. Zintl and W. Dullenkopf (*Z. physikal. Chem.*, 1932, [B], 16, 195-205).—Addition of sodium to a solution of thallos iodide in liquid ammonia results in the formation of NaTl crystallizing in the cubic system ($a = 7.473$ A.) with 8 atoms of each metal in the unit cell, which consists of 2 interpenetrating lattices of the diamond type which are pushed towards one another about one half of the diagonal of the elementary cell; one lattice is occupied by sodium and the other by thallium atoms. The atomic radius (1.62 A.) is for thallium about equal to the usually accepted value (1.66 A.), but for sodium it is about 13% lower than the usually accepted value (1.86 A.). The empirical law, which requires that 2 atoms should share 3 valency electrons in this type of structure, is not fulfilled in this case.—v. G.

Lattice Structure of KBi_2 . E. Zintl and A. Harder (*Z. physikal. Chem.*, 1932, [B], 16, 206-212).— KBi_2 may be prepared by fusion of the elements in an iron crucible in an argon atmosphere; the compound has a cubic structure, $a = 9.501$ A., resembling that of MgCu_2 .—v. G.

Polyantimonides, Polybismuthides, and Their Transitions in Alloys. E. Zintl and W. Dullenkopf (*Z. physikal. Chem.*, 1932, [B], 16, 183-194).—Alloys of sodium with antimony and with bismuth when extracted with liquid ammonia yield solutions containing the complex compounds $\text{Na}_3\text{Sb}_7, x\text{NH}_3$ and $\text{Na}_3\text{Bi}_7, x\text{NH}_3$. On removing the ammonia, these compounds decompose into NaSb and antimony, and NaBi and bismuth, respectively; both NaSb and NaBi occur in molten binary alloys of these metals. NaBi has a body-centred tetragonal lattice with 1 atom each of sodium and bismuth in the unit cell, $a = 3.46$ A.; $c = 4.80$ A. NaSb has a monoclinic lattice with 8 atoms of each element in the unit cell.—v. G.

The Rolling Texture of Zinc and Magnesium. V. Caglioti and G. Sachs (*Metallwirtschaft*, 1932, 11, 1-4; corrigenda, 35).—Debye-Scherrer photographs of rolled magnesium and zinc sheets taken at different directions have allowed conclusions to be reached as to the complete distribution of the crystal orientations, and these are shown graphically. The results confirm those in the literature with respect to the principal positions, but the scattering is different from that previously reported, and is not identical for both metals. The differences are explained by the fact that whereas twinning occurs during the elongation of zinc crystals, it does not occur with magnesium crystals. The recrystallization texture of both metals is such that the basal plane lies in the plane of rolling, *i.e.* it is not greatly different from the rolling structure.—v. G.

Remarks on the Rolling Texture of Zinc. M. A. Valouch (*Metallwirtschaft*, 1932, 11, 165-166).—X-ray examination of technical zinc rolled to 0.3 mm., then etched to 0.03 mm. thickness, has shown that the orientation may be represented with sufficient accuracy as that of a single-crystal orientation with the hexagonal axis at an angle of 20° to the normal to the sheet and 70° to the direction of rolling and with a $[10\bar{1}0]$ direction in the rolling plane perpendicular to the direction of rolling.—v. G.

Precision Measurements of the Crystal Parameters of some of the Elements. E. A. Owen and John Iball (*Phil. Mag.*, 1932, [vii], 13, 1020).—The following values of the respective lattice parameters (in A.), distance of closest approach of the atoms (in A.), and crystal density at 16.5° C. (gm./c.c.) have been found for the elements stated: silver, 4.077₃, 2.883, 10.50₆; aluminium, 4.040₆, 2.857, 2.69₈; copper, 3.607₀, 2.551, 8.93₇; gold, 4.071₁, 2.879, 19.29₁; iridium, 3.831₄, 2.709, 22.66₁; molybdenum, 3.140₈, 2.720, 10.23₃; nickel, 3.517₉, 2.487, 8.89₉; lead, 4.939₃, 3.493, 11.35₀; palladium, 3.885₀, 2.747, 12.01₁; rhodium, 3.795₄, 2.684, 12.42₈; tantalum, 3.311₁, 2.868, 16.49₇; tungsten, 3.159₂, 2.736, 19.25₉.—J. S. G. T.

Some X-Ray Measurements. [G.] Sachs and [J.] Weerts (*Metallurgist* (Suppt. to *Engineer*), 1932, 8, 51-52).—A summary of two papers by S. and W., *Z. Physik*, 1930, 60, 481; see this *J.*, 1930, 43, 528, and 1930, 64, 344; see this *J.*, 1930, 44, 594.—R. G.

Precision Method of Measuring Small Changes of Lattice Spacings of Metal Single Crystals. Rudolf C. Hergentrother (*Physics*, 1932, 2, 63-69).—A method of studying the progressive crystal lattice changes occurring in a series of alloys or mixed crystals is described. The method compares the Bragg angles of X-ray reflection from a standard crystal with those of the crystal being studied. An accuracy of 0.002% is obtained without the use of an accurately calibrated scale of angles. Experimental data relating to bismuth-tin alloys are very briefly given.—J. S. G. T.

The Applications of Optical and X-Ray Spectra to Metallurgy. Anon. (*Light Metals Research*, 1931, 1, (6), 3-9).—A general account of the principles involved in optical and X-ray spectroscopy.—J. C. C.

V.—ANALYSIS

(Continued from pp. 309-311.)

The Rôle of Analytical Chemistry in Industrial Research. Beverley L. Clarke (*Indust. and Eng. Chem.*, 1931, 23, 1301-1304).—Read before the Division of Industrial and Engineering Chemistry of the American Chemical Society.—F. J.

On a New Spectral Line Photometer for the Visible Region and Its Use in the Rapid Analysis of Alloys. G. Scheibe and G. Limmer (*Metallwirtschaft*, 1932, 11, 107-110).—The apparatus compares a standard arc with that produced between pieces of the metal under examination and by means of Nicol's prisms suitable lines in both spectra can be adjusted to the same intensity, and thus the quantity of the desired constituent can be calculated. The use of the apparatus in the analysis of iron is described.—v. G.

Magnesia Apparatus for Qualitative Chemical Reactions. E. Wedekind (*Chem.-Zeit.*, 1932, 56, 107).—Specially prepared MgO rods made by the Steatit-Magnesia A.-G. may be used for flame tests, borax bead tests, and Na_2CO_3 - KNO_3 fusion tests for Mn and Cr instead of Pt wire or foil.

—A. R. P.

On the Behaviour of Some Insoluble Electrodes. I. Lifschitz and M. Reggiani (*Gazz. chim. ital.*, 1931, 61, 915-921; *Chem. Zentr.*, 1932, 103, I, 1557).—The suitability of electrodes of various metals for potentiometric titrations has been examined. Mo and W are useless with KMnO_4 titrations, but Ta gives as good results as Pt, although potential equilibrium is obtained more slowly. SiC can be used as the opposing electrode to Pt or Ta in acid solutions. W is useful in alkaline solutions, and Mo in acid solutions involving no oxidation-reduction reactions.—A. R. P.

New Universal Electrolysis Stand for Stationary and Rapid [Electrolytic] Methods [of Analysis]. Anon. (*Chem.-Zeit.*, 1931, 55, 60).—The stand has a large heavy box-like foot which houses the motor, regulator, and switches, and carries a hollow vertical shaft which acts as a support for the bearings of the rotating shaft to which the electrode is attached, and is itself the bearing of the driving-shaft, which is coupled with the electrode shaft by means of variable speed pulleys and a belt at the top.—A. R. P.

The Analysis of Copper Alloys and White Metals. Walter Berg (*Chem.-Zeit.*, 1931, 55, 530-531).—The alloy (5 gm.) is dissolved in HNO_3 and the precipitate of Sb and Sn oxides collected, washed, ignited, and fused with Na_2CO_3 and S; the melt is extracted with H_2O and the insoluble sulphides are returned to the HNO_3 solution. The filtrate is acidified with $\text{CH}_3\text{CO}_2\text{H}$, the

Sb_2S_3 and SnS_2 are dissolved in HCl , and the metals determined by KBrO_3 and, after reduction, I_2 titration in the usual way. The HNO_3 solution is treated with H_2SO_4 to remove Pb , electrolyzed for Cu (aliquot part), and analyzed for Fe , Mn , Co , Ni , and Zn in the usual way after first separating Zn by digestion with NaOH .—A. R. P.

The Volumetric Assay of Gold. W. Branch Pollard (*Bull. Inst. Min. Met.*, No. 330, 1932, 1-21).—The following solutions are prepared: (A) 400 gm. of Na_2HAsO_3 are dissolved in 30 l. of H_2O and 350 c.c. of HCl (d 1.19), 1 l. of 6% HgCl_2 solution, 0.3 gm. of KI in 25 c.c. of H_2O , and 6500 c.c. of cold H_2O are added in succession; (B) 400 gm. of $\text{CO}(\text{NH}_2)_2$, 200 gm. of KBr , and 80 c.c. of HCl (d 1.19) are dissolved in 40 l. of H_2O ; (C) 0.4186 gm. of hydroquinone is dissolved in distilled H_2O containing 5 c.c. of HCl (d 1.19), and the mixture is diluted to 500 c.c.; (D) a saturated solution of *o*-tolidine in saturated NaF acidified with $\text{CH}_3\cdot\text{CO}_2\text{H}$. To determine the Au in bullion or in an alloy rich in Au , the sample containing about 0.5 gm. of Au is dissolved in 3 c.c. of HCl and 1 c.c. of HNO_3 , and the solution cooled, whilst a current of air is passed through it; 50 c.c. of (B) are added and the solution is slowly titrated at 40°C . with (A) until the precipitated Au settles well and the supernatant liquor just loses its brown colour. After addition of 20 c.c. of (D), the last traces of Au are titrated with (C) until the yellow colour disappears. Solution (A) is standardized against pure Au and adjusted, before use in an assay, so that 1 c.c. = 0.01 gm. of Au ; 1 c.c. of solution (C) = 0.001 gm. of Au . When the alloy contains much Ag it may be inquarted with Cu to assist dissolution in aqua regia. Of all the metals usually found in Au alloys only Pd and a large excess of Cd interfere.—A. R. P.

Analysis of Nickel by the Method of Parr-Lindgren. G. I. Smirnov (*Ucheniye Zapiski Kazan. Gosudarst. Univ. (Science Reports of the Kazan State University)*, 1930, 90, (6), 1024-1035; *C. Abs.*, 1932, 26, 1541).—[In Russian.] The modification of the dimethylglyoxime method of determination of Ni suggested by Parr and Lindgren consists in dissolving the nickel compound in H_2SO_4 of known concentration and titrating the excess. This method was investigated by S. in a series of analyses of $\text{Ni}(\text{NO}_3)_2$ with HCl sometimes in place of H_2SO_4 , and found to give more exact results than other methods in general use.—S. G.

Microchemistry in Metallurgy. M. Niessner (*Mikrochemie*, 1931, 10, 271-276).—A lecture.—A. R. P.

Application of Microanalysis to the Examination of Precious Metal Alloys. R. Strebinger (*Mikrochemie*, 1931, 10, 306-312).—A lecture reviewing recent work on streak and spot tests and quantitative microanalysis of Au , Ag , and Pt metal alloys.—A. R. P.

On the Behaviour of 1-Phenyl-2:3-dimethylpyrazolone [Antipyrin] towards Cobalt Solutions. K. Woynoff (*Chem.-Zeit.*, 1931, 55, 914).—Solutions containing Co give no colour reaction with antipyrin, but if a piece of filter-paper is moistened with CoCl_2 solution, dried, and treated with a few drops of 20-30% antipyrin solution, greenish-blue streaks appear in a few minutes, more rapidly on warming. These streaks gradually form bright blue rings enclosing a yellow spot; with only traces of Co the colour disappears on cooling; the sensitivity is 0.0004 gm. of CoCl_2 per c.c. Fe and Cu interfere, the former giving a brown and the latter a citron-yellow colour; Ni , Hg , Mg , and the alkaline-earths are without action on the reagent.—A. R. P.

Fractional Reaction for Barium. A. W. Larionov (*Ukrainskii Khenichnii Zhurnal (J. Chim. Ukraine, Scientific Part)*, 1931, 6, (4), 191-193).—[In Russian.] Ba may be detected in the presence of all other cations by means of its chromate. Pb , Bi , Mg , Fe , Al , Cr , and Mn are first removed as hydroxides by NH_4OH . Of the other cations, only Ag and Ba give precipitates with $\text{K}_2\text{Cr}_2\text{O}_7$ in $\text{CH}_3\cdot\text{CO}_2\text{H}$ solution, but Ag_2CrO_4 , which is brick-red, can easily

be detected, and removed with excess of NH_4OH , leaving a residue of yellow, crystalline BaCrO_4 .—M. Z.

Fractional Reaction for Magnesium. E. W. Vassilieva (*Ukrainskii Khemichnii Zhurnal (J. Chim. Ukraine, Scientific Part)*, 1931, 6, (4), 195–197).—[In Russian.] Mg may be detected after 5 minutes in concentrations of 0.12 grm./l. in the presence of all other cations by means of sodium hydrogen phosphate. The original solution is treated with concentrated NH_4OH , saturated solutions of $(\text{NH}_4)_2\text{C}_2\text{O}_4$, and $\text{K}_4\text{Fe}(\text{CN})_6$. NH_4OH removes Fe^{+++} , Al, and Cr. $(\text{NH}_4)_2\text{C}_2\text{O}_4$ removes Ba, Sr, and Ca, and $\text{K}_4\text{Fe}(\text{CN})_6$ removes the rest of the cations which might give precipitates with acid sodium phosphate, with the exception of Mg.—M. Z.

Fractional Reaction for Strontium. E. P. Garmasch (*Ukrainskii Khemichnii Zhurnal (J. Chim. Ukraine, Scientific Part)*, 1931, 6, (4), 173–181).—[In Russian.] Sr can be detected in the presence of all other cations in concentrations of 0.043 grm./l. after 5 minutes and 0.022 grm./l. after 6–7 minutes. To the original solution a concentrated solution of $\text{CH}_3\text{CO}_2\text{Na}$ is added, and all the cations forming insoluble chromates are removed by the addition of $\text{K}_2\text{Cr}_2\text{O}_7$. All the remaining cations form soluble sulphates except Sr, which gives a precipitate on boiling with a solution of $(\text{NH}_4)_2\text{SO}_4$. If considerable amounts of Ca are present a similar reaction occurs.—M. Z.

On the Application of *p*-Dimethylaminobenzylidenerhodamine in Spot Analysis [for the Detection of Silver]. Hans Holzer (*Mikrochemie*, 1931, 10, 60–63). Remarks on the Paper by H. Holzer. F. Feigl (*ibid.*, 64–65).—Polemic.—A. R. P.

A Capillary-Chemical Micro-Method for the Detection of Silver. G. Ettisch and J. Tamchyna (*Mikrochemie*, 1931, 10, 92–96).—A strip of collodion membrane is immersed in a solution of albumen or aminoacetic acid for 18 hrs., then thoroughly washed and immersed in the solution to be tested for Ag. After 24 hrs. the strip is washed, transferred to a tube containing 0.5 c.c. of H_2O , and treated with 1 drop of alcoholic *p*-dimethylaminobenzylidenerhodamine and 1 drop of dilute HNO_3 . A red colour appears on the membrane in the presence of more than 1 part of Ag in 4×10^7 parts of solution. By means of this test, Ag has been found in distilled H_2O left in contact with Ag for 4 days.—A. R. P.

Use of Phenolic Acids in the Detection, Separation, and Estimation of Metals. V.—Separation of Copper from Cadmium and their Subsequent Estimations. Pabitra Nath Das-Gupta and Haribola Saha (*J. Indian Chem. Soc.*, 1931, 8, 19–21; *C. Abs.*, 1931, 25, 2938).—By adding a 1% solution of gallic acid to the boiling solution of Cu and Cd in the presence of alkaline acetate, a voluminous, brown precipitate is formed which can be filtered off and ignited to CuO . The precipitate is bulky, and can serve for the determination of small quantities of Cu. The Cd is not precipitated by gallic acid under these conditions.—S. G.

Investigations into the Analytical Chemistry of Tantalum, Niobium, and their Mineral Associates. XX.—The Separation of Tin from Tantalum and Niobium. W. R. Schoeller and H. W. Webb (*Analyst*, 1931, 56, 795–801).—The mixed oxides are fused with KHSO_4 , the melt is extracted with tartaric acid, and the solution, without filtering, is saturated with H_2S after addition of a little HgCl_2 . The precipitate is collected, ignited, and weighed; it may be tested for purity by reduction in H_2 at a low red heat and dissolution of the Sn in HCl . Any residue is fused with KHSO_4 and added to the main earth acid fraction. Ta and Nb are recovered by expelling H_2S , neutralizing the solution, and adding tannin.—A. R. P.

Drop Reactions and their Use in Analysis. Fritz Feigl (*Tech. u. Industrie u. Schw. Chem.-Zeit.*, 1931, 14, 211–212).—Practical applications of drop reactions to systematic qualitative analysis are indicated.—A. R. P.

VI.—LABORATORY APPARATUS, INSTRUMENTS, &c.

[See also "Testing" and "Pyrometry."]

(Continued from pp. 311-312.)

An Electric Laboratory Furnace for High Temperatures. W. Weyl and M. Bichowsky (*Chem. Fabrik*, 1931, 469).—The furnace which is of the wire-wound resistance type has the heating coils arranged in recesses inside the refractory lining, so that all the heat generated is reflected into the furnace. By using a platinum or, better still, a rhodium-platinum alloy wire, temperatures between 1500° and 1600° C. can be maintained constant for considerable periods if the outside of the lining is efficiently lagged. Obviously operations in which a vapour is formed which attacks the wire, cannot be carried out in the furnace.—A. R. P.

Electric Eye Means Accurate Heat-Treatment. Anon. (*Metal Progress*, 1932, 21, (1), 43-45).—The use of the photoelectric cell in heat-treatment is described; the cell opens a sensitive relay when the intensity of colour indicates the maximum temperature desired. The relay cuts off the heating current and at the same time allows the piece under treatment to drop into the quenching tank. Very close control and complete freedom from distortion and overheating are claimed for this method.—P. M. C. R.

Apparatus for Producing Vacuum Used in Industrial Laboratories. E. Küss and G. Ritter (*Dechema Monogr.*, 1931, 3, (13), 20-30; *Chim. et Ind.*, 1931, 26, 1093-1094; *C. Abs.*, 1932, 26, 1159).—Examples are given of cases in which the use of apparatus for producing high vacuum has proved very useful, particularly in analytical chemistry.—S. G.

New Method for the Complete X-Ray Investigation of the Fine Structure of Technical Materials. F. Regler (*Z. Physik*, 1932, 74, 565-573).—X-ray analysis equipment for general work, viz. the determination of lattice constants, the detection of strained portions of industrial products, &c., is briefly described.—J. S. G. T.

Test for Smoothness of Machined Surfaces. F. A. Firestone, F. M. Durbin, and E. J. Abbott (*Metal Progress*, 1932, 21, (4), 57-59).—Apparatus is described for measuring the roughness of a machined surface and for determining the nature of irregularities. A photographic recorder traces the movements of a spot of light reflected by a small mirror, angular displacements of which are produced by a fine attached tracer point which traverses the surface under investigation. A pilot point rests on the pilot surface, which has the same nominal curvature as the surface to be measured; hence only departures from the theoretical curvature are indicated, and the record is not affected by the normal curvature. No special treatment is required for the sample, and measurements can be taken on any portion of the surface.—P. M. C. R.

New Methods of Measurement for Tool Machines. E. Sachsenberg and W. Osenberg (*Z.V.d.I.*, 1932, 76, 262-268).—Mechanical, mechanical-optical, electrical, and electrical-optical apparatus for the measurement of power and deformation is described with especial reference to processes in which metal is removed, e.g., by turning, from the material being worked.—v. G.

On the Exact Measurement of Small Round Parts. Anon. (*Bull. tech. Suisse Romande*, 1932, 58, 95-96).—An appreciable error through scratching of the specimen is introduced by contact gauging between two gripping surfaces. Optical methods are subject to defects due to reflections, shadows, &c. The "Magister" micrometer, produced by "Micromécanique S.A.," Neuchâtel, reduces abrasion to a negligible amount, and over the values 0-20 mm. obtains results accurate to less than one micron.—P. M. C. R.

VII.—PHYSICAL AND MECHANICAL TESTING AND RADIOLOGY

(Continued from pp. 312-313.)

Some Principles of Testing.—I. W. Rosenhain (*Metallurgist* (Suppt. to *Engineer*), 1932, 8, 57-58).—A discussion of the interdependence of design and quality of materials in castings, the reasons for the present methods of testing, and the functions of specifications.—R. G.

Material Testing. O. Föppl. P. Ludwik (*Z.V.d.I.*, 1932, 76, 345-346).—A polemical discussion on Lehr's paper (see *J.*, this volume, p. 174). F. considers that a distinction should be made between his method of improving the endurance limit of constructional parts by surface pressure and the usual method of polishing to a mirror surface by burnishing. F. further doubts the validity of accepting the rise in temperature in endurance tests as a measure of the damping capacity of the material. L. replies that he looks upon this rise in temperature not as an absolute measure of the damping, but as a useful indication of the damping capacity of the material.—v. G.

Polarized Light and its Applications to Engineering. E. G. Coker (*Metallurgia*, 1932, 5, 189-194).—A very full and detailed abstract of a lecture to the Institution of Mechanical Engineers (Southern Branch) dealing with the application of polarized light to the viewing of loaded transparent plate models of parts of machines, whereby internal stresses are shown just as they occur in the actual members. The abstract is well illustrated by photographs, some in colour, sketches, and diagrams.—J. W. D.

Testing Machine of Unusual Capacity. Anon. (*Metallurgia*, 1932, 5, 160).—A description of a testing machine to be installed in the laboratory of the University of California capable of testing columns up to 33 ft. 6 in. long in compression up to 4,000,000 lb. load and in tension up to 3,000,000 lb.

—J. W. D.

The World's Largest Compound Lever Testing Machine. Anon. (*Iron Steel Ind.*, 1932, 5, 278).—A description of 1250-ton compound lever testing machine for testing the material used in the construction of the Sydney Bridge. Models of all the important units of the bridge were made to a scale of $\frac{1}{8}$, and these were individually tested in the machine.—J. W. D.

On New Methods and Results of Plasticity and Velocity of Sound Measurements in Solid and Liquid Metals. O. Stierstadt (*Metallwirtschaft*, 1932, 11, 18-21, 32-34, and (summary) *Metallurgist* (Suppt. to *Engineer*), 1932, 8, 55-57).—An electro-acoustic method is described for the determination of the velocity of sound in solid and liquid metals. From the results the elastic modulus E may be calculated in the solid state and the compressibility, k , in the liquid. On solidification the velocity of sound for a number of materials (bismuth is an exception) jumps to double its value in the liquid. From this it follows that $25E = 1/k$ approximately. This rule is explained thermodynamically.—v. G.

The Practice of the Notched Tensile Test with Reference to the Technical Determination of Cohesion [in Metals]. W. Kuntze (*Metallwirtschaft*, 1932, 11, 179-184).—Tensile tests are made at the Staatlichen Materialprüfungsamt (State Testing Department) in Berlin-Dahlem on cylindrical rods with a triangular notch cut round the cylinder. The angle and depth of the notch can be varied, but it is important that the notch be carefully made, so as not to strain the metal unduly. The apparatus and method of carrying out the test are described in detail and possible sources of error are discussed.—v. G.

On the Mechanics of Tensile Testing—Tensile Strength, a Phenomenon of Instability. Paul Melchior (*Light Metals Research*, 1931, 1, (11), 16).—An abstract of a paper read before the Third International Congress for Technical

Mechanics, Stockholm, 1930. The tensile test is examined from the viewpoint that it is a "forced stretching" test during which the resistance to stretching is observed. The maximum load is the load at which deformation becomes unstable. The relation between ordinary tensile tests and "creep" tests is considered.—J. C. C.

Large Tensile Testing Machine for Toronto. Anon. (*Canad. Mach.*, 1932, 43, (1), 30-31).—A large Avery tensile testing machine for wire rope cables up to a maximum circumference of 11 in. and length 6 ft. is described and illustrated. The specimen is in clear view during the straining process. Methods of preparing, handling, and gripping are described. Straining speeds of 0.1 in. and 0.4 in. per minute are obtainable. There is an autographic recording apparatus. The machine, which applies a strain of one million lb., occupies relatively very little floor space.—P. M. C. R.

Tests Simple Shapes for both Static Band and Repeated Loading. Anon. (*Automotive Ind.*, 1931, 65, 992).—The Föppl-Heydekampf machine is adapted both for static bending tests and for fatigue testing. For the latter, one end of the specimen is rigidly held, whilst the other is oscillated by attachment to a mass swung by electro-magnets. A static weighing device allows of determination of the actual stress-strain relation, and eliminates error arising from non-rigidity in the clamps. Stress is constant over the full gauge length of the specimen, and failures consequently occur at the weakest point, thus revealing any lack of uniformity.—P. M. C. R.

On the Standardization of the Notched Bar Impact Test. M. Moser (*Z.V.d.I.*, 1932, 76, 257-261).—A review of a paper read before the New International Association for Testing Materials. See this *J.*, 1931, 47, 492.—v. G.

The Duroskop [Hardness Tester]. O. Schwarz (*Z. Metallkunde*, 1932, 24, 93-94).—Describes the handling of the Duroskop, a small pocket hardness-tester which in some respects resembles the Scleroscope. Curves show the relation between the Duroskop hardness of carbon steel, chromium-nickel steel, aluminium, and brass of different degrees of hardness.—M. H.

Hardness Tester for Internal Cylinder Walls. Anon. (*Machinery (Lond.)*, 1930, 36, 635).—The load is applied to the steel ball by hydraulic pressure, and is read on a pressure gauge; the resulting impression is measured by means of a special microscope which is introduced into the cylinder. The instruments are applicable to cylinders of from 2.75 in. internal diam., and of up to 15.75 in. in depth.—H. F. G.

Service Function of Pistons is Used as Basis for Testing and Inspecting. Ernst Mahle (*Automotive Ind.*, 1932, 66, 523-526, 540, 552-555).—I.—The testing of motor and aero pistons is classified, and methods are described and illustrated. The tests applied are dynamometer tests, piston temperatures, thermal conductivity, thermal expansion of both material and piston, hardness, and wear-resistance. Special apparatus has been designed in some cases to reproduce service running while eliminating the variability of certain conditions. II.—Tensile, compression, and deformation tests on pistons, piston pins and connecting-rods are described. The influence of the piston pin in deformation is discussed, and methods of determining stress distribution are considered.—P. M. C. R.

RADIOLOGY

X-Ray Installation at Sun Shipyards. Anon. (*Marine Eng. and Shipping Age*, 1932, 37, 151).—A detailed description of an installation designed primarily for the routine examination of welded seams in pressure vessels, but which can also be used with equal facility for the inspection of castings, tanks, and other objects. This flexibility and convenience have been secured by a co-ordinated system of supporting and rotating the vessels to be examined and of supporting and shifting the X-ray tube.—J. W. D.

VIII.—PYROMETRY

(Continued from p. 313.)

High-Temperature Control. Photoelectric Tube Pyrometry. Lewis R. Koller (*Indust. and Eng. Chem.*, 1931, 23, 1379-1381).—Development work done in the research laboratory of the General Electric Company at Schenectady, N.Y., U.S.A., on a photoelectric tube apparatus is described and illustrated. By its means it is possible to control the temperature of industrial furnaces. This method can be applied to temperatures from 1000° C. upwards. The principle involved, the circuit and limits of accuracy of this method are described.—F. J.

Temperature Measurement. J. Marteret (*Science et Industrie*, 1932, 16, 97-98).—The fundamental principles of heat exchange are discussed, and are followed by a survey of various scales and their correlation. The merits of Kelvin's absolute scale are emphasized. A combined scale, utilizing helium, hydrogen, resistance thermometers, and thermocouples, and finally optical methods, is the nearest experimental realization of Kelvin's scale: this composite scale is in process of becoming general, and its wider adoption in industrial pyrometry is advocated.—P. M. C. R.

New Micropyrometer. Anon. (*Met. Ind. (Lond.)*, 1932, 40, 494).—A new type of micropyrometer has been developed at the Westinghouse Research Laboratories, primarily for studying the characteristics of welding slags, but it is expected to have other metallurgical applications. It consists essentially of a platinum strip suspended between 2 terminals in a gas-tight chamber. Current is supplied from a step-down transformer. A small sample of the material, the melting point of which is required, is placed on the platinum strip and the current switched on. The specimen is kept under observation through a microscope and a quartz window in the heating chamber. Experiments can be conducted in various atmospheres and *in vacuo*.—J. H. W.

IX.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Continued from pp. 314-318.)

ELECTRODEPOSITION

Electrolytic Cadmium Plating. F. Pietrafesa and C. Luciani (*Metallurgia italiana*, 1932, 24, 1-9; *Chem. Zentr.*, 1932, 103, I, 1709-1710).—The cathode yield and grain-size of deposits from sodium cadmiyanide baths increase with increase in cadmium concentration. Increase in free sodium cyanide improves the efficiency but reduces the adherence of the deposits; free sodium hydroxide or carbonate or both have a similar effect. Anodic corrosion decreases slowly with rising CN' concentration owing to decreased polarization. Gelatin is the best colloid for refining the grain-size. Lead and antimony have a deleterious effect in the bath with or without gelatin, but tin is harmless in the absence of gelatin.—A. R. P.

The Theory of the Deposition of Chromium from Aqueous Chromic Acid Solutions.—V. Erich Müller (*Z. Elektrochem.*, 1932, 38, 205-211).—Theoretical considerations on the question of chromium plating are continued. See this *J.*, 1931, 47, 164, 397.—J. H. W.

Durable Bright Chromium Finish Now Assured by Proper Processing. Joseph Geschelin (*Automotive Ind.*, 1932, 66, 481-484).—The influence of quality and uniformity of undercoatings on the corrosion of chromium plating is considered, together with the improvement in corrosion-resistance produced

by heat-treatment, although with diminution of hardness. No simple wear-hardness relation is available; some experimental results are given. The selection and inspection of the basis materials are of great importance. Some developments in nickel-plating are described, and recent applications of nickel and chromium plating are enumerated.—P. M. C. R.

Electrostatic Distribution in Chromium Plating. R. J. Piersol (*Metal Cleaning and Finishing*, 1931, 3, 965-969).—A discussion.—S. G.

Bright Plating Ratio in Chromium Plating.—II. R. J. Piersol (*Metal Cleaning and Finishing*, 1931, 3, 827-830).—Cf. *J.*, this volume, p. 314. Data on metal distribution tests are given.—S. G.

The Determination of the Bright Plating Ratio in Chromium Plating. R. J. Piersol (*Metal Cleaning and Finishing*, 1931, 3, 863-865).—Cf. preceding abstract. A procedure for control work in a plant is outlined.—S. G.

Chromium Plating. Frances D. Weaver (*Woman Engineer*, 1931, 3, 134-136; and *Burn's Eng. Mag.*, 1932, 26, 214-216).—An account is given of the process, and the advantages and limitations of the method are discussed.

—P. M. C. R.

Preparation of Chromium Deposits of Sufficient Thickness Free from Fissures and Pores. P. Hentschel (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, 30, 11-13, 13-14).—Polemical. A discussion of Hentschel's paper (see *J.*, this volume, p. 176).—A. R. P.

Stella Chromium Plating Solution. Anon. (*Met. Ind. (Lond.)*, 1932, 40, 406).—A short note on the advantages claimed for a plating solution marketed under the name of the "Stella Chromium Plating Solution."—J. H. W.

Chromium Plating on Zinc Alloys Should Have 0.0003 in. Thickness. E. A. Anderson and C. E. Reinhard (*Automotive Ind.*, 1932, 66, 528-529, 542).—Chromium-plated zinc goods are increasingly produced on account of the cheapness of zinc and the recent availability of many more of its alloys, but adequate specifications must be insisted on to ensure high quality. A. and R. consider the accelerated salt-spray test inferior as a criterion of protective value to the outdoor service test, and, using the latter as basis, they find the lower limit of thickness for effective protection of zinc to be 0.0003 in. Methods of gauging thickness are enumerated, and the results of corrosion tests illustrated.

—P. M. C. R.

Electrodeposited Lead Coatings as a Protection against Corrosion. Anon. (*Z.V. d.I.*, 1932, 76, 300).—Lead coatings deposited from phenolsulphonic acid baths are particularly resistant to corrosion, owing to the presence of small quantities of adsorbed hydrogen; 100 grm./m.² of lead corresponding with a thickness of 0.001 mm. afford adequate protection to iron articles. Electrolytic lead coatings are especially suitable for iron work exposed to the atmosphere and to the action of locomotive smoke, e.g. railway stations and bridges. The life of such coatings is about 10 years.—v. G.

New Process Might Restore Nickel Plating to Popularity. Paul Fidrmuc (*Canad. Mach.*, 1932, 43, (4), 22).—The "Panzer-nickel" plating process is claimed to give a passive non-rusting coating, non-porous, dense, and finely granular in structure, and free from the flaking tendency exhibited by older types of nickel coating. Existing plating plant can be easily adapted to the new process.—P. M. C. R.

Notes on the Low p_{H} Nickel Plating Solution. A. K. Graham (*Metal Cleaning and Finishing*, 1931, 3, 911-914; *C. Abs.*, 1932, 26, 1197).—A discussion of the advantages of a low p_{H} for nickel plating baths.—S. G.

Chemical Control of Nickel Plating Baths.—II-IV. L. C. Pan (*Metal Cleaning and Finishing*, 1931, 3, 799-804, 877-880, 961-964, 970; *C. Abs.*, 1932, 26, 1197).—Cf. *J.*, this volume, p. 315. (II)—The determination of the alkalinity and acidity of nickel plating baths is described. Methyl red was found to be the most suitable indicator for the titration of nickel sols. An analysis chart

is given from which the acidity in c.c. of 95% sulphuric acid per gall. or the alkalinity in c.c. of 28% ammonium hydroxide per gall. can be directly read off from the number of c.c. standard ammonium hydroxide or sulphuric acid solution used. (III)—The method of correcting acidity or alkalinity is discussed. (IV)—The determination of the chloride and boric acid content of nickel plating baths is described. Convenient analysis charts are given.—S. G.

ELECTRO-REFINING, &c.

Recovery of Precious Metals from Electrolytic Copper Refining at the Canadian Copper Refiners' Plant, Montreal East, Quebec. C. W. Clark and A. A. Heimrood (*Electrochem. Soc. Preprint*, 1932, 437-450).—The anode slimes contain copper 45.2, silver 8, gold 2.5, selenium 24.6, tellurium 3.8, lead 1.9, arsenic, antimony, nickel, and iron 0.04-0.4% each; they are roasted in a five-hearth furnace at 200°-300° C. and the copper is extracted by leaching with foul electrolyte from the refinery. The residue contains silver 31, gold 9.3, copper 3.8, selenium 24.6, tellurium 2.4, lead 10.2%, and a little arsenic, antimony, and iron; it is smelted to a crude gold-silver alloy containing 25% gold, 74.5% silver, and 0.5% copper, and slags from which selenium, tellurium, and copper can be recovered. The bullion is electrolysed in Möbius cells to obtain pure silver, and the slimes from these cells are boiled with concentrated sulphuric acid to obtain a residue of pure gold, which is subsequently melted under a borax flux in a graphite crucible. The flue gases from the roasting and melting furnaces are passed through a series of scrubbers and a Cottrell plant to recover fume which carries a high proportion of gold and silver.

—A. R. P.

Direct Production of Magnesium-Aluminium Alloys by the Electrolysis of the Molten Material. Robert Weiner (*Z. Elektrochem.*, 1932, 38, 232-240).—The electrodeposition of magnesium from the molten material using a cathode of molten aluminium has been investigated, and the effect of different conditions of working is shown in tables and curves. For the electrolyte, carnallite with the sole addition of 2% calcium fluoride is used; the addition of sodium chlorides is deleterious. The most satisfactory temperature for the electrolysis lies between 600° and 640° C., and the best current density was found to be 1.5 amp./cm.², giving a current efficiency of 85-90%. The e.m.f. depends largely on the current density; for 1.5 amp./cm.² at 600° C., 5.5 v. gives the best results. The energy consumption under these conditions is 13-15 kw.hr. per kg. magnesium.—J. H. W.

Contribution to Our Knowledge of the Principles of Technical Zinc Electrolysis. P. Röntgen and R. Buchkremer (*Metallwirtschaft*, 1931, 10, 931-936).—The relation between the hydrogen overvoltage and the cathode potential of zinc electrodes in sulphuric acid solutions at current densities of 100-4000 amp./m.² on the one hand and the temperature, current density, surface properties and acid and zinc concentration in the electrolyte on the other are shown graphically. Current yield increases with rise in temperature, increase of zinc concentration, decrease of acid concentration and, in concentrated zinc solutions, with increase in current density.—v. G.

Influence of Cobalt on Technical Zinc Electrolysis. P. Röntgen and R. Buchkremer (*Metallwirtschaft*, 1931, 10, 963-967; corrigenda, 1932, 11, 35).—In zinc sulphate solutions free from colloids up to 10 mg./l. of cobalt is harmless, but the limiting amount varies somewhat with the conditions; with 100 mg./l. the yield of zinc is very poor, but addition of gelatin to the electrolyte will produce a good yield with 100-500 mg./l. of cobalt, according to the acidity. Under certain conditions the yield and quality of the zinc deposit are better in the presence of colloids and small quantities of cobalt than from solutions which have been freed completely from cobalt.—v. G.

X.—INDUSTRIAL USES AND APPLICATIONS

(Continued from pp. 319-323.)

Bearing Metals To-day. Anon. (*Met. Ind. (Lond.)*, 1932, 40, 497).—Comment on a paper read by C. H. Bierbaum at a Conference on Metals and Alloys held under the auspices of the Cleveland Engineering Society. See *J.*, this volume, p. 179.—J. H. W.

Babbitt for Machine Repair Work. Robert Tweedside (*Canad. Mach.*, 1931, 42, (26), 185).—A cheap, strong Babbitt of analysis: tin 20, lead 63.5, antimony 15.0, copper 1.5%, if made up carefully from virgin ingredients, is found to be very durable, to flow easily, to stand reheating, and to oxidize very little when molten.—P. M. C. R.

Babbitting Plant for Bearings. G. Ambrose Gibbs (*Machinery (Lond.)*, 1930, 36, 529-531).—The plant described for preheating, tinning, and filling bearings, is said to overcome many of the difficulties of hand pouring.—H. F. G.

Aluminium and Bauxite. C. L. Mantell (*Mineral Ind.*, 1931, 39, 13-31).—The resistance of aluminium to atmospheric corrosion is responsible for a steady increase in its use as a roofing and sheet metal and as an ornamental metal on buildings. Some progress has been made in the manufacture of aluminium office furniture. The use of aluminium paint has been extended to the preservation of wood. Electroplating of other metals on aluminium has been commercialized.—E. S. H.

Development of the Uses of Aluminium and its Alloys in the Tawing and Glove Leather Dyeing Industries. Constantin Szumukler (*Cuir tech.*, 1931, 20, 418-421; and *Halle aux cuirs*, 1932, 16-22; *C. Abs.*, 1932, 26, 1472).—Aluminium and Duralumin are gradually replacing iron, steel, wood, &c., in the leather industry equipment because of their chemical resistance. The individual steps in the tawing process are described in detail, with emphasis on the present or future use of aluminium or Duralumin.—S. G.

Aluminium Increases the Pay Load. W. E. Archer (*Welding Eng.*, 1932, 17, (2), 37-38).—Two transport tanks for petrol are described. They were fabricated by oxy-hydrogen welding from $\frac{1}{4}$ in. thick half-hard sheet. The combined capacity of the two tanks is a little more than 7000 gall., and a saving in weight of 46% was obtained, compared with similar tanks made from $\frac{1}{8}$ in. steel.—H. W. G. H.

Aluminium Foil Used for Tank Roofing. H. F. Perkins (*Oil and Gas J.*, 1930, 29, (28), 31; *J. Inst. Petrol. Tech.*, 1931, 17, 64A).—Aluminium has proved very resistant to the ravages of hydrogen sulphide, organic sulphur compounds, and atmospheric corrosion. Aluminium foil 0.005 in. thick, rolled from chemically pure aluminium, is most suitable for use, being equivalent to 1 in. of good insulating material at probably one-tenth the weight and half the cost. Asphalt may be used as the adhesive, but disintegration of the adhesive may cause the foil to become loosened at the edges. Locked seams can now be made by machine, ensuring mechanical continuity, and making them proof against vapour and moisture.—S. G.

Aluminium Foil for Cheese Wrapping. Anon. (*Aluminium Broadcast*, 1930, 2, (41), 4-8).—A review of the requirements for aluminium foil for wrapping cheese, and a description of the ammonia-salt tests for measuring corrosion attack developed in the German Food Research Laboratories. Cheese should not be packed until fully ripened. Although aluminium is attacked more strongly than tin by the products of the ripening process, none of the aluminium compounds is poisonous.—J. C. C.

Aluminium in Wireless. Anon. (*Aluminium Broadcast*, 1930, 2, (32), 21).—Examples of the use of aluminium in wireless receiving sets.—J. C. C.

Aluminium Seals and their Application. Anon. (*Aluminium Broadcast*, 1930, 2, (31), 11).—A résumé of a booklet issued by Aluminium (II), Ltd., dealing with the advantages and construction of aluminium seals and screw caps for bottles.—J. C. C.

Aluminium Paints in the Construction of Apparatus. Erich Becker (*Apparatebau*, 1932, 44, 59-60).—The advantages, application, and properties of aluminium paint are briefly discussed.—M. H.

Rubber Aluminium Paint. Anon. (*Aluminium Broadcast*, 1930, 2, (50), 23).—Abstracted from *India Rubber J.*, 1930, November 29. Aluminium paint using liquid rubber as a vehicle is claimed to have a very high covering power and to be particularly resistant to heat. It has kept in good condition for more than 4 months on the exhaust manifold of motor cars.—J. C. C.

Aluminium Fuel Tubes for Aircraft. Anon. (*Met. Ind. (Lond.)*, 1932, 40, 446).—Very brief note. Experiments, using a special testing machine, conducted by the Material Division of the U.S. Air Corps, on the effect of vibration on the semi-flexible tubing used for petrol and oil connections on aeroplanes, show that tubes made of aluminium alloys proved equal in strength to copper with the advantages of lighter weight. A further improvement was effected by applying vulcanized rubber tubing to the metal tubing, giving increased flexibility at the joints to fittings.—J. H. W.

Aluminium Alloys for Aircraft-Engine Pistons and Cylinder Heads. A. J. Lyon (*Z. Metallkunde*, 1932, 24, 84).—A detailed abstract from the paper published in *Trans. Amer. Soc. Mech. Eng.*, 1930, 52, (1), AER. 257-269; see this *J.*, 1931, 47, 555-556.—M. H.

Bohnalite Cylinder Heads. Anon. (*Automotive Ind.*, 1932, 66, 246).—Two types of cylinder-head in Bohnalite, an aluminium alloy, are stated to permit higher compression ratios than with the usual iron heads, thus giving increased power and lower fuel consumption. There is also better cooling of the sparking-plugs, and a 60% reduction in weight as against cast-iron. The single-unit head consists entirely of Bohnalite, the combustion chamber side being cast in a permanent mould, whilst the upper part, cored for water-circulation, is a sand-casting. In the composite type, the combustion chamber is of Bohnalite and the upper part of grey iron.—P. M. C. R.

Aluminium in the Motor-Cycle Industry. W. Tyson (*Met. Ind. (Lond.)*, 1932, 40, 447-448).—The properties of aluminium and aluminium alloys which make them especially suitable for use in motor-cycle construction and their applications in this respect are discussed.—J. H. W.

Aluminium Alloys in Transportation. W. Holzauer (*Metal Progress*, 1932, 21, (3), 37-41).—Non-productive weight can be reduced by the use of light alloys in such parts as pistons, crank-cases, radiator shells, body castings, and air-cooled engine heads (castings), and as forgings, or in the rolled condition, for piston and connecting-rods, propellers, car frames, panelling, and car and truck body-work. Suitable alloys for each of these purposes are enumerated.—P. M. C. R.

Light Metal Omnibuses. F. Gentzke (*Aluminium Broadcast*, 1930, 2, (40), 20).—Abstract of a pamphlet issued by V. L. W. (Germany). About 200 omnibuses having frameworks of Lantal and similar alloys have been built in 4 years. A weight reduction of 65-70% should be obtainable. Constructional details are given.—J. C. C.

An All-Metal Bus Service. Anon. (*Aluminium Broadcast*, 1930, 2, (39), 20).—Abstracted from *Motor Body Building*, 1930, Sept. Describes the construction of a motor-coach body from aluminium alloy extruded sections.—J. C. C.

Aluminium in Tramway Rolling Stock. Anon. (*Aluminium Broadcast*, 1930, 2, (42), 13-15).—J. C. C.

The Hull; Economy in Weight. — Dollé (*Science et Industrie*, 1932, 16, (Special Issue 218B), 23-32).—Economizing weight has received much attention

on account of recent international agreements limiting the displacement of warships. D. recommends: (1) systematic experimental checking of the rules, mostly empirical, which govern the choice of scantlings, and thus a more intelligent and effective use of materials now available; (2) fuller application of recently developed materials, especially of the light alloys; (3) extended use of electric welding. In connection with (2), D. considers present marine applications of light alloys, mainly in regard to corrosion. He enumerates some suitable alloys, and briefly considers their protection by paint, varnish, anodic oxidation, Parkerizing, or metallic coating of various types. He outlines methods of joint-protection. Possible future developments in the use of light alloys for marine work, especially in framework and superstructure, are outlined, and their limitations indicated.—P. M. C. R.

Silumium in Shipbuilding. Anon. (*Aluminium Broadcast*, 1930, 2, (39), 23-24).—Abstracted from a special supplement to *Metallwirtschaft*, 1928, 7, 1107.—J. C. C.

Aluminium Motor Boats. Anon. (*Aluminium Broadcast*, 1930, 2, (42), 16-18).—Abstracted from *Motor Boat*, 1930, October 10. Describes the construction of motor boats from a magnesium-aluminium alloy, Birmabright.—J. C. C.

Germany Uses Aluminium Alloy for Transmission Lines. Anon. (*Compressed Air Mag.*, 1932, 37, 3738).—An account is given of Aldrey, which, by reason of its high electrical conductivity, good drawing properties, high tensile strength, and good fatigue and corrosion resistance, is stated to be replacing copper for transmission work in Germany, especially near the coast.—P. M. C. R.

Steel-Cored Aluminium Conductors. Anon. (*Met. Ind. (Lond.)*, 1932, 40, 456).—A brief abstract of a brochure entitled: "Steel-Cored Aluminium Transmission Lines," published by the British Aluminium Co., Ltd.—J. H. W.

Steel-Cored Aluminium Conductors in 1930. Anon. (*Aluminium Broadcast*, 1930, 2, (39), 25).—Details are given of recent transmission schemes employing steel-cored aluminium conductors.—J. C. C.

Use of Aluminium Alloys in Machine Tools. Anon. (*Aluminium Broadcast*, 1930, 2, (45), 10-11).—Examples are described of the use of aluminium alloys for pulleys, jigs, arbor supports, driving heads, inspection doors, and work heads.—J. C. C.

The Use of Aluminium Alloys in Machine Construction. Anon. (*Machinery (Lond.)*, 1930, 36, 754).—Brief editorial note, mentioning that a special aluminium alloy had been used for the work head slide of a gear grinding machine, not because it was lighter, but because it maintained its accuracy in service to a greater extent than did cast-iron.—H. F. G.

Antimony. K. C. Li (*Mineral Ind.*, 1931, 39, 32-37).—Mainly statistics. The automobile industry is still the largest consumer.—E. S. H.

Arsenic. Paul M. Tyler and Alice V. Petar (*Electrochem. Soc. Preprint*, 1932, April, 431-436).—One of the by-products of the copper industry is arsenic, or arsenious acid. The consumption of the metal and its compounds has been appreciably less than the total that might be recovered from existing sources of supply, notably the copper industry. This paper gives a brief review of the occurrence, production, methods of extraction, and uses of the metal and its compounds in the hope of encouraging a wider field of application.—S. G.

Arsenic. Paul M. Tyler (*Mineral Ind.*, 1931, 39, 38-45).—Discusses production and uses of arsenic.—E. S. H.

Barium and Strontium. Charles Hardy (*Mineral Ind.*, 1931, 39, 64-68).—Barium and strontium can now be obtained commercially, but neither has yet found a large market. Barium has been used as a hardening agent and as a constituent of bearing alloys.—E. S. H.

Chromium. William Drumm Johnston, Jr. (*Mineral Ind.*, 1931, 39, 69-77).—Discusses new chromium alloys and the increasing use of chromium-plated articles.—E. S. H.

Nutrition and Culinary Science. Experiments on Chromium-Plated Cooking Utensils. J. Kochs (*Z. Ernährung*, 1931, 1, 164-165; *C. Abs.*, 1932, 26, 1986).—The juice of a number of red fruits changes from bright red to violet red when cooked in tinned vessels. The change in colour is due to combination of the anthocyanins of the juice with tin or tin salts; this is facilitated by slight acidity or by presence of alkali, but is retarded or prevented by strong acidity. The anthocyanins also facilitate corrosion of the metal. No colour change occurs when the fruits are cooked in chromium-plated copper or brass kettles, and the latter show no signs of corrosion, even after being in regular use for several months.—S. G.

Cobalt. C. W. Drury (*Mineral Ind.*, 1931, 39, 110-115).—A large increase in the consumption of cobalt for magnet steels in the electrical industry is probable.—E. S. H.

Copper. Percy E. Barbour (*Mineral Ind.*, 1931, 39, 116-169).—Statistics of production, refining, and consumption are given.—E. S. H.

Utilization of Copper and Copper Alloys. Wm. G. Schneider (*Mineral Ind.*, 1931, 39, 170-178).—Statistics of consumption of copper in the various industries are given. The consumption is likely to increase, particularly on account of electrical developments. A list of the principal alloys of copper is given, showing their compositions.—E. S. H.

British Standard Specification for Plain Dead-Soft Copper Strip, Bars, and Rods for the Windings of Electrical Machines. — (*Brit. Stand. Inst. No. 444*, 1932, 1-11).—The material is required to be made from electrolytic copper, and to have an electrical resistance not exceeding 0.0241893 ohm./in.²/1000 yards (99.25% of Int. Standard). Tolerances on dimensions and on the radii of corners of square bars are given. The tensile strength is required to be not less than 13 tons and not more than 15.5 tons/in.², with a minimum elongation of 50% for material 0.2 in. thick and above, or 38% for material less than 0.2 in. thick. Other clauses deal with finish, provision of test samples, dimensions of test-pieces, re-tests, inspection, and testing facilities. A table of temperature coeff. of resistance is given in an appendix.—R. G.

British Standard Specification for Copper Commutator Bars for Electrical Purposes. — (*Brit. Stand. Inst.*, No. 445, 1932, 1-10).—This specification refers to bars in which the inclination of the two surfaces is constant throughout the width. The bars are to be manufactured from electrolytic copper and to have an electrical resistance of not more than 0.0247504 ohm/in.²/1000 yards at 60° F. (16° C.). The test may be made on the bar or on wire drawn down from the bar. The bars are to be supplied hard-drawn or rolled. Tolerances on width, thickness, convexity, and length are laid down. A minimum tensile strength of 18-20 tons/in.² is required, according to thickness of the bar, and the required elongation is varied according to tensile strength from 17% for material of 18 tons to 5% for material of 24 tons/in.². The Brinell hardness or scleroscope test may be applied, if desired by the purchaser, and minimum values are given. Other clauses deal with provision of test samples, re-tests, and inspection, and a list of temperature coeff. of resistance is given in an appendix.—R. G.

Special Bronzes for Telephone and Telegraph Wires. F. Freude (*Metallbörse*, 1931, 21, 1491-1492, 1539-1540, 1673-1674).—Copper containing small quantities of cadmium and tin is used in Austria, Rumania, and Poland instead of pure copper for telephone and telegraph wires; the official specifications for the mechanical and electrical properties of such wires are tabulated and an account is given of the methods used in melting and casting the alloys and working them into wire. To produce the desired properties, absolute homo-

gencity of the ingot is essential, and this is obtained only by careful deoxidation; the copper is first melted and after heating to 1200° C. sufficient phosphorus is added to remove most of the oxygen (an excess is particularly deleterious), silicon is then added to improve the tenacity, and finally about 1% cadmium is added to complete deoxidation. Tin may be added to increase the tensile strength above 50 kg./mm.². Red phosphorus (20 grm./180 kg. of copper) is preferable to phosphor-copper, and pure metallic silicon (25 grm. 180 kg. of copper) to silicon-copper.—A. R. P.

Materials for Overhead Trolley Wires. O. Aoki (*Denki Gakkwai Zasshi (J. Inst. Elect. Eng. (Japan))*, 1931, 51, 44-45; *C. Abs.*, 1932, 26, 1886).—[In English.] The results of field tests on hard-drawn copper, cadmium-copper, and silicon-copper trolley wires are given. Materials for overhead trolley wires should possess both a high degree of hardness and a high melting point. The armoured steel-contact conductor is recommended.—S. G.

Copper in Railroad Electrification. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1931, (66), 2-15).—Existing installations and the contemplated development of railroad electrification in all countries with the consequent application of copper are briefly discussed.—J. S. G. T.

Copper, the Highway of Communication. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1931, (63), 2-15).—The use of copper in telegraphy, telephony, television, &c., is briefly referred to.—J. S. G. T.

Use of Non-Ferrous Metals in the Construction of Axial Flow Pumps. Anon. (*Met. Ind. (Lond.)*, 1932, 40, 425-426).—The components of the Vickers-Gill axial flow pump can be divided into 3 main sections: (a) castings and guide vanes. These are made of cast iron. (b) Impellers. These are made of P.M.G. alloy, consisting of copper 88, hardener 10, and zinc 2%, and having a yield-point of 12 tons/in.², ultimate tensile strength 22.4 ton/in.², elongation 18%, and Brinell hardness 95. (c) Pump shafts and liners. The former are made of 3% nickel-steel and the latter of phosphor-bronze containing tin 9.5% and phosphorus 0.5%, and consisting of δ material in a cored α background. The structure of the phosphor-bronze and of cast P.M.G. alloy are illustrated by photomicrographs.—J. H. W.

Copper in the Manufacture of Condenser Tubes for Steam Turbines. Anon. (*Cuivre et Laiton*, 1932, 5, 53-60).—In addition to the usual alloys for condenser tubes: Muntz metal, 70:30 brass, Admiralty brass, and cupro-nickel, two other alloys—Ambrac and Ambro—which correspond, as regards composition, with alloys developed in England, are mentioned. Ambrac is produced in two grades: A.—Copper 75, nickel 20, zinc 5%; B.—Copper 65, nickel 30, zinc 5%. Ambro has the composition: copper 76, zinc 22, aluminium 2%. The main processes by which the tubes are produced are those in which a cylindrical casting is drawn out on a mandril, and in which a disc of metal is gradually forced into a tubular shape by a punch—called, respectively, the "cast shell" and the "cup-drawn" processes. The fitting and cleaning of the tubes are discussed. The question of condenser-tube corrosion is reviewed generally. Inherent causes of attack are wrong composition, bad fitting, and irregular treatment. External causes are the composition of the water, gaseous content, vibration, turbulence, erosion, electrolytic currents. Diagrams and descriptions of a grill to prevent turbulence and of the electrolytic method of corrosion prevention are given. A short bibliography is attached.

—W. A. C. N.

Alumbr Condenser Tubes. Anon. (*Aluminium Broadcast*, 1930, 2, (42), 12).—An abstract of a booklet issued by I.C.I. Metals, Ltd., describing the 76:22:2 aluminium-brass (BNF Patent 308647), which in service acquires a self-healing corrosion-protecting film. During manufacture, special non-turbulent casting methods are necessary to avoid oxide inclusions, which may lead to serious flaws.—J. C. C.

Copper Tubes in Domestic Water Supply.—III, IV. Anon. (*Cuivre et Laiton*, 1932, 5, 7-21).—The article is devoted to the fitting and bending of copper tubes into such forms as may be met in any domestic installation. The best methods suggested for adoption in a variety of typical cases are clearly illustrated by diagrams and photographs. Galvanized iron supports have hitherto been largely used, but polished brass is now being employed. Economically it is considered that at the end of the tube life the copper has still a higher scrap value—both actually and proportionally to original cost—than either lead or iron.—W. A. C. N.

Brass Pipe Banishes Rust Troubles in U.S. Post Offices. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1929, (52), 11).—The replacement of lead water pipes by brass pipes in U.S. post offices is briefly referred to.—J. S. G. T.

What to Look For in a Rustproof House. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1929, (53), 11).—A model dwelling showing the use of brass pipe in the water system, copper in the electrical installation, and brass and bronze hardware and lighting fixtures, is described.—J. S. G. T.

Millions of Pounds of Copper, Brass, and Bronze in the North German Lloyd Liners "Bremen" and "Europa." Anon. (*Bull. Copper and Brass Res. Assoc.*, 1929, (55), 2-3).—The extensive use of copper, brass, and bronze in the construction and equipment of the liners "Bremen" and "Europa" is referred to. The two vessels together contain more than 5,700,000 lb. of copper and its alloys.—J. S. G. T.

Various Bronzes Used by the Compagnies de Chemins de Fer. R. Loiseau (*Cuivre et Laiton*, 1932, 5, 33-37).—Originally published in *Aciers spéciaux*, 1931, 6, 203. See *J.*, this volume, p. 52.—W. A. C. N.

How the World Gets its Food Supply. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1929, (54), 2-16).—The use of copper appliances in food industries is discussed briefly and illustrated.—J. S. G. T.

World's Oldest Countries Become the Newest Market for Copper and its Alloys, Brass and Bronze. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1930, (57), 2-3).—The potentialities of the Orient as a market for copper, brass, and bronze goods are suggested and illustrated by examples of utensils contained in the Damon galleries, New York.—J. S. G. T.

Largest Optical Disk Drilled with Brass Tube. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1929, (52), 12).—A hole 8 in. in diam. in an optical disk 70 in. in diam. and 11 in. thick was bored in 70 hrs. by means of a brass boring tube using water and carborundum in the cut.—J. S. G. T.

Rod Metal in Ornamental Work. Anon. (*Met. Ind. (Lond.)*, 1932, 40, 417, 430).—The advantages of using brass rod and strip in ornamental work are outlined. If the rodding has to be forged, a suitable alloy is: copper 68, zinc 29, lead or aluminium 3%; but if a straight copper-zinc alloy is to be used, the copper should not be less than 70% for forgings. Details of working the metal to suit the design are given.—J. H. W.

New Street Light Standards Use Tons of Copper and Bronze. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1929, (53), 14).—The use of manganese bronze and copper in connection with the street-lighting developments at Seattle and St. Louis is illustrated.—J. S. G. T.

Bank Architects Find Versatility in Metal for Ornament. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1929, (55), 4-5).—The use of copper and bronze for constructional and ornamental details of banks in the U.S.A. is referred to and illustrated.—J. S. G. T.

Modern Design and Metal Buildings. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1931, (62)).—The use of copper and bronze in buildings recently erected in Germany is referred to and illustrated.—J. S. G. T.

Copper Hoods Radiate the Heat of the Fireplace. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1929, (55), 15).—The use of copper for the construction of fireplace hoods is illustrated.—J. S. G. T.

Mediterranean Architecture Permits of Roof Gutters. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1929, (55), 8-10).—The use of copper for the construction of down-pipes of buildings constructed after the style of Mediterranean architecture is suggested and illustrated.—J. S. G. T.

Lead-Coated Copper for Vertical Surfaces and for Roofings. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1932, (69), 2-16).—The use of lead-coated copper sheet in architecture is referred to and illustrated.—J. S. G. T.

Copper and its Alloys in Unusual Applications. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1931, (67)).—Applications of copper and bronze in architecture, in air-conditioning plant, are briefly referred to.—J. S. G. T.

Copper in Modern and Unique Uses. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1931, (65), 2-15).—Modern uses of copper in constructional and artistic work are briefly referred to.—J. S. G. T.

Gold and Silver. H. N. Lawrie (*Mineral Ind.*, 1931, 39, 229-294).—Mainly economics and statistics of production. A brief discussion of the more important recent developments in the hydrometallurgy, pyrometallurgy, and amalgamation of gold and silver follows.—E. S. H.

Lead. Reigart M. Santmyers (*Mineral Ind.*, 1931, 39, 356-384).—The consumption of lead in cable manufacture now exceeds that in the storage-battery industry. New fields are being found for the use of lead-coated steel pipe. Antimonial lead has found a new use in burial caskets. An oil-less bearing metal recently developed consists of the powdered metals zinc, copper, and lead thoroughly mixed with some fatty oxide and moulded at high temperature under very high pressure. De-bismuthizing of lead by means of calcium has come into practice. The calcium is added as a lead-calcium alloy which is stirred with the molten lead at about 660° F (294° C). The bismuth and part of the calcium form a dross which is removed, the bismuth being subsequently recovered. The remaining calcium is removed by the action of chlorine, which produces a slag of calcium chloride.—E. S. H.

On Lead Alloys for Cable Sheaths. T. Aizawa and K. Osani (*Res. Electro-chem. Lab., Tokyo*, 1931, No. 313, 16 pp.; *Physikal. Ber.*, 1931, 12, 2581).—[In Japanese.] For resistance to shock lead-antimony alloys are better than lead-tin alloys; antimony has a greater hardening effect and therefore confers better mechanical properties on the lead. There is no difference in the resistance to corrosion of the antimony and tin alloys in potassium or sodium chloride, nitrate, sulphate, or phosphate solutions or in ammonium chloride solution; in 0.5% nitric acid corrosion of antimonial lead containing more than 0.5% antimony is rapid.—A. R. P.

Lead Poisoning from the Use of Tap Water. F. Tödt (*Centr. Gesundheits. u. Stadtehyg.*, 1930, 2-4; and *Apparatebau*, 1930, 42, 258-260; *C. Abs.*, 1932, 26, 1366).—In Prussia a lead content of 0.3 mg./litre is allowed. This limit is too high. The use of lead pipe should be avoided and may be displaced by copper or by asphalt-coated iron pipes.—S. G.

Magnesite [and Magnesium]. Paul M. Tyler (*Mineral Ind.*, 1931, 39, 384-398).—Magnesite may be used in refractory brick, crucibles, and furnace hearths, for which dead-burned magnesite and dead-burned dolomite are employed. Improvements have been made in the fabrication operations of magnesium products and magnesium alloys, especially in forging, extruding, and rolling. The welding of magnesium alloys no longer presents serious obstacles. Electric spot and seam welds can easily be made. Heating should be carefully regulated to avoid too rapid melting of the metal, but an inert atmosphere is not necessary, and the standard aluminium fluxes are suitable for magnesium welding. The practical application of magnesium and its alloys continues to expand, mainly in deoxidizing or desulphurizing other metals, as a minor addition to aluminium heat-treated alloys, and in aircraft. There is some increase in the use of extruded magnesium ribbon for insulating

electrical heating appliances. The ribbon is wound round the element and then provided with an insulating film of oxide by means of superheated steam.—E. S. H.

Magnesium: Reviewing its Technology of Production and Uses. John A. Gann (*Min. and Met.*, 1932, 13, 179-182).—A brief description of modern methods of extracting magnesium from magnesite and dolomite and some account of its industrial uses.—A. R. P.

Manganese. Chas. H. Behre, Jr. (*Mineral Ind.*, 1931, 39, 399-410).—Mainly statistics of production. Manganese alloys are briefly discussed.—E. S. H.

Quicksilver. H. W. Gould (*Mineral Ind.*, 1931, 39, 529-534).—Statistics of production and consumption (decreased) are given. No new uses have appeared.—E. S. H.

Molybdenum. Alan Kissock (*Mineral Ind.*, 1931, 39, 417-420).—The increasing use of molybdenum is still mainly in conjunction with nickel, chromium, vanadium, manganese, silicon, &c., in alloy steels. Attention is being given to the addition of molybdenum alone to plain carbon steels. Pure molybdenum continues to be used in radio, electrical, and allied requirements, and its applications should increase if the present high cost of production can be lowered.—E. S. H.

Nickel. Thos. W. Gibson (*Mineral Ind.*, 1931, 39, 421-430).—Recent publications on nickel and its alloys are reviewed. A probable new use for considerable quantities of nickel is in the construction of electric transformers in which the usual iron core is replaced by "hypernik," containing 50% of nickel. The permeability is thus increased about 10 times, allowing the size of the transformer to be reduced.—E. S. H.

Nickel and Nickel Alloys in Marine Engineering. J. McNeil (*Trans. Inst. Marine Eng.*, 1931, 43, 561-585; and (summaries) *Metallurgia*, 1931, 5, 57-58; *Met. Ind. (Lond.)*, 1931, 39, 583-585, 609).—The use of nickel and nickel alloys in marine engineering for meeting the demand for materials which will retain strength and resist corrosion at temperatures above 400° C. is very fully considered. Pure nickel deposits are used for corrosion-resisting purposes and for the building up of worn or damaged parts. Copper-nickel alloys and Monel metal have a wide range of application, the former being used for condenser tubes, boiler tubes, and oil-cooler tubes, and the latter for turbine blades, valve parts, and many types of fittings. For parts where non-seizing properties are required, suitable materials are found in the nickel-copper alloys containing either tin or chromium and iron, and use is also made of nickel-bronzes with low nickel content for propellers, &c., and of nickel-brasses for sanitary fittings and ornamental work. Light alloys containing nickel which are being increasingly used in marine engineering are the "Y" alloy and the group of R.R. alloys, whilst heat-resisting alloys such as the 80% nickel, 20% chromium have a limited application for boiler parts and Diesel engine exhaust valves and for electrical heating, appliances, and nickel-chromium-iron alloys for superheater parts. Reference is also made to the uses of nickel cast irons and nickel alloy steels. In the discussion examples are given of the behaviour of such alloys under service conditions, and mention is made of the more recent work on heat-resisting alloys.—J. W. D.

Nickel Tubing Resists Fatigue. Robert Worthington (*Automotive Ind.*, 1932, 66, 164).—Nickel tubing is found to withstand both ordinary and vibration fatigue tests very much better than similar specimens of copper tubing. Unannealed nickel, which is superior to the annealed metal in fatigue resistance, has a fair degree of ductility, and the use of such material in place of copper in fuel-line tubing is advantageous in aero work, but where sharp bends are necessary the annealed metal must be employed.—P. M. C. R.

Despite Low Tonnage, Nickel Alloys and Rating Processes Gained Momentum in 1931. Robert C. Stanley (*Automotive Ind.*, 1932, 66, 254).—A survey of the increased applications of nickel and its alloys. Stress is laid on nickel as an ingredient in such corrosion-resisting materials as Ni-resist, in high-permeability alloys, and in plating in low p_H solutions. Recent application of Monel metal and suitable welding methods are described.—P. M. C. R.

Nickel in Wireless Valves. Anon. (*Nickel Bull.*, 1932, 5, 58).—The applications of pure nickel and of nickel-chromium and nickel-iron alloys for use in wireless valves are briefly described.—J. H. W.

Elinvar Hairsprings for Watches. G. E. Shubrooks (*Metal Progress*, 1932, 21, (2), 58-63).—Some principles of watch construction are discussed. The constant elasticity of Elinvar over a wide temperature range renders it suitable for hairsprings, which can be used with a simple balance wheel without the usual compensating device. Elinvar cannot be permanently magnetized and is not subject to corrosion under the working conditions experienced.—P. R.

Platinum Group Metals. George Frederick Kunz (*Mineral Ind.*, 1931, 39, 474-491).—Statistics of production are given. The question of adopting platinum as a standard of coinage is discussed. A possible new use may result from attempts to employ some metals of the platinum group as a protective coating on silverware, to prevent surface tarnish. Platinum and palladium are now produced in leaf form, for applications similar to those of gold leaf. The leaf has a thickness of about 0.000005 in. and is made by beating rolled sheet having an initial thickness of 0.001 in.—E. S. H.

Tin. E. Baliol Scott (*Mineral Ind.*, 1931, 39, 579-601).—The production and consumption of primary and secondary tin are discussed. No new uses have been reported.—E. S. H.

Titanium and Zirconium. F. H. Driggs and J. W. Marden (*Mineral Ind.*, 1931, 39, 602-611).—An electrode containing tungsten 98, titanium 1.5, and chromium 0.5% has been placed on the market for use as a source of ultra-violet radiation. Metallic zirconium is now available commercially (90-98% purity). It is used in the preparation of flashlight powders and photo-flash lamps. Articles of zirconium metal, such as wire, sheet, and bars, are formed from the powder by compressing in a hydraulic press and heating to a relatively low temperature in a high vacuum to effect degasification. The article is then sintered at a temperature just below the melting-point and then worked mechanically at about 800° C. An alloy consisting of zirconium with 1.5-2.0% of aluminium is claimed to be suitable for use in thermionic cathodes.—E. H.

Tungsten. Colin G. Fink (*Mineral Ind.*, 1931, 39, 612-623).—The chief consumption of tungsten continues to be in high-speed steels. An entirely new application of the metal is the electroplating of tungsten on brass, copper, steel, and other metals. This plate is very resistant to acids, including hydrochloric acid.—E. S. H.

New Structural and Decorative Materials. William E. Blewett (*Marine Engineer and Shipping Age*, 1931, 36, 575).—Abstract and discussion of a paper read before the Society of Naval Architects and Marine Engineers (U.S.A.), Nov., 1931. In a paper dealing with structural and decorative materials, the properties and uses of such non-ferrous materials as aluminium, aluminium insulation, and metal-spraying processes are discussed. The heat loss in the insulation of steam pipes, through a single sheet of aluminium foil (about 0.003 in. thick) compares favourably with that through 1.0 in. of magnesia, and renders possible a considerable gain in space. It is also stated that there are limits in the scope of the metal-spraying process, and that for protection from sea-water corrosion cadmium is the best metal to apply. Zinc under some conditions gives satisfactory service, but aluminium has to be used with caution.—J. W. D.

Manufacture and Life of Screen Wire. John G. Ralston (*Southern Med. J.*, 1931, 24, 449-451; *C. Abs.*, 1932, 26, 1557).—Wire screen cloth for protection against insects is commercially made from 2 kinds of wire, *i.e.* steel, and bronze or copper. For black painted wire cloth, the steel wire fabric is run through a bath of paint, the surplus being pressed or blown out to prevent filled meshes, and is then dried in a heated tower. Electro-galvanized wire cloth is made by the usual galvanizing process with zinc. Bright galvanized wire cloth does not give as satisfactory service against insects as the electro-galvanized cloth. Bronze and copper wire cloths are relatively soft and do not make the best grade of screens. A more general use of 16-mesh wire screens is advocated.—S. G.

XI.—HEAT-TREATMENT

(Continued from pp. 323-324.)

Heat-Treating Aluminium by Immersion Process. J. B. Nealey (*Western Gas*, 1932, 8, (31), 45; *C. Abs.*, 1932, 26, 1886).—A brief description is given of the heat-treating practice in the Boeing Airplane Co. A mixture of potassium and sodium nitrates is used for the immersion bath, with a temperature of 940°-950° F. (504°-510° C.). A novel feature is the temporary suspension of the ageing of Duralumin rivets after treating, accomplished by refrigeration in dry ice immediately after quenching. The process is described for rivets and other parts made of aluminium. Short details are also given of the heat-treatment of tool steel and aircraft structural steel.—S. G.

The Heat-Treatment and Use of Aluminium Alloys for Aircraft Structures. Robert J. Anderson (*Fuels and Furnaces*, 1931, 9, 1243-1250, 1375-1380; 1932, 10, 53-56, 133-136, 217-226).—An illustrated review in which the following subjects are discussed: the application of aluminium alloys in aircraft construction, the principles and practice of the heat-treatment of Duralumin, corrosion in its relation to heat-treatment, salt baths and electric furnaces for heat-treatment, quenching tanks, equipment for handling in and out of quenching tanks and for supporting the structures in the furnace, temperature control.—A. R. P.

Effect of Heat-Treatment on the Forming Properties of Aluminium Alloys. J. A. Nock, Jr. (*Metal Stampings*, 1932, 5, 261-266).—The cold-working characteristics and the mechanical properties generally of aluminium alloys are greatly improved by such methods of heat-treatment as annealing, and solution and precipitation heat-treatment. Duralumin is taken as an example, and it is shown how annealing this alloy at 650° F. (345° C.), or at 800° F. (425° C.) followed by slow cooling, softens the metal. Solution heat-treatment consists of annealing at 925°-970° F. (495°-520° C.) followed by quenching, which allows the precipitated CuAl_2 to be dissolved as a solid solution in the aluminium. Precipitation heat-treatment consists of ageing. Artificial ageing is usually carried out at 250°-320° F. (120°-160° C.), and has the effect of increasing the tensile strength, the yield-point, and the Brinell hardness, but of somewhat lowering the percentage elongation. The technical methods and the furnace equipment required for these processes are described.—J. H. W.

The Heat-Treatment of Aluminium and Aluminium Alloys. J. Suhr (*Light Metals Research*, 1931, 1, (2), 6-13).—Translation of a paper read at the Liège Congress, 1930. See this *J.*, 1931, 47, 110.—J. C. C.

The Heat-Treatment of Brass. H. M. St. John (*Fuels and Furnaces*, 1931, 9, 787-794, 838).—The relation of annealing temperature to grain structure is discussed and emphasis is laid on the desirability of uniform grain-size in sheet. Types of furnaces and various annealing treatments are described.—A. R. P.

XII.—JOINING

Continued from pp. 324-326.)

New Countersunk Riveting Process for Sheet Metal. A. E. (*Machinery (Lond.)*, 1930, 36, 779).—Short illustrated description of the De Bergue process, which has been applied successfully to aluminium, brass, copper, Duralumin, Monel metal, nickel, and various ferrous metals. The process produces in thin sheet metal a riveted joint which has one surface flush and which has about double the strength of a standard joint with cup-head rivets.—H. F. G.

Cadmium in Soft Solders. Anon. (*Metallbörse*, 1932, 22, 2-3).—A table is given showing the comparative strengths of soldered joints in brass, copper, and galvanized iron sheet made with 50 : 50 tin-lead solder and with 17 lead-cadmium-tin solders. In Germany an alloy of lead 80, tin 10, and cadmium 10% is used instead of the more expensive 60 : 40 lead-tin solder; it produces joints having about 75% of the strength of those produced by 50 : 50 lead-tin solder. A solder containing 32.5% tin, 39.5% lead, 19% cadmium, and 2% zinc having a freezing range of 165°-136° C. gives very satisfactory joints. Zinc chloride is the best flux for solders containing cadmium.—A. R. P.

Alumaweld Solder. Anon. (*Automotive Ind.*, 1931, 65, (24), 54).—This solder for aluminium and other metals is claimed to be suitable for application without flux in the case of aluminium, pot metal, or die-castings: a special flux is available for ferrous metals. The melting point is low, but is higher on remelting. A tensile strength of 5.5 tons/in.² is claimed, together with good ductility and a surface capable of taking polish or plating.—P. M. C. R.

Soldering with the Aid of a Lead Bath. H. S. (*Machinery (Lond.)*, 1930, 36, 737).—Cones formed from sheet copper sectors may be soldered conveniently by immersing them in a bath of molten lead, introducing the required quantity of solder into the cone, and running the solder into the seam with the aid of a soldering iron.—H. F. G.

Brazed Copper Water Tanks. Anon. (*Welding Eng.*, 1932, 17, (3), 50 and 59).—Brass spelter was used and was melted by an oxy-coal gas blowpipe. The tanks were tinned inside after brazing.—H. W. G. H.

Copper Brazing in Electric Furnaces. H. M. W. (*Machinery (Lond.)*, 1930, 36, 758-759).—See this *J.*, 1931, 47, 47.—H. F. G.

Aluminium Piping for Chemical Plants. D. S. Lloyd (*Canad. Mach.*, 1931, 42, (26), 172-174).—The successful welding of aluminium pipes requires an experienced operator who also understands the forming and annealing of the metal. The ox-welding process is recommended, and details of flame, atmosphere, and flux are given, together with suitable adaptations in the case of light, medium, and heavy sheet.—P. M. C. R.

Blowpipe Applications. Anon. (*Indust. Gases*, 1931, 12, 210-212).—A description is given of a demonstration by a Swiss welder of oxy-acetylene welding aluminium alloys. Full details of the technique used are given.

—H. W. G. H.

Assembling Light Copper Parts. Anon. (*Oxy-Acetylene Tips*, 1932, 11, 25).—Very thin sheet articles are joined by bronze-welding which permits faster work than fusion welding, gives joints of ample strength, and minimizes warping.

—H. W. G. H.

Copper Welding Solves Refinery Problem. Anon. (*Indust. Gases*, 1931, 12, 213-214).—See *J.*, this volume, p. 54.—H. W. G. H.

The Oxy-Acetylene Welding of Copper Fireboxes of Locomotives. L. Saccomani and R. Verzillo (*Welding J.*, 1931, 28, 371-373; 1932, 29, 11-13, 51-54).—Experiments carried out by the Italian State Railways are discussed. Satisfactory results, both under laboratory test and under observation in

service, are said to be obtained with electrolytic copper as filling rod and no flux. Test figures are quoted for ultimate stress and elongation of as much as 14 tons/in.² and 30%, respectively. The importance of good technique is emphasized. Where possible, the operators work in pairs, one on each side of the plate. A long weld is made in sections, each section being hammered before the seam loses colour. The complete weld is afterwards annealed at 600° C. Typical repairs are described and detailed cost data are given.

—H. W. G. H.

The Repair of Rolling Stock by Welding. W. Featonby (*Mech. and Welding Eng.*, 1931, 5, 382-391).—Deals mainly with ferrous applications, but a short description is given of the practice adopted to repair copper firebox tubeplates and backplates by oxy-acetylene welding.—H. W. G. A.

Practical Notes on Welding Brass. Anon. (*Indust. Gases*, 1931, 12, 200-204).—The best results are obtained by the oxy-acetylene method. The welder must distinguish between "alpha" and "beta" brass. A good flux is a mixture of 2 parts fused borax and 1 part boric acid. Traces of aluminium in flux or filling rod prevent loss of zinc by volatilization and act as deoxidant. Sheet is prepared for welding in the usual way, the edges being chamfered if necessary. Heavy sections need preheating. The size of tip to be used is the same as for mild steel, and a neutral flame should be kept. The weld should be hammered, hot or cold according to the composition of the brass, and annealed at 600°-650° C.—H. W. G. H.

Lead Burning (Welding) as Applied to Ship Plumbing. Anon. (*Indust. Gases*, 1931, 12, 193-195).—With welded joints, as opposed to soldered joints, the expansion and contraction of a lead pipe are uniform and the risk of corrosion is less. The welded joint is economical as the filling material may be scrap cuttings. Besides joining lead to lead, it may also be easily joined to brass or zinc with the lead burning flame.—H. W. G. H.

Nickel and its Non-Ferrous Alloys, with Special Reference to Welding. J. McNeil (*Welding J.*, 1932, 29, 70-76).—Brief, but comprehensive directions are given for oxy-acetylene and arc welding malleable nickel, Monel metal and nickel-chromium alloys. Test figures, quoted for dressed welds, show that the oxy-acetylene process gives greater strength and ductility with both nickel and Monel metal. Some applications of welding in the materials discussed are described and illustrated.—H. W. G. H.

Welding Sheet Monel Metal. Anon. (*Oxy-Acetylene Tips*, 1932, 11, 45-46).—The usual directions are given.—H. W. G. H.

Stress Distribution in Welds. W. Hovgaard (*Z. angew. Math.*, 1931, 11, 341-348).—The magnitude and distribution of internal stresses in welds are considered mathematically.—v. G.

Fatigue Strength and Strain Relief (of Welds). Charles H. Jennings (*Welding Eng.*, 1932, 17, (2), 39-41, 58).—Refers to arc welds on carbon steel, but the results are of general interest. Fatigue tests on fillet welds, and machined, unmachined, and peened weld metal are discussed and their endurance limits given. Machined specimens gave lower endurance limits than those in the rough condition. It is suggested that the machined surfaces contain tiny pinholes which reduce the endurance limit. Peening increases the fatigue strength.—H. W. G. H.

Oxy-Acetylene Welding in the Brewing Industry. Lewis Davies (*Mech. and Welding Eng.*, 1932, 6, 34-38).—Applications of welding in a brewery are described and illustrated. Reference is made to both constructional and repair work.—H. W. G. H.

Multi-Flame Torches Cut Costs. Anon. (*Welding Eng.*, 1931, 16, (12), 43-44).—The "Keel" multi-flame blowpipe is described. It may have two or three nozzles: in the former case, the first flame preheats the seam and the second makes the welds; in the latter case, the third flame is used to preheat

the welding rod. The welding speed is claimed to be increased 25-40% under working conditions and it is stated that this type of blowpipe is likely to be further developed.—H. W. G. H.

Safe Welds. R. Meslier (*Soudeur-Coupeur*, 1931, 10, (11), 1-5).—To eliminate, as far as possible, the personal element in oxy-acetylene welding, it is suggested that methods of technique should be adopted by which the attention of the operator need be concentrated only on one important factor at a time. For example, plates, 8 mm. or more thick, are butt-welded in two passes. The edges are chamfered and, in the first pass, attention is paid to obtaining penetration, the second pass then completing the weld. Tacking is recommended and the plates are inclined at an angle of 30°-45° to the horizontal, the welding being performed forwards, where possible, and up the slope. Detailed instructions are given.—H. W. G. H.

Modern Electric Welding Processes. Arcogen and Arcatom Welding. Anon. (*Helios (Fachzeit.)*, 1932, 38, (6), 46-47).—Cf. *J.*, this volume, p. 155.—v. G.

Practical Hints on Electric Welding. J. Lyall (*Mech. and Welding Eng.*, 1932, 6, 6-13).—Very comprehensive hints on technique are given, mainly from the point of view of ferrous welding.—H. W. G. H.

The Present Position of Arc Welding. H. Michel (*Rev. univ. Mines*, 1932, [viii], 7, 261-269).—A review.—A. R. P.

Carbon Arc Welding. A. Y. Stirrat (*Welding J.*, 1931, 28, 378-380; 1932, 29, 14-15).—The process is discussed mainly as applied to steel welding. The great difference in technique from metallic arc welding is explained and the relative advantages of the two methods are presented.—H. W. G. H.

Electric Resistance Welding. Ad. Klopfert (*Rev. univ. Mines*, 1932, [viii], 7, 270-275).—A review of the methods used and a description of modern welding machines with illustrations.—A. R. P.

Resistance Welding. Frank O'Brien (*Mech. and Welding Eng.*, 1932, 6, 39-44).—Various types of spot- and butt-welding machines are described and their operation explained.—H. W. G. H.

The Possibilities of Electrical Resistance Welding. M. J. Eckman (*Canad. Mach.*, 1932, 43, (4), 32-36).—The fusion and resistance welds, E. considers, stand in much the same relation as do casting and forging, the resistance weld being completed under heavy pressure without the introduction of foreign material. The speed and economy obtained by using spot, projection, seam, and flash welding, with the special applications of each, are discussed.

—P. M. C. R.

The Weldery: a New, Growing Industry. Robert E. Kinkad (*Canad. Mach.*, 1931, 42, (26), 165-166).—Castings are being replaced to a serious extent by welded structures; the main reasons are: (1) cost reduction; (2) easy construction of special machinery in the absence of patterns; (3) avoidance of sinking money in patterns; (4) elimination of risk of defective castings; (5) quick delivery. The value of the welding industry should be enhanced and maintained by avoiding over-competition, by establishing and adhering to proper technical standards, and by co-operative technical progress.

—P. M. C. R.

The Storage of Carbide of Calcium . . . Statutory Licensing Conditions under the Petroleum (Consolidation) Act, 1928, and the Petroleum (Carbide of Calcium) Order, 1929, with Extracts from the Official Regulations of the British Acetylene Association and Explanatory Notes. — (*British Acetylene Assoc.*, 1930, 1-42).—The regulations in force are set forth and explained. A form of licence and set of conditions for Local Authorities and carbide users, are suggested.

—H. W. G. H.

XIII.—WORKING

(Continued from pp. 326-328.)

Studies of the Wire-Drawing Process. II.—Factors Involved in the Power Requirements. F. C. Thompson and E. L. Francis (*Carnegie Schol. Mem. Iron Steel Inst.*, 1931, 20, 87-124).—Despite the success with which wire-drawing is practised, little is known of the mechanical aspects of the process. The application of photo-elastic methods to the problem has already been described (cf. this *J.*, 1931, 47, 116), and further experimental work is here discussed. As a result of these experiments, it is shown that the tension required to initiate drawing is, for a series of non-ferrous metals and alloys with a face-centred cubic space lattice, a linear function of the elastic limit in simple tension. The stresses required vary with the space lattice, but no confirmation is found for the view that the basic factors which affect the power requirements are different for ferrous and non-ferrous materials. Even with so high a reduction as 20%, the minimum tension required to effect the reduction at negligibly slow rate is distinctly less than the elastic limit of the undeformed wire. At higher speeds, the stress conditions are such that the sum of the tensile and compressional stresses is constant and in excess of the tensile strength of the material, even after the test. At very low rates of reduction, the speed, S , increases as the load, L , is increased according to the equation: $L = a + bS - cS^2 + dS^3$. After the initial stage, the speed may be increased over a very wide range without much alteration in the tension required. The tension necessary is shown to be very closely proportional to the percentage reduction of area. The power requirements, P , for the drawing of wire are given by the equation: $P = k \times M \times S \times a$, where M is the maximum stress, S the speed of drawing, and a the final area of cross-section. Conclusions reached as to the effect of speed on the load requirements at slow speeds may be quite erroneous when applied to high-speed drawing. In an appendix, the results obtained for the power requirements are compared with those derived from equations put forward by other workers.—J. H. W.

The Production of Bright Soft Copper Wires. F. Freude (*Metallbörse*, 1931, 21, 1929-1930).—The coils of hard-drawn bright wire are packed in a copper box and the empty spaces are filled with clean scrap, a copper lid is luted on with fireclay, and the whole packed in a larger iron box which is then filled with charcoal or with a mixture of steel turnings and charcoal. An iron lid is luted on the iron box and the latter is then slowly heated to 550°-600° C. and allowed to cool completely before opening; heating and cooling should occupy about 5 hrs.—A. R. P.

Aluminium Sheet Production. XII.—Rolling Operations. Robert J. Anderson (*Metallurgia*, 1932, 5, 161-163, 201-202, 208).—The preliminary rolling operations on aluminium slabs prior to finishing to gauge in the production of sheet and coil are described. The operations known as stock and slab shearing for the squaring of ends and the trimming of sides of hot-mill slabs before cold-rolling, the slabbing for flat sheet production by the preliminary roughing of hot-mill slabs, the rolling operation following slabbing in the production of bright flat sheet and grey plate called roughing, and the roughing of slabs for coil production are described. The various types of mills used for the individual operation and for the different types of operation are also considered.—J. W. D.

Work of the Rolling Process. A. W. Rusinov (*Metallurg (The Metallurgist)*, 1931, 6, (1), 30-49).—[In Russian.] Mathematical and theoretical. A series of mathematical expressions is developed based on theoretical considerations of the work done in rolling, and found to be in good agreement with the experimental data given by Puppe in his work "Versuche zur Ermittlung des Kraftbedarfs an Walzwerken" (Düsseldorf: 1909). In a preface to the paper,

the editor of the journal expresses the hope that this treatment of the subject will invite further discussion.—M. Z.

Improved Extrusion Press. Anon. (*Met. Ind. (Lond.)*, 1932, 40, 470, 473).—A full description and diagrams are given of an improved pattern extrusion press which can be operated either for the direct or indirect extrusion of metals.—J. H. W.

Power Consumption and the Mechanism of Flow in Extrusion Presses. W. Eisbein (*Z. Metallkunde*, 1932, 24, 79–84).—Abridged from *Mitt. Material., Sonderheft 16*, 1931, 67–96; cf. *J.*, this volume, p. 58.—M. H.

The Extrusion of Metals. R. Genders (*Metallurgia*, 1932, 5, 198).—A summary of a paper to the Co-ordinated Societies. See *J.*, this volume, p. 327.—J. W. D.

Discussion on "The Extrusion of Metals." R. Genders (*Met. Ind. (Lond.)*, 1932, 40, 398).—Cf. preceding abstract. Abstract of the discussion of a paper read before the Co-ordinated Societies.—J. H. W.

Determination of Internal Stresses in Cold-Drawn Tubes. Anon. (*Metallurgist (Suppt. to Engineer)*, 1932, 8, 53–54).—A brief review of published work, referring particularly to a paper by N. Dawidenkow, *Z. Metallkunde*, 1932, 24, 25–29. See *J.*, this volume, p. 327.—R. G.

The Manufacture of Thin-Wall Tubing. W. S. L. (*Machinery (Lond.)*, 1930, 36, 657–661).—The minimum wall thickness of drawn tubing is normally limited by the strength of the metal, and in practice is about 0.025 in. for tubes of from 1 to 2½ in. diam. In the machine described the tubing is subjected to both pulling and pushing actions as it passes through the die in a series of intermittent movements. Tubes may be produced of diam. up to 9 in., and 20 ft. in length, with a wall thickness of only 0.004 in. The process has been applied successfully to brass, aluminium, copper, and even zinc; the raw material may be solid or sheet metal, or commercial drawn tubing. Tubing having a brazed seam may be drawn without leaving any trace of the seam, as far as physical properties are concerned.—H. F. G.

A Line Chart for Determining the Blank Size for a Flanged Cup. A. Alison (*Machinery (Lond.)*, 1930, 36, 620–621).—The chart reproduced enables the blank diameter to be read directly from the diameter and height of the finished cup. The theoretical basis of the diagram is given.—H. F. G.

The Cold-Sawing of Metals (the Range and Capacity of Working now Possible with Machines Designed for Production Purposes). R. B. Hobson (*Mech. World*, 1931, 90, 425–426).—Machines using hacksaws, bandsaws, magazine saws, and circular saws (chiefly the latter) are described and illustrated. The high-speed cold-sawing machine of to-day possesses a cutting output of about six times that of the machine on the market four or five years ago.—F. J.

The Quantity Production of Thin Brass Wheels. Anon. (*Machinery (Lond.)*, 1930, 36, 643).—Brief account of the production of 0.25 in. thick brass discs from bar stock.—H. F. G.

Ramet. Tantalum Carbide as Cutting Material. I. Anastasiadis (*Z. Metallkunde*, 1932, 24, 66).—A brief note. Ramet (with a melting point of 4400° C. and a tensile strength of 17.5–21 kg./cm.²) has a very low heat absorption during the cutting process.—M. H.

Diamond Lapping of Tungsten Carbide Tools. Anon. (*Machinery (Lond.)*, 1930, 36, 730).—Diamond-lapped tools are especially suitable for finish machining non-ferrous metals, Bakelite, ebonite, and fibre. For finishing Babbitted bearings such tools have about 4 times the life of ordinary tools. Methods of hand- and machine-lapping are briefly described.—H. F. G.

Accurate Machining. F. Horner (*Machinery (Lond.)*, 1930, 36, 457–460, 500–502).—A discussion of possible causes of error and means of overcoming them. Special consideration is given to the foundations for machinery, distortion of machine elements by weight and by cutting pressure, the use of

pilots and steadies, accurate chucking methods, tool and grinding wheel operation, and the distortion of the work as a result of local overheating and of the release of internal stresses effected by machining castings, forgings, and rolled or drawn stock.—H. F. G.

Machining Pistons and Axle Casings for Heavy Motor Vehicles. Anon. (*Machinery (Lond.)*, 1930, **36**, 785-791).—A fully illustrated description of, *inter alia*, the machining of aluminium (and cast-iron) pistons.—H. F. G.

Machining Cylinder Blocks and Gear Boxes for Heavy Motor Vehicles. Anon. (*Machinery (Lond.)*, 1930, **36**, 817).—Describes, *inter alia*, the machining of cast aluminium gear-box cases.—H. F. G.

Machining Aeroplane Engine Cylinder Heads. Anon. (*Machinery (Lond.)*, 1930, **36**, 521-523).—Straight and spherical boring, tapping, recessing, chamfering, and facing cuts are performed on aluminium alloy cylinder head castings in 6 consecutive operations. By the use of a Bullard Mult-Au-Matic machine the total machining time has been reduced from 28 minutes to 1 minute 58 seconds.—H. F. G.

Applying Stellite to Trimming Dies. Anon. (*Machinery (Lond.)*, 1930, **36**, 629).—A description of a method of applying Stellite to worn dies by means of the oxy-acetylene flame. The results have been so satisfactory that new dies are made of mild steel, with Stellite tips, and in consequence hardening and warping difficulties have been obviated. The life of the new dies is 10 times that of carbon steel dies.—H. F. G.

XIV.—FINISHING

(Continued from pp. 328-329.)

Artificial Patina on Copper. W. H. J. Vernon (*Met. Ind. (Lond.)*, 1932, **40**, 479).—In a letter commenting on the claims of the American Copper and Brass Research Association in connection with the production of an artificial green patina on copper, V. observes that the facts on which these claims are based were published in 1929 (cf. this *J.*, 1929, **42**, 181). It was further shown (*ibid.*, 1930, **44**, 789) that after very prolonged exposure, the basic sulphate, which had been found to be the principal constituent instead of the basic carbonate, coincided in composition with the mineral brochantite, $\text{CuSO}_4 \cdot 3\text{Cu}(\text{OH})_2$, which fact received no acknowledgment in the American specification. A provisional patent was not completed, as it was found that more prolonged exposure caused the deposit to flake, but a provisional patent has since been filed for an improved method. The results of the work as a whole will be published in due course.—J. H. W.

Abrasives. V. L. Eardley-Wilmot (*Mineral Ind.*, 1931, **39**, 1-12).—Natural and artificial abrasives are discussed. Pumice powder is used to a small extent in some metal polishes. Tripoli is used in foundry partings, and compounded with grease for buffing. Silt and some clays are used for polishes for soft metals such as aluminium. Vienna lime, a magnesium limestone, is used fairly extensively in the form of a grease compound for buffing soft metals, but particularly for the colouring of nickel after plating.—E. S. H.

Preparation of the Buffing Wheel. F. A. Livermore (*Met. Ind. (Lond.)*, 1932, **40**, 406).—The preparation of emery wheels for polishing is a matter of great importance. There are 5 glues on the market: (1) skin glue; (2) bone glue; (3) horn-pith glue; (4) semi-horn pith glue; and (5) a mixture of skin and bone glue. Of these, only (1) is satisfactory. The preparation of the glue and testing it by means of the Cochell copper plate test are described.

—J. H. W.

XV.—FOUNDRY PRACTICE AND APPLIANCES

(Continued from pp. 329-331.)

The Danger of Contraction. Anon. (*Cuivre et Laiton*, 1932, 5, (71), 41).—It is pointed out that contraction during cooling may lead to very serious defects in a casting. It is essential, in avoiding these, to arrange that at all points the sections of the casting should be as uniform as possible.—W. A. C. N.

On the Formation of Pipes and Pores in Castings. E. Scheuer (*Metallwirtschaft*, 1931, 10, 947-951).—The formation and shape of pipes and pores are discussed with especial reference to the constitution of casting alloys. Of the greatest importance is the question as to whether the liquid during solidification can fill up all the hollow spaces in the zone between the metal which has already solidified and that which is still liquid. Formation of pores is more difficult in the case of alloys with a short solidification range and when the fall in temperature is large. If evolution of gas occurs, the configuration of the porous parts of the casting depends on the rate of gas evolution and the movement of the gas bubbles in the liquid metal and between the dendrites. On cooling in a vacuum or when the surface of the metal cools rapidly the pressure in the liquid and therefore the configuration of the pores are considerably modified. Small pores are not dangerous if they are round in shape and evenly distributed. Frequently, however, there is a regular distribution of the pores in certain parts, and this may produce a dangerous "notch effect."—v. G.

Moulding and Pouring Heavy Castings in Non-Ferrous Alloys. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1931, 52, 98-99, and *Fonderie moderne*, 1932, 26, 33).—Heavy castings are subject to special difficulties of production, but in many cases can be made without risers or many feeders. An example is given of a bevel gear, for which the usual 2 feeders would be unsuitable. The casting is made under pressure obtained by the use of a feeder $1\frac{1}{2}$ -2 times the height of the casting. Another example given is that of a valve casing, with a complicated core, which can be cast in the same way. The advantages of this method of casting are: (1) If the metal is sound and well cast, piping and pin-holes are avoided; (2) The method of pouring is more efficacious than the use of 2 risers; (3) The time and cost of trimming are saved.—J. H. W.

Contribution to the Study of the "Flowability" of Aluminium and its Alloys. André Courty (*Light Metals Research*, 1931, 1, (11), 3-15).—A fairly full translation, illustrated with curves, from *Rev. Mét.*, 1931, 28, 169-182, 194-208. See this *J.*, 1931, 47, 407-408, 572-573.—J. C. C.

Aluminium Castings in Modern Practice. Anon. (*Aluminium Broadcast*, 1930, 2, (42), 21).—A description of some notable aluminium castings. Abstracted from a booklet issued by William Mills, Ltd., Birmingham.—J. C.

Casting Properties, under Constant Pressure, of Aluminium and Alpac. André Courty (*Aluminium Broadcast*, 1930, 2, (44), 18-19).—A translation from *Compt. rend.*, 1930, 190, 936-938. See this *J.*, 1930, 43, 678-679.—J. C.

Production of Light Alloys. Anon. (*Machinery (Lond.)*, 1930, 36, 622-623).—An account of the methods used at the Slough works of High Duty Alloys, Ltd., for the production of such alloys as R.R.50, Hiduminium, and other "Y"-type alloys. The melting equipment consists of Morgan oil-fired tilting furnaces. The principal key alloys used are those of aluminium and copper, aluminium and nickel, and manganese and copper, all of which are produced from the virgin metals.—H. F. G.

Aluminium Alloy Manufacture. Anon. (*Aluminium Broadcast*, 1930, 2, (43), 23-26).—A description of the melting, casting, forging, and testing methods used by High Duty Alloys, Ltd., Slough, in the manufacture of the R.R. group of alloys. Cf. this *J.*, 1931, 47, 179.—J. C. C.

Preparation of Copper- and Nickel-Rich Aluminium Alloys. Anon. (*Metallbörse*, 1931, 21, 2059).—In preparing 50:50 copper-aluminium alloy as a

hardener for aluminium the best procedure is to pour molten copper into molten aluminium; the vigorous exothermic action which occurs due to reduction of the oxide in the copper by the aluminium may be prevented by adding a small proportion of the aluminium to the copper to effect complete deoxidation. Alloys of aluminium with 15-25% nickel are preferably prepared by adding to aluminium at 825° C. thin nickel sheet and covering the metal with a flux consisting of 10 parts of anhydrous sodium carbonate, 2 parts of anhydrous potassium carbonate, 1 part of borax glass, and 2 parts of cryolite.

—A. R. P.

The Casting of Bronze to Resist Pressure. M. Gossieaux (*Cuivre et Laiton*, 1932, 5, (71), 39-40).—The methods used in the American Naval yards are discussed. The principal non-ferrous alloy used for pieces to be employed under pressure is one containing copper 87.25, nickel 0.75, tin 9, and zinc 3%. This is primarily cast into ingots in pit-type coke-fired furnaces, using about 0.06% manganese as deoxidizer. In the final casting a pouring temperature of about 1065° C. is found to be most suitable. So far as possible the sections in the castings are made uniform. Especial attention is paid to the manufacture of the patterns and to the proper allowances, keeping in mind the tolerances which are permitted after final machining. The personal factor is eliminated so far as possible.—W. A. C. N.

Effect of Casting Temperature and of the Addition of Iron on Bearing Bronze. C. E. Eggenschwiler (*Met. Ind. (Lond.)*, 1932, 40, 471-473).—Slightly condensed abstract from *U.S. Bur. Stand. J. Research*, 1932, 8, 67-77; see *J.*, this volume, p. 225.—J. H. W.

Factors Influencing the Soundness of Brass and Bronze Castings. Anon. (*Machinery (Lond.)*, 1930, 36, 564-565).—A summary of the work of J. W. Bolton and S. A. Weigand (this *J.*, 1930, 43, 461; 44, 496-497) on the problem of shrinkage in non-ferrous alloy castings, and especially on the question of intercrystalline porosity in steam bronze (tin 6, zinc 4, nickel 0.5, and lead less than 2%) and the effects of oxidation on an alloy containing copper 84.14, tin 5.72, zinc 4.87, and lead 2.07%. Other work described includes that of H. M. St. John, G. K. Eggleston, and T. Rynalski (this *J.*, 1930, 43, 470; 44, 500-501) on the influence of silicon on red casting brasses; that of O. W. Ellis (see this *J.*, 1930, 43, 466; 44, 500) on the effects of oxide in an alloy containing copper 84 (minimum), zinc 4-10, tin 2.5-6, lead 1.5-4, and other metals not more than 0.2%; and that of E. J. Daniels (this *J.*, 1930, 43, 125) on the influence of the casting temperature on the mechanical properties and soundness of gun-metal containing copper 88, tin 10, and zinc 2%.—H. F. G.

The Melting of Scrap Brass in Reverberatory Furnaces. E. T. Richards (*Giesserei*, 1932, 19, 5-9).—The various types of furnace for remelting old brass are compared with especial reference to the advantages and disadvantages of reverberatory furnaces. The questions of gas adsorption, loss of zinc, suitable fluxes and deoxidizers, and preparation of the material for smelting are considered.—A. R. P.

The Production of Malleable Nickel. M. Schurygin (*Metallurgy (The Metallurgist)*, 1931, 6, (3), 298-307).—[In Russian.] Methods are examined for producing malleable nickel of high purity, for the manufacture of apparatus hitherto made of platinum. The highest grade of electrolytic nickel obtainable on the market is melted and cast under special conditions which rigorously exclude contact of the metal with carbon, sulphur, silicon, oxygen, &c.: the melting may be carried out in an induction furnace, in shamoto, china clay or magnesite crucibles (but not graphite to avoid carburization), provided with tight-fitting covers; about 2% of manganese should be added as a deoxidizer 1-2 minutes before pouring and melting should be carried out as rapidly as possible. The metal should be cast into open iron moulds; pouring temperature has no influence on the final properties. The casting should be annealed

at 750°–800° C. and allowed to cool slowly before working (*i.e.* rolling or stamping).—M. Z.

How is Monel Metal Melted? Gustav Krebs (*Z. ges. Giesserei-Praxis: Das Metall*, 1931, 52, 99–100).—Monel metal normally consists of nickel 68, copper, 29, iron 2, and manganese 1%, but if a more fluid alloy is required, the nickel is reduced to 60% and 5% tin and 3% silicon are added. The silicon increases the hardness and tensile strength of the alloy, but tends to make it hot-short, to avoid which, more manganese is required. These two metals are added as copper alloys. To avoid porosity, only 20–25% Monel metal scrap should be used, owing to the fact that it contains carbon and sulphur, both of which are harmful to the mechanical properties of the alloy. The metal is melted in graphite crucibles. Thin copper scrap is included in the charge, and the spaces between the metal are filled with dextrin, which has the effect of protecting the nickel from the action of the oxygen in the air. The pouring temperature lies between 1450° and 1550° C. and is controlled by means of a radiation pyrometer, lower temperatures cause porous castings. Deoxidation is effected by plunging a little magnesium (50 grm. for 100 kg. of charge) into the melt with an iron rod, and subsequently adding the same amount of manganese. The alloy shrinks 2% on solidification. The charging, melting, and pouring operations are fully described and the preparation of test-pieces is discussed.—J. H. W.

Effect of Centrifugal Casting on the Grain-Size of Metals. J. E. Hirst (*Met. Ind. (Lond.)*, 1932, 40, 467–469).—Photomicrographs of centrifugally-cast iron, phosphor-bronze, and aluminium-brasses show that the grain-size is not always reduced or the dendritic structure broken up by this method of casting. An interesting observation is the curvature of the crystal grains as an effect due to the centrifugal action.—J. H. W.

Design of Automatic Die-Casting Dies. Anon. (*Machinery (Lond.)*, 1930, 36, 489–491, 585–588).—Details are given of the dies used for producing zinc speedometer brackets. The working pressure is 350 lb./in.², and the rate of production 3 double brackets per minute. Amongst other dies described and illustrated is one for the production of carburettor bodies, in which the cores are capable of sliding in 5 directions. The method of operation of such dies is described in some detail.—H. F. G.

Modern Core Making. John A. Smeeton (*Iron and Steel Ind.*, 1932, 5, 261–263).—Core-making mechanism has developed and progressed in line with modern high output moulding machines and core-making can be carried out efficiently with low-priced labour, if suitable core sands are fed to the machines. Two types of machines are fully described, the double pattern plate machine and the compressed-air core blowing machine. Such machines are stated to be very suitable in multiple production brass valve and tap foundries.—J. W. D.

Dry-Sand Versus Green-Sand Moulding. — (*Found. Trade J.*, 1932, 46, 261–262).—Abstract of a discussion held at a meeting of the Scottish Branch of the Institute of British Foundrymen.—J. H. W.

Flowers Buried in Sand Form Patterns from which Ornate Bronze Pieces Are Cast. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1931, (64), 12–13).—The production of bronze artistic castings by Peano using actual flowers as patterns is briefly referred to.—J. S. G. T.

Mould- and Pattern-Making for Built-up Ship Propellers. Anon. (*Z. ges. Giesserei-Praxis: Der Modellbau*, 1932, 53, 88–90, 108–110).—A detailed description of the procedure followed in designing, patterning, and constructing a mould for a four-blade built-up propeller is given.—J. H. W.

Sand Testing in the Foundry. Wm. Y. Buchanan (*Found. Trade J.*, 1932, 46, 97–100, 113–116, 124; discussion, 129, 133).—Read before the Scottish

Branch of the Institute of British Foundrymen. Describes at length methods and apparatus for testing the various sands used in foundry work.—J. H. W.

Some Practical Notes in Oil-Sand Practice. H. W. Keeble (*Found. Trade J.*, 1932, 46, 130-133).—Abstract of a paper prepared for presentation to the London Junior Section of the Institute of British Foundrymen.—J. H. W.

Oil-Sand Practice. B. Gale (*Found. Trade J.*, 1932, 46, 118-120).—Read before the Lincolnshire Branch of the Institute of British Foundrymen.

—J. H. W.

Sand Slinging Practice in the Foundry. A. J. S. Shewan and R. Atchison (*Found. Trade J.*, 1932, 46, 111-112; discussion, 143-144).—Abstract of a paper read before the Lancashire Branch of the Institute of British Foundrymen.—J. H. W.

XVI.—FURNACES AND FUELS

(Continued from pp. 331-332.)

FURNACES

Modern Heat-Treatment Furnaces Serve Industry's Needs. Anon. (*Canad. Mach.*, 1931, 42, (26), 131-134).—The possibilities of the heat-treating furnace with "artificial atmosphere" are discussed; scale-formation may be almost entirely obviated by suitable control of temperature and of atmosphere. Various types of gas-fired and electric furnaces are described and illustrated, with details of handling and control plant and of special carbonizing agents, where these are employed.—P. M. C. R.

Oil-Fired Brass-Melting Furnace. Anon. (*Eng. and Min. J.*, 1932, 133, 77).—The efficiency of a brass foundry depends to a large extent on the type and construction of the melting furnace used. A short description is given of an inexpensive oil-fired furnace made from scrap material. Draft is controlled by an air connection from the burner on to the flue end of the furnace.

—R. Gr.

The Re-Circulation System of Gas Heating. Application to Drying Ovens. Anon. (*Gas World (Industrial Gas Supplement)*, 1932, 4, (2), 10-11).—The Maehler re-circulation system of gas heating, employing a large volume of comparatively low-temperature heating gases which are rapidly swept through the oven is briefly described. The system is conducive to safety in the treatment of varnished and enamelled articles. The system can also be applied to processes operating up to about 1300° C.—J. S. G. T.

Ellipsoid Rotary Melting Furnaces. Anon. (*Met. Ind. (Lond.)*, 1932, 40, 224).—Details of the construction, operation, and advantages of the Ellipsoid rotary furnace, as used on the Continent for the melting of brass, bronze, gun-metal, and other non-ferrous metals are given. See also *J.*, this volume, p. 130.

—J. H. W.

Electrically Heated Galvanizing Furnace. R. M. Cherry (*Iron Age*, 1932, 129, 334-338).—A description of the construction and operation of an electrically-heated furnace suitable for galvanizing is given, and the process of pipe- and wire-galvanizing with this furnace is described. The great advantage of this method is the ease of temperature control, on which the efficiency of galvanizing primarily depends; if the temperature is too high, the pot burns out rapidly, if too low, the zinc is not fluid enough for satisfactory galvanizing.—J. H. W.

Electric Melting and Annealing Furnaces for Aluminium. A. von Zeerleder (*Aluminium Broadcast*, 1930, 2, (43), 17).—A general review. It is pointed out that, apart from questions of convenience or ease of automatic control, the use of electric heating for muffle furnaces has no intrinsic advantages over the use of coke, oil, or gas.—J. C. C.

The Electric Melting of Aluminium. E. F. Russ (*Aluminium Broadcast*, 1930, 2, (50), 3-8).—Translated from *Z. Metallkunde*, 1930, 22, 273-276. See this *J.*, 1930, 44, 716.—J. C. C.

Conveyor-Type Heat-Treatment Furnace. Anon. (*Mech. World*, 1931, 90, 434).—A small portable type of furnace (for the continuous heat-treatment of thin metal discs) produced by the Wild-Barfield Electric Furnaces, Ltd., London, is illustrated and described. The conveyor system consists of two pulley-guided continuous bands of nickel-chromium ribbon on which the metal discs are placed. The pulleys are motor-driven and are counterweighted so as to take up slack in the ribbons as they expand with the heat. The furnace is electrically heated and is fitted with automatic temperature control.—F. J.

Electric Furnaces and Oil Baths for Thermal Treatment. — Baumstein (*Vestnik Elektropromishlenosti (Messenger of the Electrical Industry)*, 1931, (5-6), 200-202).—[In Russian.] A description of the designs of furnaces, salt, and oil baths for thermal treatment, equipped with electrical heating devices as manufactured by the V.E.O. (Pan-Union Electrical Association).—N. A.

High-Frequency Induction Heating. H. Smethurst (*J. Junior Inst. Eng.*, 1931, 41, 113-130).—A description of the modern H.-F. furnaces. Included in this are a comparison with other types of furnaces, an historical account of the development of the induction type, a theoretical consideration of the principles involved, and a brief discussion of the cost of melting. A typical valve-operated induction furnace is described.—W. A. C. N.

The Rôle Played by Self-Induction in Electric Arc Furnaces. M. S. Maximov (*Metallurg (The Metallurgist)*, 1931, 6, (2), 152-155).—[In Russian.] The factors governing the steady operation of arcs are examined: it is considered that the nature of the oscillogram exercises the determining influence. There is no need to increase self-induction in furnaces with protected arcs, but this is essential in open-arc furnaces.—M. Z.

Resistance Material for Electric Furnaces for High Temperatures. Gunnar Nordström (*Teknisk Tidskrift*, 1931, 61, 55-59, 68-70; *Chem. Zentr.*, 1932, 103, I, 1810).—Comparative tests have been made on various common nickel-chromium alloys and on the alloy "Kanthal," which consists of iron, chromium, cobalt, and aluminium. Tables and diagrams are given which show that Kanthal is more resistant than Nichrome to sulphur dioxide, hydrogen sulphide, and carburizing gases and has a high resistance to oxidation, a long life, and a high electrical resistance.—A. R. P.

A Muffle Induction Furnace with Automatic Temperature Regulation. R. Perrin and V. Sorrel (*Génie civil*, 1932, 100, 124).—P. and S. have constructed an induction furnace utilizing an electric supply of the usual industrial voltages and frequencies. See *Rev. Mét.*, 1931, 28, 448-452; *J.*, this volume, p. 270.—W. P. R.

Steel Making in Coreless Induction Furnaces. Anon. (*Metallurgist (Suppt. to Engineer)*, 1932, 8, 7-9).—A description of a plant installed at Bochum, Germany. Smaller furnaces of similar type are used for the melting of non-ferrous alloys.—R. G.

FUELS

Fuel Consumption in Metallurgical Works. L. Bassel and Rocaut (*Chaleur et Ind.*, 1928, 9, (103), 744-761).—Various heat balance calculations are given, and a plea is made for the modernization of the many existing out-of-date types of furnace.—H. F. G.

A Comparison of the Various Fuels in Copper-Refining Furnaces. E. S. Bardwell (*Amer. Inst. Min. Met. Eng. Tech. Publ. No. 457*, 1932, 1-18).—Very interesting data obtained in the commercial working of large copper-refining furnaces when using the following fuels are reviewed: (1) lump coal; (2) pulverized coal; (3) fuel oil, and (4) natural gas. The relative cost of fuel

delivered at any particular plant must always be the deciding factor at that plant. Natural gas, however, is considered to be almost ideal from the operator's point of view owing to its cleanliness and ease of regulation.—W. N.

Some Aspects of the Industrial Gas Problem. G. E. Windiate (*Gas World (Industrial Gas Supplement)*, 1932, 4, (2), 11-13).—Read before the Manchester and District Junior Gas Association, February, 1932. Advantages in the application of gas to industrial purposes are briefly referred to and experiences in the melting of lead and other non-ferrous metals briefly discussed.—J. T.

Coal and the Metallurgical Industry of Western Europe. — Hessegie (*Industrie chimique*, 1932, 19, 93-94).—Mainly statistics of consumption.

—E. S. H.

Mechanism of Combustion of Individual Particles of Solid Fuels. David F. Smith and Austin Gudmundsen (*Min. and Met. Investigations (Min. and Met. Advisory Boards, Pittsburgh, Pa.) Co-operative Bull.* No. 49, 1931, 1-21).—Reprint from *Indust. and Eng. Chem.*, 1931, 23, 277-285. See this *J.*, 1931, 47, 616.—S. G.

Fuel. J. G. King (*Ann. Rep. Prog. Applied Chem.*, 1931, 16, 25-54).—A review of papers published during 1931, with full references. The subjects dealt with include: dust removal; the cleaning and storage of coal; comparative tests with various types of coke, especially as regards melting efficiency; specifications of coke for metallurgical purposes; and oil and gaseous fuels.—H. F. G.

Pulverized Fuel in 1930. Thomas Frederick Hurley (*Iron Coal Trades Rev.*, 1931, 122, 136-137; *Power and Fuel Bull.*, 1931, (1), 6).—A concise review of progress, in which special reference is made to burner developments, furnace details and ash disposal, and grit and sulphur removal.—S. G.

The Examination of Coals and Cokes. Anon. (*Fuel Economist*, 1931, 7, (75), 111-112).—Extracts from the annual report of the Northern Coke Research Committee are given. Tests of the agglutinating value of coal, the measurement of the change of volatile matter content of coal heated at definite rates, and apparatus for measuring the swelling, softening temperatures, and initial contraction of coal on heating are briefly discussed.—J. T.

The Rational Analysis of Coals. Richard Vernon Wheeler (*Midland Section, Coke Oven Managers' Assoc. Advance copy*, 1931; *Power Fuel Bull.*, 1931, (4), 62).—W. points out that it cannot be expected that the properties of coals should be related directly to the proportions of their principal elements, carbon and hydrogen, because of the heterogeneous nature of the coal, the individual substances it contains having different elementary compositions. The methods of rational analysis described in detail in the paper aim to make an approximately quantitative separation of the four principal ingredients of coals, viz.: (1) free hydrocarbons, (2) resins, (3) structural plant entities, resistance to decay, such as spore exines and cuticular tissues, and (4) ulmins, the degradation and condensation products of the cellular tissues and proteins of the plants. The headings are as follows: methods of analysis, preparation of samples for analysis, determination of the organized plant entities, of the hydrocarbons and resins, and of the reactivity of the ulmins, special treatment of durain, the determination of the organized plant entities of the durain. Some typical rational analyses of British coals are given in a table.—S. G.

The Sampling of Coal and Coke. E. S. Grummell and J. G. King (*Fuel Research Station, Lond.*), *Separate*, 1931, 1-32; *C. Abs.*, 1932, 26, 1093).—The conclusions of Bailey are modified to justify smaller coal samples. A new theory based on an "average error," an inherent characteristic of each coal, is described. The average error is shown to increase with increasing ash content. The importance of accuracy in the reduction of the gross sample is emphasized. For coke, a 50 lb. shatter test sample, consisting of lumps only, is considered satisfactory.—S. G.

The Analysis of Solid Fuels, Especially their Distillation under Vacuum at Increasing Temperatures. L. Bautier de Mongeot (*Giorn. chim. ind. applicata*, 1931, 31, 411-413; *C. Abs.*, 1932, 26, 1093).—As ordinary analyses do not give an infallible method for evaluating solid fuels, de M. proposes to submit the coal to vacuum distillation. A weighed sample is placed in a quartz boat, which is then placed in a combustion tube connected to a gas collector. Vacuum is applied and the coal is rapidly heated to 400° C., and the liberated gases are collected, as is that liberated at 400°-600° C., and 600°-1000° C. Curves showing the c.c. of gas evolved at the various temperatures are similar for similar types of fuels.—S. G.

Report of Committee D-5 [of A.S.T.M.] on Coal and Coke. A. C. Fieldner, H. C. Porter, and W. A. Selvig (*Proc. Amer. Soc. Test. Mat.*, 1931, 31, (I), 494-496).—See this *J.*, 1931, 47, 617.—S. G.

XVII.—REFRACTORIES AND FURNACE MATERIALS

(Continued from pp. 273-275.)

Report of Committee C-8 [of A.S.T.M.] on Refractories. G. A. Bole and L. J. Trostel (*Proc. Amer. Soc. Test. Mat.*, 1931, 31, (I), 312-321).—See this *J.*, 1931, 47, 618.—S. G.

Tentative Revisions of A.S.T.M. Standards. Standard Definitions of Terms Relating to Refractories (C 71-31). — (*Proc. Amer. Soc. Test. Mat.*, 1931, 31, (I), 1059).—See *J.*, this volume, p. 201.—S. G.

Recent Advances in the Field of Refractories. Hans Trapp (*Metallbörse*, 1931, 21, 1977-1978, 2009-2010, 2041-2042, 2073-2074).—A review.

—A. R. P.

The Development of Some Special Refractories. H. E. White (*Fuels and Furnaces*, 1931, 9, 1061-1066, 1155-1162).—Discusses recent progress in silicate refractories and in carborundum, fused alumina, and zircon bonded refractories.—A. R. P.

Refractory Materials. Colin Presswood (*Metallurgia*, 1932, 5, 169-170, 172).—Cf. this *J.*, 1931, 47, 459. A description of fireclay bricks deals with specifications for various grades, and the importance of careful definition in the absence of specifications is particularly stressed. In service, technical data regarding refractories although important, are by no means conclusive and must not be too rigidly applied. Authentic reports of service under practical conditions are more valuable, provided that the reports state these conditions. The composition of fireclay bricks is considered, and the cone and the load tests for refractoriness dealt with. Permanent and reversible expansion of firebricks are also considered, as well as the influence of reducing atmospheres in lowering refractoriness. Properties such as abrasive resistance, density, conductivity (thermal and electrical), and spalling resistance, which vary widely, must be considered in relation to the conditions under which the bricks have to be used.—J. W. D.

Refractories and Their Uses. P. F. Thompson (*Chem. Eng. and Min. Rev.*, 1931, 23, 455-459).—Abstract of a paper read before the Melbourne University Metallurgical Society. Describes the changes undergone by refractories during heating and cooling and discusses the testing of refractories.—J. H. W.

Tentative Definitions of Terms Relating to Heat Transmission of Refractories (C 71-31 T). — (*Proc. Amer. Soc. Test. Mat.*, 1931, 31, (I), 779-780).—See *J.*, this volume, p. 201.—S. G.

Relative Heat Transfer Through Refractories. A. S. Watts and R. M. King (*Ohio State Univ. Studies, Eng. Series Bull. No. 64*, 1931, 1-32).—The two recognized bases for heat conductivity data are the absolute and the

comparative. The former should give the amount of heat flowing through a given thickness over a given area in a given time per degree difference in temperature. In the latter a material is selected as a standard, tested in a specific manner, and values obtained. An unknown material of the same specifications with the exception of composition is selected and tested in a similar manner. The ratio of the values obtained is the relative heat transfer. In the first section of the paper these definitions are further developed, and theoretical considerations are discussed. A simple method has been devised for obtaining comparative heat transfers as an aid to the selection of refractories for specific purposes. A special heavily insulated electric furnace was used and recrystallized alumina employed as the standard material. As a standard of insulation diatomaceous earth was considered very suitable. During examination the test-piece was under the control of a series of thermocouples the temperatures of which were recorded autographically. The method of calculating the results is fully explained. Certain discrepancies are explained by the presence of surface phenomena, such as the "skin effect." It is also suggested that the orientation of the crystals in the surface by mechanical means has a decided effect on the thermal properties of a refractory. A general conclusion offered is that the conductivity of aggregates is a complex independent problem of "heat flow," and data connected therewith are only remotely related to the properties of the material itself. Where, however, as in the case of a series of carborundum products, the conductivity is sufficiently pronounced to overcome the resistance due to mechanical arrangement, the effect of chemical composition is felt. In order to study the rôle of surfaces in heat transfer, measurements have been made of the "corrected temperature gradient." Data have also been given showing the relationship of heat transfer to porosity. A critical analysis by H. L. Johnston of the method used and a bibliography are appended.—W. A. G. N.

Electrical Resistivity of Refractory Materials at Elevated Temperatures. Hobart M. Kraner (*Indust. and Eng. Chem.*, 1931, 23, 1098-1102).—The effect of impurities (including intentionally-added materials), particularly on the electrical conductivity of ceramic material at high temperatures, is discussed.—F. J.

New Methods of Improving Refractories and of Protecting them from Soot. M. Seillan (*Chaleur et Ind.*, 1928, 9, 152-153, 478).—Neutron is a colloidal solution of graphite. Applied cold with a brush or cement gun to refractory walls, &c., it penetrates and effectively seals the surface, and thus affords protection from hot gases and soot. If special precautions are taken it may be applied directly to heated surfaces.—H. F. G.

Testing of Refractory Materials. Eugène Dupuy (*Chaleur et Ind.*, 1928, 9, 801-802; discussion, 802-803).—The need of rational tests is emphasized. From the thermal viewpoint there must be considered the sp. heat, thermal conductivity, melting point, coeff. of expansion, and transition temperatures (if any); from the mechanical viewpoint, the strength at various temperatures under instantaneous and prolonged loading; and from the chemical viewpoint, the composition, not merely in terms of the ultimate analysis, but in terms of the various compounds present, and the nature of the reactions which may take place between the refractory and the materials with which it comes into contact.—H. F. G.

Refractories and [Heat] Insulators. Anon. (*Chaleur et Ind.*, 1928, 9, 362-363).—Brief notes of various products of French firms.—H. F. G.

Almost 3800° F. with only Gas and Air and Refractories that will Stand it. Anon. (*Ceramic Age*, 1932, 19, 71-77).—A description is given of a new furnace which operates on the principle of surface combustion, the fuel gases being brought into contact with as large a surface of a fixed heated body as possible in a relatively small combustion chamber. Refractory mixtures

based on the aluminium silicates are unsatisfactory at the high temperatures reached. Zirconium silicate, alumina, spinel, beryllium oxide, zirconium oxide, magnesium oxide, and thorium oxide are satisfactory refractories.

—E. S. H.

A New Ceramic Body of Low Expansion. Anon. (*Ceramic Age*, 1932, 19, 77, 98).—A new ceramic material, Crolite No. 7, has the lowest coeff. of thermal expansion of all known materials, excepting fused quartz. For some purposes it may replace special alloys, such as Invar, the expansion of which is twice as great as that of Crolite No. 7.—E. S. H.

Tentative Revisions of A.S.T.M. Standards. Standard Method of Test for Porosity and Permanent Volume Changes in Refractory Materials (C 20-20). — (*Proc. Amer. Soc. Test. Mat.*, 1931, 31, (I), 1054-1055).—Changes are made in Section 5, paragraphs (c), (d), (e), (f), (g), and (h). A new paragraph (l) *Water Absorption* is added.—S. G.

Tentative Method of Control Test for Resistance of Fire-Clay Brick to Thermal Spalling Action (C 38-31 T). — (*Proc. Amer. Soc. Test. Mat.*, 1931, 31, (I), 777-778).—See *J.*, this volume, p. 201.—S. G.

Tentative Revisions of A.S.T.M. Standards. Standard Method of Test for Softening Point of Fire-Clay Brick (C 24-31). — (*Proc. Amer. Soc. Test. Mat.*, 1931, 31, (I), 1056-1058).—It is proposed to change the title to read "Standard Method of Test for Determining the Pyrometric Cone Equivalent of Fire-Clay and Fire Brick." Changes are made in Sections 1, 2, and 3, and a cone temperature table is added as an appendix.—S. G.

New Developments in Unburned Magnesite Brick for Metallurgical Industry. A. E. Fitzgerald (*Min. and Met.*, 1931, 12, 527-532).—Recent improvements in the manufacture of magnesite bricks include the use of a colloidal coating on the magnesite grains, careful grading of the mixture, and the use of 10,000 lb./in.² pressure to reduce the porosity of the brick. Unburnt bricks produced in this way shrank only 1.02% after 44 days in a kiln, had a crushing strength of 8127 lb./in.², withstood 1600° C. without deformation, and had little tendency to spall.—A. R. P.

Silicon Carbide and its Applications in Metallurgy. H. R. Houchins and C. McMullen (*Metals and Alloys*, 1932, 3, 12-14).—The properties and uses of silicon carbide for electric and fuel-fired furnace linings are briefly described.—A. R. P.

The Aluminium Silicate Refractories. G. A. Bole (*Metals and Alloys*, 1932, 3, 15-21).—Methods of preparation, properties, and uses are given of sillimanite, mullite, kaolin, and diaspore refractories.—A. R. P.

Dolomites and Magnesite. J. Dautrebande (*Chaleur et Ind.*, 1927, 8, 266-268).—The chemical and physical properties of dolomite and magnesite are described and discussed in relation to the use of the materials as refractories. Dolomite should preferably contain not less than 45% of magnesium carbonate, and this percentage should be constant throughout any given specimen; the material should be of compact and uniform texture, and non-friable. Both calcined dolomite and magnesite are used as refractories and for the production of magnesium cement. Calcined dolomite should contain not less than 20% of magnesium, and not more than 4% of silica, alumina, and ferric oxide, which tend to lower the melting point. Four methods are given for preparing fairly pure magnesium oxide, suitable for use in magnesium cement, from calcined dolomite.—H. F. G.

Refractory Hydraulic Concrete and Cement. J. Arnould (*Chaleur et Ind.*, 1928, 9, 536).—Whereas natural and ordinary artificial Portland cements disintegrate at temperatures in excess of 500° C., and aluminous cements such as *ciment fondu* shrink, crack, and, finally, melt at about 1400° C., Kestner cement commences to soften only at 1400° C., and melts at about 1500° C.; its coeff. of expansion is 5.3×10^{-6} and its density 1.5-1.8. With broken

silica brick or alumina as aggregate it produces an excellent refractory concrete.—H. F. G.

Refractory Hydraulic Concrete and Cement. E. Rengade (*Chaleur et Ind.*, 1929, 10, 44).—R. denies Arnould's contention (*cf.* preceding abstract) that aluminous cements are not satisfactory for use at high temperatures, and asserts that if properly mixed with suitable aggregates they yield good refractory concrete.—H. F. G.

Refractory Hydraulic Concrete and Cement. J. Arnould (*Chaleur et Ind.*, 1929, 10, 155).—A reply to Rengade (*cf.* preceding abstract).—H. F. G.

Volumetric Determination of Magnesia and Alumina in Minerals and Refractories. Horst Eckstein (*Chem.-Zeit.*, 1931, 55, 226).—The Al_2O_3 is separated from Fe_2O_3 in the usual way, precipitated with 8-hydroxyquinoline, and determined bromometrically. For MgO, 0.5 grm. of material is fused with 5 grm. of $Na_2B_4O_7$ in a Pt crucible, the product is dissolved in HCl and, after dilution to 250 c.c., 25 c.c. of the solution are filtered through a dry paper, neutralized with NH_4OH , treated with 5 grm. of NH_4Cl , 5 grm. of CH_3-CO_2Na , and, after dilution to 100 c.c., 3% hydroxyquinoline solution in excess. The precipitate is collected, washed, and dissolved in 10% HCl; titration of the solution with $KBr-KBrO_3$ gives the MgO.—A. R. P.

On the Determination of Silica and Alumina in Silicious and Clay Refractories. C. Pertusi and E. di Nola (*Annali Chim. appl.*, 1931, 21, 482-490; *Chem. Zentr.*, 1932, 103, I, 1140-1141).—The material (1 grm.) is evaporated several times to dryness with HF and $H_2C_2O_4$ or HNO_3 ; the final residue is ignited and weighed, the SiO_2 being obtained by difference. Al_2O_3 is determined by fusion of the residue with NaOH in a Ni crucible followed by leaching, filtration of the aluminate solution, and precipitation with NH_4Cl and NH_4OH .
—A. R. P.

XVIII.—MISCELLANEOUS

(Continued from pp. 275-280.)

Origin and Development of the Kaiser-Wilhelm-Institut für Metallforschung. O. Bauer (*Metallwirtschaft*, 1931, 10, 911-912).—v. G.

On the Importance for Science of the Work of the Kaiser-Wilhelm-Institut für Metallforschung. A. Smekal (*Metallwirtschaft*, 1931, 10, 913-914).—v. G.

The Importance for Technology of the Kaiser-Wilhelm-Institut für Metallforschung. G. Masing (*Metallwirtschaft*, 1931, 10, 914-916).—v. G.

Metallurgical Language. Anon. (*Metallurgist (Suppt. to Engineer)*, 1932, 8, 2-3).—A discussion emphasizing the importance of correct language and absence of specialized "slang" in metallurgical publications.—R. G.

Simplicity and Uniformity in Technical Nomenclature. Anon. (*Eng. and Min. J.*, 1932, 133, 72).—Criticism is made of the term "diatomaceous earth" as unnecessarily cumbersome, misleading when referring to "earth" and illogical. "Diatomite" is given as the correct term. It is cited as an example of a common error in technical literature of a neglect to employ terms that clarify a written description and so prevent ambiguity or misinterpretation.
—R. Gr.

Report of Committee E-8 [of A.S.T.M.] on Nomenclature and Definitions. Cloyd M. Chapman and R. E. Hess (*Proc. Amer. Soc. Test. Mat.*, 1931, 31, (1), 619-625).—See this *J.*, 1931, 47, 632.—S. G.

Report of Committee B-2 [of A.S.T.M.] on Non-Ferrous Metals and Alloys. William Campbell and E. E. Thum (*Proc. Amer. Soc. Test. Mat.*, 1931, 31, (1), 250-251).—A progress report.—S. G.

Cardinal Factors in the Development Plan of Non-Ferrous Manufactures. E. G. Deretchey (*Zvetnye Metally (The Non-Ferrous Metals)*, 1931, 6, (9),

1259-1275).—[In Russian.] Cf. *J.*, this volume, pp. 202-203. A review of the present state of non-ferrous manufacture and its development in relation to the production of non-ferrous metals under the Five-Year Plan. It is shown that, at present, the capacity of works producing non-ferrous manufactures (mainly copper and its alloys) exceeds the output of metal, but that gradually this situation will be reversed, so that unless a planned expansion is undertaken, overproduction of the raw metals will result. It is estimated that the use of copper and brass strip and similar semi-manufactured goods will develop in U.S.S.R. with great rapidity, the requirements of copper for this purpose reaching 640,000 tons in 1938. The distribution of the copper and brass utilized (Table I) in 1928/30 was: sheet 59.1%, rods 22.4%, wire 6.7%, and tubes 12.8%. The estimates for 1932 were: sheet 48.6%, rods 36%, wire 5.8%, and tubes 9.6%, and for 1938: sheet 51.2%, rods 31.8%, wire 3.5%, and tubes 13.5%. It is anticipated that the development of industries utilizing copper tubes will require their increased output. Rods will be required in increasing amounts, chiefly for the manufacture of light automatic machinery. At the same time, it is considered probable that profound changes in demand for any particular type of product may take place owing to the alterations in the composition of existing alloys and the substitution of new ones, so that the estimates for 1938 (Tables 2 and 3) must be regarded as approximate. The types of works necessary for fulfilling the development programme are discussed and compared with the existing Russian (Krasnye Vyborjetz, Koltchugin, &c.) and foreign works. It is concluded that development of such works should be regional so that each serves the needs of industries grouped round them. Their number and scale for each region are to be determined by the industrial demands of the latter; each should consist of a variety of departments to serve the various requirements; the maximum degree of co-ordination should be established between them and the centres of production of raw material and energy. It is considered that such a system of planning is entirely in agreement with the principles of national concentration and specialization of production, in view of the large-scale of the regional units. Detailed estimates of output of copper and brass semi-manufactured goods by the Krasnye Vyborjetz and Koltchugin works for the periods 1930-1938 are given (Tables 4, 5, 6, and 7). The maximum capacity of these works will be 210,000 tons, the balance of the demand being satisfied in the "regional" units to be created (Tables 8 and 9). As regards other non-ferrous metals, the estimated demand for aluminium goods is based on very vague data, and no definite location for producing units is given. Demand for semi-manufactured goods of lead is estimated at 30,000 tons in 1938 and of zinc at 80,000 tons (12,000 tons in 1933), regional units being planned in the Central Industrial Region and Eastern Siberia. The production of bi-metal is likely to be fraught with great difficulties owing to the low stage of development of its manufacture and uses, so that no data on which to base organized planning exist. It is possible that a producing unit may be located in the Ural region, close to centres of iron production. Detailed estimates for the demand and production of non-ferrous semi-manufactured goods under the First and Second Five-Year Plans are given in Appendix I and II.—M. Z.

Disgraceful Results of the Financial and Industrial Plan in the Non-Ferrous Metal Industry of the Ural During the First Half-Year of 1931. W. S. Gulin (*Zvetye Metally (The Non-Ferrous Metals)*, 1931, 6, (10), 1281-1294).—[In Russian.] A detailed analysis of the estimated and actual production figures in the Ural non-ferrous industry (copper) during January-June 1931 and (in part) for July. Various causes for the poor results obtained (about 50% of that planned) are examined. The costs of production of blister copper in two centres (Kalata and Karabash) have been estimated at £46 and £69 per ton, respectively, the actual costs being £70 and £115.—M. Z.

An Outline of the Production Programme for Non-Ferrous Metallurgy in 1932. D. I. Steinbock (*Zvelnye Metally (The Non-Ferrous Metals)*, 1931, 6, (10), 1401-1407).—[In Russian.] A review of the factors causing the unfavourable production figures of 1931 and of the objectives to be achieved in 1932. It is stated that 1931 was the first year in which activities of "wreckers" in the non-ferrous metal industry had been suppressed, so that the lack of co-ordination which caused failures in attaining the projected output should henceforth be overcome. The output of blister copper is estimated in 1932 at 104,000 tons, an increase of 219% above that of 1930. The development of the various centres—Kalata, Karabash, Uralmedstroy, Zakzvetmet, Bashkiz, and Karsak-Paisk is analyzed. The output of lead is estimated at 45,000 tons—an increase of 125% above the 1931 estimates, the chief centres being Ridder and Sevkavazinc. The output of zinc is estimated at 40,000 tons or 43% above that of 1931, chiefly at Sevkavazinc, Belovo, and Konstantinovsk, and the Tcheliabinsk electrolytic works. At the Ridder works metallic cadmium is to be produced for the first time in the U.S.S.R. In order to create a stable body of mining workers, a 30% increase in miners' wages is contemplated in 1932.—M. Z.

Non-Ferrous Metals. Progress in Light Alloys. — (*Times Trade and Eng. Suppl. Annual Eng. Review*, 1932, 29, (708), xv).—During 1931 aluminium and its alloys were used in increasing amount for electrical work in place of non-magnetic iron, brass, and bronze. Thousands of tons of steel-cored aluminium cable in connection with the "grid" were used, and, in addition, there was a strong demand for aluminium and its alloys by makers of aircraft, motor-vehicles, and railway stock. Other items of interest relating to non-ferrous metals to which reference is made are the successful welding of copper, use of aluminium brass, precious metals and electrometallurgy, &c. Reference is also made to the activities of the Institute of Metals and of the British Non-Ferrous Metals Research Association.—S. V. W.

An Unusual Case of Arsine Poisoning. D. Kremer (*Gasmasker*, 1931, 3, 109-111; *C. Abs.*, 1932, 26, 945).—Several workmen were killed by arsine developed when waste metal, left after the purification of raw tin, was sprinkled with water. The waste contained also tin, antimony, arsenic, and aluminium. The formation of arsine was ascribed to the presence of unstable aluminium arsenide and to the fact that the waste metal was at a temperature of about 50° C. when it was sprinkled with water. The same waste metal, when cold, and sprinkled with water, did not generate arsine.—S. G.

Industrial Poisoning in the Use of Chromium Compounds. — Freitag (*Oberflächentechnik*, 1931, 8, 22-23).—See this *J.*, 1931, 47, 588.—A. R. P.

Arsenic Elimination in the Reverberatory Refining of Native Copper. C. T. Eddy (*Trans. Amer. Inst. Min. Met. Eng.*, 1931, General Volume, 104-117; discussion, 117-118).—The origin of the arsenic in native copper from Lake Superior is traced and its effect on the properties of the metal described. The presence of arsenic above 0.1% in cast copper leads to segregations and hard-drawn wires of this metal have a higher electrical conductivity than annealed wires; this tendency may be overcome by prolonged annealing of the casting at a high temperature, after which the curves for the conductivities of hard-drawn and annealed wire become almost contiguous. The electrical conductivity of arsenical copper is a linear function of the logarithm of the arsenic content between 0.1 and 1%. Arsenic is eliminated from the copper bath in the reverberatory furnace by injecting sodium carbonate with air into the metal at the end of the oxidizing period when the sulphur has been removed and the oxygen content of the metal is about 1%; the arsenic is thereby converted into sodium arsenate which is skimmed off and the metal poled to "tough pitch" in the usual way. Minimum soda consumption with 0.3% arsenic in the bath is obtained with an oxygen content of 0.85%. Data are

given to illustrate the relationship between the initial arsenic concentration in the bath and the amount of soda required for its removal.—A. R. P.

Failures of Cast-Iron Kettles in Lead Refining. Carl E. Swartz (*Trans. Amer. Inst. Min. Met. Eng.*, 1931, General Volume, 125-135; discussion, 135-141).—See this J., 1931, 47, 247.—S. G.

Lead Solution Used to Recover Tin from Scrap. A. E. B. (*Sci. American*, 1932, 88, 107).—Scrap tinplate, &c., is treated with a solution containing lead 4.45, caustic soda 10.25, and water 85.3% at 90° C. Lead is precipitated and the tin goes into solution as sodium stannate. The precipitated lead is recovered by placing in a tower with sodium hydroxide and air blown through the solution.—W. P. R.

The Tunis Plant of the Coley Process for Zinc Manufacture. O. W. Roskill (*Indust. Chemist*, 1931, 7, 449-452).—A description of the large plant recently erected in Tunis.—E. S. H.

Amalgamating Zinc Rods with Mercury. A. E. (*Machinery (Lond.)*, 1930, 36, 278).—Pickling in sulphuric acid (1:10), followed by immersion in mercuric nitrate solution, is recommended.—H. F. G.

The Formation and Adhesion [to Metals] of Ice. Anon. (*Engineering J.*, 1929, 12, 549-551).—Summary of a report made by Howard T. Barnes to the National Research Council of Canada on the deposition of ice on the struts, wings, &c., of aeroplanes. The force with which ice adheres to different materials varies very considerably, and decreases in the order: steel, wood, copper brass, wrought iron, nickel (plating), zinc, paraffin wax, aluminium, chromium (plating), magnesium, cast iron, graphite. Further research on this matter is deemed necessary.—H. F. G.

Utilization of Heat in Metallurgical Works. L. H. Stechepine (*Chaleur et Ind.*, 1928, 9, 217-222).—Various heat balance calculations are given and discussed from the economic viewpoint.—H. F. G.

Waste Materials Disposal. Anon. (*Machinery (Lond.)*, 1930, 36, 40).—An increased price may be obtained for scrap metals if oil, &c., has been reclaimed. It is often advantageous to arrange with the supplier of, e.g., brass sheet or rod, to remelt or re-roll the scrap for subsequent use.—H. F. G.

Tracking Factory Waste Losses to their Real Sources. C. H. McKnight (*Canad. Mach.*, 1931, 42, (25), 22-24).—In reducing controllable expense, labour and arrangement have received great attention, whilst the question of economy in material has remained neglected. Working plans include excessive allowances for waste. Much picking and sorting of scrap can be avoided by keeping different types of waste distinct from the beginning. This has especially beneficial results in the case of white-metal scrap and of copper contaminated with lead. Systematic application of such a scheme in a large works is described.—P. M. C. R.

Pure and Applied Science. Cecil H. Desch (*Science*, 1931, 74, 495-502).—A general lecture on the inter-relation of pure and applied science, and on the way in which each stimulates the other. Frequent examples in connection with metallurgy are quoted.—W. H.-R.

The History of Science and Technology. Anon. (*Mech. World*, 1931, 90, 25-26).—Editorial article on the growing appreciation of the disadvantages we have suffered as the result of the neglect of scientific and technological history, and on the intention to rectify matters, as reflected in the proceedings of the second International Congress of the History of Science and Technology, held in London, in June 1931.—F. J.

The Zürich Congress of 1931. Anon. (*Metallurgist (Suppt. to Engineer)*, 1931, 7, 146-147).—A summary of the work and results of the Congress organized by the (New) International Association for Testing Materials.—R. G.

Researches of the American Society for Testing Materials. Anon. (*Met. Ind. (Lond.)*, 1931, 39, 518-519).—Particulars are given of research work now

being carried out by the American Society for Testing Materials. They are abstracted from a larger summary published in the Society's Bulletin for October, 1931, and are classified under the headings: Properties of Materials, Methods of Testing, and Refractories.—J. H. W.

The Standards Association of Great Britain. Anon. (*Mech. World*, 1931, 89, 527-528).—Editorial comment on the inauguration of this Association which marks an extension of the work of the British Engineering Standards Association.—F. J.

International Engineering Standardization. Anon. (*Indian Eng.*, 1931, 89, 491).—The development of the International Standards Association is traced and the scope and incidence of its work are indicated.—P. M. C. R.

Engineering Standardization—Its International Aspect. Anon. (*Engineering J.*, 1931, 14, 258-259).—A note on the formation, objects, and achievements of the International Standards Association.—H. F. G.

Report of Committee E-10 [of A.S.T.M.] on Standards. T. R. Lawson and C. L. Warwick (*Proc. Amer. Soc. Test. Mat.*, 1931, 31, (I), 630-638).—See this *J.*, 1931, 47, 631-632.—S. G.

A New High-Voltage Research Laboratory. Anon. (*Indian Eastern Eng.*, 1930, 66, 172a-172b).—The high-voltage research laboratory of the Metropolitan-Vickers Electrical Co., Ltd., is described.—P. M. C. R.

Report of Committee E-9 [of A.S.T.M.] on Correlation of Research. H. F. Moore and C. L. Warwick (*Proc. Amer. Soc. Test. Mat.*, 1931, 31, (I), 626-629).—See this *J.*, 1931, 47, 632.—S. G.

Research and Government Economy. Anon. (*Bull. British Cast-Iron Res. Assoc.*, 1931, 3, (2), 42-43).—Extracts from the Report of the Committee on National Expenditure. The Committee emphasizes the importance of encouraging research and no reduction in the Department of Scientific and Industrial Research estimates is suggested. It is considered that State aid should be limited to industrial research of definite benefit to the general community, in order to encourage individual manufacturers to carry out research of definite benefit to themselves.—W. H.-R.

The State and Industrial Research. Anon. (*Bull. British Cast-Iron Res. Assoc.*, 1932, 3, (3), 65-68).—Extracts from the Report of the Department of Scientific and Industrial Research for the year 1930-31. The extracts emphasize the advantages to be expected from industrial research on a co-operative basis, and show how the Research Associations have succeeded in this because they also retain the individualism characteristic of British industry. The Research Association also serve to promote contact between the scientific worker and industry. The causes of the delay between scientific discovery and commercial manufacture are discussed.—W. H.-R.

Difficulties of Industrial Research Associations. H. C. Dews (*Mech. World*, 1931, 90, 330-331).—Abstract of paper read before the London branch of the Institute of British Foundrymen.—F. J.

Research in Theory and Practice. W. R. Whitney (*Mech. World*, 1931, 90, 205-206).—Abstract of an address given on the occasion of the presentation of a Franklin medal of the Franklin Institute to the Vice-President in Charge of Research in the General Electric Company, U.S.A.—F. J.

Cost Reduction through Materials. B. Brown (*Machinery (Lond.)*, 1930, 35, 845-846).—Replacement of one material by another may prove to be an economy by (1) reducing initial cost; (2) reducing machining time; (3) reducing number of operations; or (4) eliminating shop troubles due, e.g., to poor welds or to local brittleness. This view is illustrated by reference to the gradual replacement of drawn brass by manganese bronze, and to the substitution of one nickel alloy by another which, in connection with the operation described, would not require annealing.—H. F. G.

XIX.—BIBLIOGRAPHY

(Continued from pp. 333-334.)

(Books marked * may be consulted in the Library.)

- *Africa. *The Manufacturing Industries of the British Empire Overseas.* Part IV.—*Africa, West, East, and Central.* 8½ × 13½ in. Pp. 36, with 13 folding diagrams and 1 map. 1932. London: Erlangers, Ltd., 4 Moorgate, E.C. 2. (7s. 6d.)
- *American Society for Testing Materials. *Index to Proceedings, Volumes 26-30 (1926-1930).* Med. 8vo. Pp. 251. 1932. Philadelphia, Pa.: The Society.
- *Anderson, H. A. *Zinc Alloys for High- and Low-Temperature Service.* (Bell Telephone System Technical Publications. Monograph B-652.) Med. 8vo. Pp. 19, with 14 illustrations. 1932. New York: Bell Telephone Laboratories, Inc.
[Reprinted from the A.S.T.M. and A.S.M.E. Symposium on Effect of Temperature on the Properties of Metals, see *J.*, 1931, 47, 431.]
- Bardtke, P. *Darstellung der gesamten Schweisstechnik.* Zweite erweiterte und vollständig erneuerte Auflage. 8vo. Pp. 275. 1931. Berlin: V.D.I.-Verlag. (M. 12.50.)
- Baud, Paul. *Chimie industrielle: la grande industrie chimique, les métalloïdes et leurs composés, les métaux et leurs sels, industries organiques.* Deuxième édition entièrement refondue. Pp. 1022. 1932. Paris: Masson et Cie. (100 francs.)
- Bausch and Lomb Optical Co. *Optical Instruments for Examining and Analyzing Metals.* New York: Bausch and Lomb Optical Co.
- Billiter, Jean. *Technische Elektrochemie.* Band 3.—*Schmelzfluss-Elektrolyse (Alkalimetalle, Erdalkalimetalle, Magnesium, Aluminium, Beryllium usw.).* 2., umgearb. u. verm. Auflage. Pp. vii + 186. 1932. Halle: Wilhelm Knapp. (nn. M. 12.50; geb. nn. M. 14.)
- *Canada. Department of Mines. Mines Branch. *Investigations of Fuels and Fuel Testing (Testing and Research Laboratories) 1929.* (No. 721.) Roy. 8vo. Pp. 131, illustrated. 1932. Ottawa: F. A. Acland.
- Cazaud, R. *Agenda Dunod: Métallurgie.* 48° édition. Pott 8vo. Pp. xx + 516. 1932. Paris: Libr. Dunod. (20 francs.)
- *Claus, Willi, und Fincke, Hans. *Säure beständige Bronzen, Kupfer, Zinnbronzen und verwandte Legierungen als chemischbeanspruchte Werkstoffe im allgemeinen Maschinen- und Apparate-Bau.* Med. 8vo. Pp. viii + 137, with 113 illustrations. 1932. Halle (Saale): Wilhelm Knapp. (Br. R.M. 12.50; geb. R.M. 13.80.)
- Cole, Charles Bradford, and Curtis, F. W. *Tool and Die Design, a Practical Handbook on Tool Design, Die Making, and Metal Stamping.* 8vo. Pp. 65, illustrated. 1932. Chicago: American Technical Society.
- Crowther, J. G. *Industry and Education in Soviet Russia.* Demy 8vo. Pp. xi + 94 + 16 plates. 1932. London: William Heinemann, Ltd. (7s. 6d. net.)
- Davis, H. W. *Platinum and Allied Metals in 1930 (Mineral Resources of the United States, 1930. Part I.).* Med. 8vo. Pp. 99-112. 1932. Washington, D.C.: Government Printing Office. (5 cents.)
- Denver Fireclay Co. *Refractories.* Pp. 72. Denver, Colo.: Denver Fireclay Co.

- Deretchey, E. G. *Non-Ferrous Metals*. Volume II. [In Russian.] Pp. 400. 1931. Moscow and Leningrad : State Scientific-Technical Bookshop. (Rbl. 4.80.)
- Drucker, C., und Proskauer, E. Herausgegeben von. *Physikalisch-chemisches Taschenbuch*. Band 1. Cr. 8vo. Pp. viii + 546. 1932. Leipzig : Akademische Verlagsgesellschaft m.b.H. (M. 29.)
- Engel, W. *Die heutige theoretische Grundlage der Materialprüfung der Metalle*. (Ingenieurvidenskabelige Skrifter, A, Nr. 25.) Roy. 8vo. Pp. 96. 1931. København : G. E. C. Gad. (3.00 kr.)
- *Engelhardt, Victor. Herausgegeben von. *Handbuch der technischen Elektrochemie*. Erster Band, 2 Teil : *Die technischen Elektrolyse Wässeriger Lösungen*. A.—*Die technische Elektrometallurgie Wässeriger Lösungen Gold, Silber, Kupfer, Verschiedene Metalle*. Bearbeitet von G. Eger, M. Hosenfeld, u. W. Schopper. Med. 8vo. Pp. 331, with 89 illustrations. 1932. Leipzig : Akademische Verlagsgesellschaft m.b.H. (Br. R.M. 30 ; geb. R.M. 32.)
- Faure, Petrus. *Histoire de la Métallurgie au Chambon-Feugerolles*. Pp. 145. Paris : Ed. de la Chambre syndicale des ouvriers métallurgistes de Chambon-Feugerolles.
- Fowler, W. H. Edited by. *Fowler's Mechanics' and Machinists' Pocket Book*, 1932. Twenty-fourth annual edition. 18mo. Pp. 449. 1932. London and Manchester : Scientific Publishing Co. (2s. net.)
- Fowler, W. H. Edited by. *Fowler's Electrical Engineer's Pocket Book*, 1932. Thirty-second annual edition. 18mo. Pp. 534. 1931. London and Manchester : Scientific Publishing Co. (3s. net.)
- Fowler, W. H. Edited by. *Fowler's Mechanical Engineer's Pocket Book*, 1932. Thirty-fourth annual edition. 18mo. Pp. 568. 1932. London and Manchester : Scientific Publishing Co. (3s. net.)
- Goujon, L. *Précis de Fonderie*. Deuxième édition. Pp. 330. 1932. Paris : Ch. Béranger. (relié, 40 francs.)
- Hatmaker, Paul, and Davis, A. E. *Abrasive Materials in 1930*. (Mineral Resources of the United States, 1930. Part II.) Med. 8vo. Pp. 151-169. 1932. Washington, D.C. : Government Printing Office. (5 cents.)
- Heikes, V. C. *Arsenic, Bismuth, Selenium, and Tellurium in 1930*. (Mineral Resources of the United States, 1930. Part I.) Med. 8vo. Pp. 25-30. 1932. Washington, D.C. : Government Printing Office. (5 cents.)
- Hess, F. L. *Vanadium, Uranium, and Radium*. (Mineral Resources of the United States, 1930. Part I.) Med. 8vo. Pp. 133-150. 1932. Washington, D.C. : Government Printing Office. (5 cents.)
- Kaye, G. W. C., and Laby, T. H. *Tables of Physical and Chemical Constants and some Mathematical Functions*. Seventh edition. Roy. 8vo. Pp. 163. 1932. London, New York, and Toronto : Longmans, Green and Co., Ltd. (14s. net.)
- Kiessling, O. E., and Clark, M. B. *Mineral Resources of the United States, 1930 (Summary)*. Med. 8vo. Pp. 120. 1932. Washington, D.C. : Government Printing Office. (20 cents.)
- Koppel, J. Herausgegeben von. *Chemiker-Kalender*, 1932. Jahrgang 53. Berlin : Julius Springer. (R.M. 20.)

- *Krivobok, Vsevolod N., and Gensamer, Maxwell. *Dilatometric Study of Chromium-Nickel-Iron Alloys*. (Mining and Metallurgical Investigations under auspices of Carnegie Institute of Technology Mining and Metallurgical Advisory Boards. Bulletin 102.) Med. 8vo. Pp. 23, with 14 illustrations. 1931. Philadelphia, Pa.: Carnegie Institute of Technology. (25 cents.)
[Reprinted from *Amer. Inst. Min. Met. Eng. Tech. Publ.* 434. See abstract, J., this volume, p. 13.]
- *Krivobok, Vsevolod N., and Beardman, E. L., Hand, H. J., Holm, T. O. A., Reggiori, A., Rose, R. S. *Further Studies on Chromium-Nickel-Iron and Related Alloys*. (Mining and Metallurgical Investigations under auspices of Carnegie Institute of Technology Mining and Metallurgical Advisory Boards. Bulletin 103.) Med. 8vo. Pp. 40, with 27 illustrations. 1931. Philadelphia, Pa.: Carnegie Institute of Technology. (50 cents.)
[Reprinted from a paper read before the American Society for Steel Treating. See abstract, J., this volume, p. 77.]
- *Langley, M. *Metal Aircraft Construction*. A Review for Aeronautical Engineers of the Modern International Practice in Metal Construction of Aircraft, containing more than 240 diagrams and photographs of the methods used by the most prominent designers at home and abroad. Demy 8vo. Pp. vii + 240, with 241 illustrations. 1932. London: Gale and Polden, Ltd., 2 Amen Corner, E.C.4. (15s. net.)
- *Linde Air Products Company. *The Purox Manual. Instructions for Welding and Cutting by the Oxy-Acetylene Process*. Second edition. Med. 8vo. Pp. 150, with 89 illustrations in the text. 1931. New York: Linde Air Products Co. (\$1.00.)
- Long, J. S., and Anderson, H. V. *Chemical Calculations*. Third edition. Demy 8vo. Pp. 259. New York: McGraw-Hill Book Co., Inc. (\$1.75); London: McGraw-Hill Publishing Co., Ltd. (10s. 6d.).
- *Lundquist, Eugene E. *The Compressive Strength of Duralumin Columns of Equal Angle Section*. (Technical Notes, National Advisory Committee for Aeronautics, No. 413.) 4to. [Mimeographed.] Pp. 12 + 7 figures. 1932. Washington: D.C.: U.S. National Advisory Committee for Aeronautics.
- Malyschew, W. K. *Technology of Metals. Short Text-Book of Alloys*. [In Russian.] Pp. iv + 124. 1932. Leningrad: Kubutsch-Verlag. (Rbl. 1.75.)
- Montessus de Ballore, R. de, Publié sous la direction de. *Index Generalis*. Tome 1: *Annuaire général des universités, grandes écoles, académies, archives, bibliothèques, instituts scientifiques, jardins botaniques et zoologiques, musées, observatoires, savantes*. Cr. 8vo. Pp. vii + 1888. 1932. Paris: Éditions Spes. (225 francs.)
- *National Physical Laboratory. *Report for the Year 1931*. 4to. Pp. vi + 313, with 54 illustrations. 1932. London: H.M. Stationery Office. (15s. net.)
- *Nederlandsch Instituut voor Documentatie en Registratuur. *Repertorium Technicum*. International Bi-monthly Bibliography of Books and Articles appearing in Periodicals on Technical and Allied Subjects. [Mimeographed.] 4to. Volumen I. Fasc. 7. Pp. 508-602. Fasc. 8. Pp. 603-690. [1932.] Den Haag: Nederlandsch Instituut voor Documentatie en Registratuur, Carol van Bylandtlaan 30. (£3 per annum.)

- Neuburger, M. C. *Gitterkonstanten*. Pp. 29. Leipzig: Akademische Verlag. G.m.b.H. (M. 2.20.)
- *Newitt, D. M. Edited by. *Chemical Engineering and Chemical Catalogue. A Catalogue of Heavy and Fine Chemicals, Raw Material, Machinery, Plant, and Equipment applicable to Production Industries, Standardized, Condensed, and Cross-Indexed*. Eighth edition. 4to. Pp. 372, illustrated. 1932. London: Leonard Hill, Ltd., 231-232 Strand, W.C. 2. (10s.)
- Newman, F. H. *Recent Advances in Physics (Non-Atomic)*. Ex. Cr. 8vo. Pp. ix + 378. 1932. London: J. and A. Churchill. (15s.)
- *Offinger, H. *Technologisches Taschenwörterbuch in 5 Sprachen*. II. Abteilung, 2 Band.—*Französisch-Deutsch-Italienisch*. 9. veränderte und verbesserte Auflage. Bearbeitet von H. Krenkel. Post 8vo. Pp. 216. 1932. Stuttgart: C. E. Poeschel Verlag. (Lw. M. 6.)
- Ost, Hermann. *Text-Book of Chemical Technology*. Part 4. [In Russian.] Pp. 439. 1931. Moscow and Leningrad: State Scientific-Technical Bookshop. (Rbl. 5.)
- Pfanhauser, Wilhelm. *Verchromungs-Technik; Umfassende Darstellung des heutigen Standes des elektrolytischen Verchromungs-Verfahrens*. 2 Auflage. Pp. 229. Leipzig: Langbein-Pfanhauser-Werke A.G.
- *Press Guide. *Willing's Press Guide, 1932*. Fifty-ninth Annual Issue. Demy 8vo. Pp. 498. 1932. London: Willing Service, 356-364 Gray's Inn Rd., W.C.1. (2s. 6d.)
- Robertson, T. Brailsford. *The Spirit of Research*. Edited by Jane W. Robertson. Cr. 8vo. Pp. xiv + 210 + 2 plates. 1931. Adelaide: F. W. Precece and Sons. (8s. 6d. net.)
- Schütz, E. *Praktische Berechnungen des Giessereimannes*. Pp. 198. Halle: Wilhelm Knapp. (M. 13.50.)
- *Shoulgin, I. G. *Investigations of Elastic and Plastic Deformation on Bending Duralumin Sheets*. [In Russian, with English abstract.] (U.S.S.R. Supreme Council of National Economy. The All-Union Association of the Aircraft Industry; Transactions of the Central Aero-Hydrodynamic Institute, No. 114.) Roy. 8vo. Pp. 35, with 37 illustrations. 1932. Moscow: Supreme Council of National Economy. (65 k.)
- *Siemens Company. Central Committee on Scientific and Engineering Research of the. *Beryllium: its Production and its Application*. Translated by Richard Rimbach and A. J. Michel. (Scientific Publications of the Siemens Company.) Med. 8vo. Pp. 331, with 198 illustrations. [1932.] New York: The Chemical Catalog Co., Inc. (\$10.00.)
- [This is a translation of the "Beryllium Arbeiten," *Wissenschaftliche Veröffentlichungen aus dem Siemens-Konzern*, VIII Band, Erstes Heft, 1929, abstracts of the papers in which have already appeared in the *Journal*. The volume contains the following: A. Stock: "Introduction"; K. Illig: "Outline of the Research Programme on the Production and Uses of Beryllium"; H. Fischer: "The Analytical Chemistry of Beryllium"; M. Hosenfeld: "The Occurrence of Beryllium"; K. Illig and M. Hosenfeld: "The Thermal Reduction of Beryllium"; K. Illig, M. Hosenfeld, and H. Fischer: "Investigations on the Dressing of Raw Beryl and on the Production of Beryllium Salts Suitable for Electrolysis"; K. Illig, M. Hosenfeld, and H. Fischer: "Electrolytic Production of Beryllium"; H. Fischer: "The Influence of Bath Composition and Bath Temperature on the Stock-Goldschmidt-Siemens- and Halske Method for the Production of Beryllium"; K. Illig: "Physical and Chemical Properties of Beryllium"; H. Fischer: "The Production of Electrolytic Deposits of Beryllium by High Temperature Electrolysis"; K. Illig and H. Fischer: "Direct Electrolytic Production of Beryllium Alloys"; G. Masing and O. Dahl: "The Structure of Beryllium-Copper Alloys"; G. Masing and O. Dahl: "Physical Properties and Age-Hardening of Beryllium-Copper Alloys"; G. Masing and O. Dahl: "Changes in the Electrical Conductivity and the Volume during the Age-Hardening of Beryllium-Copper Alloys"; G. Masing and C. Haase: "The Changes in

the Modulus of Elasticity during the Age-Hardening of Beryllium-Copper Alloys"; G. Masing and O. Dahl: "Changes in the Microstructure of Beryllium-Copper Alloys due to Age-Hardening"; O. Dahl, E. Holm, and G. Masing: "X-Ray Investigation of the Age-Hardening Process in Beryllium-Copper Alloys"; G. Masing: "Theory of the Age-Hardening Process Based on the Investigation of Beryllium-Copper Alloys"; G. Masing and O. Dahl: "The Effect of Small Additions of Phosphorus on the Age-Hardening of Beryllium-Copper Alloys"; G. Masing and O. Dahl: "Ternary Copper-Base Alloys containing Beryllium"; G. Masing and O. Dahl: "Beryllium-Nickel Alloys"; W. Kroll: "Beryllium-Iron Alloys"; O. v. Auwers: "Magnetic Measurements on Beryllium-Iron Alloys"; G. Masing and O. Dahl: "Aluminum-Beryllium Alloys, with an Appendix on Silicon-Beryllium Alloys."

Smirnow, I. D., and Stepanow, A. *Analytical Chemistry. Qualitative Analysis.* [In Russian.] Eighth edition. Pp. 102. 1931. Moscow and Leningrad: State Scientific-Technical Bookshop. (75 k.)

***Speller, F. N., and Beatty, John D.** *Third Progress Report of the Metallurgical Advisory Board to Carnegie Institute of Technology and United States Bureau of Mines, October 1928 to October 1931.* (Mining and Metallurgical Investigations under auspices of United States Bureau of Mines, Carnegie Institute of Technology and Mining and Metallurgical Advisory Boards. Co-operative Bulletin 52.) Med. 8vo. Pp. 16. 1931. Pittsburgh, Pa.: Carnegie Institute of Technology.

***Tammann, Gustav.** *Lehrbuch der Metallkunde. Chemie und Physik der Metalle und ihrer Legierungen.* Vierte erweiterte Auflage. Med. 8vo. Pp. xv + 536, with 385 illustrations in the text. 1932. Leipzig: Leopold Voss. (R.M. 48; geb., R.M. 49.50.)

Thénard, L. J. *Lehrbuch der theoretischen und praktischen Chemie.* Bände II, IV, V, VI, VII. Berlin: Verlag Chemie G.m.b.H. (M. 12.)

***U.S. Department of Commerce, Bureau of Standards.** *Bibliography on Standardization.* (Bureau of Standards Miscellaneous Publication No. 136.) Med. 8vo. Pp. 19. 1932. Washington, D.C.: Government Printing Office.

***Walters, F. M., jr., with Wells, Cyril, Gensamer, M., and Eckel, John F.** *Alloys of Iron, Manganese, and Carbon.* Part I.—*Preparation of Alloys.* Part II.—*Thermal Analysis of the Binary Alloys.* Part III.—*An X-Ray Study of the Binary Iron-Manganese Alloys.* Part IV.—*A Dilatometric Study of Iron-Manganese Binary Alloys.* (Mining and Metallurgical Investigations under auspices of Carnegie Institute of Technology Mining and Metallurgical Advisory Boards. Bulletin 101.) Med. 8vo. Pp. 45, with 24 illustrations. 1931. Philadelphia, Pa.: Carnegie Institute of Technology. (50 cents.)

[For abstracts, see *J.*, this volume, pp. 296-297.]

***West, Clarence J., and Berolzheimer, D. D.** Compiled by. *Bibliography of Bibliographies on Chemistry and Chemical Technology.* Second Supplement, 1929-1931. (Bulletin of the National Research Council, No. 86.) Sup. Roy. 8vo. Pp. 150. Washington, D.C.: National Research Council of the National Academy of Sciences. (\$1.50.)

***Williams, Robert R.** *Functions of a Laboratory Organization.* Med. 8vo. Pp. 12. 1932. New York: Bell Telephone Laboratories, Inc. [Reprint from *Indust. and Eng. Chem.*, 1932, 24, 194-198.]

***Wire.** *Wire and Wire Products Buyers' Guide and Year Book of the Wire Association.* Med. 8vo. Pp. 171. 1932. New York: Quinn-Brown Publishing Corporation, 551 Fifth Avenue.

Zimmer, George Frederick. *The Mechanical Handling and Storing of Material: a Treatise on the Automatic and Semi-automatic Handling and Storing of Commercial Products.* Fourth edition, enlarged. 2 vols. Sup. Roy. 8vo. Pp. 896. 1932. London: Crosby Lockwood and Son. (63s. net.)

XX. BOOK REVIEWS

(Continued from pp. 335-336.)

Faraday and his Metallurgical Researches, with Special Reference to their Bearing on the Development of Alloy Steels. By Sir Robert A. Hadfield. Roy. 8vo. Pp. xx + 329, with 11 figures in the text and 58 plates. 1931. London: Chapman & Hall, Ltd. (21s. net.)

Metallurgical researches were conducted by Faraday between the years 1810 and 1824, and during these five years a vast field was covered and a large number of alloys of iron with carbon, chromium, nickel, copper, silver, gold, platinum, rhodium, palladium, and silicon were prepared and examined. The manner in which the alloys were prepared can be gathered from Faraday's book on "Chemical Manipulations." A procedure, reminding one of that for Damascus steel, was apparently adopted by Faraday under the influence of the then current ideas on wootz or Indian steel. In the same year (1810) Faraday started his metallurgical research with a paper on separation of manganese from iron (Appendix I, p. 315, where a serial list of papers by Faraday relating to metallurgy is given), also another on "An Analysis of Wootz or Indian Steel" (Royal Institution's *Quarterly Journal of Literature, Science and the Arts*, 1819, 7, 288-290). Wootz is also mentioned by Faraday on several occasions as raw material for his alloys. Thus the author's (Sir Robert Hadfield's) suggestion (*Phil. Trans. Roy. Soc.*, 1931, [A], 230, 226), that wootz was one of "the means of attracting Faraday to the field of steel alloys," becomes highly probable.

In his researches Faraday was assisted by J. Stodart, F.R.S., a cutler and maker of surgical instruments and an eminent scientist. Very early he insisted on the importance of correct heat-treatment of instruments, his trade card of 1800 stating: "Fine Razors, Varieties of correct Knives, Scissors, &c., Tempered by the Thermometer" (Chapter III, *Dramatis Personæ*, p. 38); on a later card, about 1820, we find: "J. Stodart, at 401, Strand, London, Surgeon's Instruments, Razors and other cutlery made from wootz, a steel from India, preferred by Mr. S. to the best steel in Europe after years of comparative trial" (*ibid.*, p. 39). Stodart could easily have impressed on his younger colleague his ideas on the high qualities of wootz; on the other hand, Faraday refused to be bound by the comparatively narrow field of the relation of carbon and iron in wootz, "The object of the following experiments being to ascertain whether any other substances were present in the wootz than iron and carbon, no attention was given to the relative proportion of these two bodies" (*An Analysis of Wootz*, *ibid.*, Chapter V, p. 81). If, on the one hand, we may regret that we are thus deprived of an analysis of wootz by Faraday, on the other, we owe to this decision what Sir Robert Hadfield calls the "birth of alloy steels" (Chapter VI, pp. 90-136).

The author had a unique opportunity for examining the actual alloys prepared by Faraday and mentioned in his diary and in his two papers with Stodart, the first to the Royal Institution ("Experiments on the Alloys of Steel made with a view to its Improvements," *Quarterly Journal of Science*, 1820, 9, 310-330) and the second, "On the Alloys of Steel," to the Royal Society (*Phil. Trans. Roy. Soc.*, 1822, 21-3, p. 252). An account of the author's extensive research was presented by him to the Royal Society this year, and appeared in the *Phil. Trans. Roy. Soc.*, 1931, [A], 230, 221-292. In Chapter VII, pp. 137-242, of the present treatise, these researches are amplified and supplemented by much additional material; they refer, in the first instance, to the seventy-nine specimens of alloy steels (Plate XXIX and Tables II, III, and V), containing chromium, nickel, copper, gold, silver, platinum, and rhodium put aside, apparently by Faraday himself in a wooden deal box and preserved at the Royal Institution; the percentage of the alloying element in this group, according to the author's analysis, is not high, not exceeding, 2.5-3.0 per cent. The next ten specimens belong to those lent to the Science Museum by Mr. A. E. Barnard, nephew of Miss Jane Barnard, Faraday's adopted daughter; these latter (pp. 213-216, Table XVIII) are of particular interest, as some of them contain up to 48 per cent. of rhodium and 22.7 per cent. of palladium, and obviously are the high-grade alloys prepared by Faraday's own hands in 1824 and mentioned in his diary.

All these alloys were analyzed and investigated by the author with the outmost care, so as to cause the least possible damage to the specimens and to use up as small a quantity of material as possible, taking into consideration the large number of chemical determinations (434) made; moreover, to illustrate the high qualities of the alloys and Faraday's interest in the cutting properties, a miniature knife with a blade of one-hundredth of an ounce (284 mg.) was prepared, "its construction and method of manufacture being in every way similar to those used for a Sheffield pocket knife" (p. 212 and Plate XLVIII). The Brinell hardness of one of the finished blades showed a figure of 600 at the edge, and this must be considered a splendid achievement and a great credit both to the producer of the alloy (Faraday) and to the present day Sheffield manufacturer.

The author's (Sir Robert Hadfield's) considered judgment, after a careful examination of all the data thus obtained, is that not only were Faraday's results remarkable, as judged by the standards of his day (p. 247), but "as judged by the standards of to-day they represent the true beginning of research on special alloy steels." In his opinion the Faraday 50 : 50 alloy with rhodium is in certain respects superior even to modern corrosion-resisting steels as regards, for instance, resistance to mineral acids. The work of Stodart and Faraday had a very wide repercussion in many countries (p. 250) and gave rise to the whole range of experiments by General Anosoff at Zlatoust in the Urals. Readers of Sir Robert Hadfield's volume will appreciate the importance and wide range of Faraday's metallurgical achievements.

—N. T. BELAIEV.

Spanlose Formung der Metalle. von G. Sachs unter Mitwirkung von W. Eisbein, W. Kuntze, und W. Linicus. 4to. Pp. 127, with 235 illustrations. 1931. Berlin : Julius Springer. (geb M. 28.)

In this volume are gathered together three kindred researches from the Kaiser-Wilhelm-Institut für Metallforschung, on (1) heavy drawing, (2) properties of drawn wires and the power consumption in drawing, (3) power consumption and flow phenomena in extrusion. A fourth research is from the Staatlichen Materialprüfungsamt zu Berlin-Dahlem on the processes involving impression. Thus all the principal technological processes with the exception of rolling are treated. It was sought to evolve the fundamental principles of these processes. Not only the effect on the material but also that on the tool has been studied. In each instance practical and theoretical considerations have been borne in mind. In the first research the more important factors in deep-drawing blanks of 0.5 and 1.5 mm. thickness are studied. Theoretical and mathematical considerations are included. The relationships between the ease of drawing and the strength of the blanks and the nature of the die and tool are reviewed. The second investigation is concerned with the power consumed and the general conditions which arise in the operation of wire-drawing. The principal factors dealt with, beyond the above, are the effect of the angle of the die, the nature of the flow of the material, and the effect of friction. Various theories as to the real conception of the drawing process are expounded. In the discussions on pressing a large number of sections are shown on which the distortions due to the passage through the die are depicted on squares inscribed on the section before the start of the operation. Cold-pressing of lead and tin, and hot-pressing of brass and copper were the principal features examined. The last section is concerned with the impression formed principally in hardness testing according to various methods. The impressions caused by the imprint of tools having different shaped heads mainly cylindrical, spherical, and conical are compared.

—W. A. C. NEWMAN.

Coloration des Métaux. Bronzage—Patinage—Oxydation—Marbrage—Irisation—Nielle. Par Jacques Michel. Troisième édition, entièrement remaniée et considérablement augmentée. (Nouvelle Collection des Recueils de Recettes Rationnelles.) Cr. 8vo. Pp. 270, illustrated. 1931. Paris : Desforges, Girardot et Cie, 29 rue des Augustins. (France and Colonies 26.50 francs ; foreign 28.50 francs, post free.)

This is a useful little book containing a variety of information on the artificial colouring of metals and alloys. The data have been culled from a great many sources and are mostly contained in so-called recipes. In the majority of instances the directions are based on empirical results. Nevertheless, it is possible that to anyone interested in this particular subject some at least of the treatments will be valuable, if only in indicating a means of attacking certain problems. The effects producible on most of the common metals and alloys, such as iron, bronze, copper, zinc, silver, gold, nickel, are discussed. In addition, there are sections on the preparation of metal surfaces previous to the application of the reagents, and also on inlaid enamel work.—W. A. C. NEWMAN.

Métallisation. Décapage et Dérochage—Cuivrage—Bronzage—Laitonage et Galvanoplastie—Étamage et Zincage—Plombage—Aluminiage—Nickelage et Chromage—Argenture et Dorure—Polissage et Brunissage. Par Jacques Michel. (Nouvelle Collection des Recueils de Recettes Rationnelles.) Cr. 8vo. Pp. 200, illustrated. 1931. Paris : Desforges, Girardot et Cie, 29 rue des Augustins. (France and Colonies, 19.25 francs ; foreign 21 francs.)

In the ten chapters into which this small book is divided the usual methods by which protective metallic coatings are applied are described. Those which involve chemical, electrolytic, physical, thermal, and mechanical manipulation are included. Separate sections are devoted to the preparation and to the finishing of the articles undergoing treatment.

There is no continuous discussion throughout the book. The various methods described are each given a small paragraph, and in many instances extracts from journals, new and old, are quoted complete. The discussions are of the simplest, the author contenting himself in the majority of cases with little more than a recital of various media which have been used. There is no mention of modern large-scale operation and of the many difficulties which the practitioner will encounter. For the new-comer to the art there should, however, be much of interest to be culled from this work. For more complete information he will, perforce, have to consult larger treatises.—W. A. C. NEWMAN.

Gmelin's Handbuch der anorganischen Chemie. System-Nummer 58: **Kobalt.** Teil A: Lieferung I. Pp. v + 220, with 19 illustrations. Teil B: **Die Ammine des Kobalts.** Pp. xxv + 376. Herausgegeben von der Deutschen Chemischen Gesellschaft. Bearbeitet von R. J. Meyer. Achte völlig neubearbeitete Auflage. Sup. Roy. 8vo. 1931. Berlin: Verlag Chemie G.m.b.H. (Teil A, Lief. I, R.M. 34; subscription price, R.M. 30; Teil B, R.M. 58; subscription price, R.M. 45.)

The first portion of section A of system number 58 of Gmelin's handbook deals entirely with the metal cobalt. The history of the metal is considered first, and this is followed by accounts of the occurrence and topographical distribution of the element. The minerals and their properties are next described in very great detail, and the section ends with tables of the statistics of the production and prices of cobalt. The production of cobalt compounds from ores and intermediate products is described in the next 20 pages. The remainder of the volume, some 160 pages, is devoted to the treatment of the element. The methods of preparation and purification are very fully described, as also are the methods of cobalt plating. The properties are then described, the physical properties of the atom being considered first, then follow, in order, the crystallographic, mechanical, thermal, optical, magnetic, and electrical properties. In connection with the optical properties, the regularities of the spectrum lines and the relationship of these with the structure of the atom are discussed at length. The description of the properties is very full and contains a wealth of valuable detail. The chemical behaviour of the metal towards a large number of substances is detailed. The succeeding section deals with the detection and estimation of cobalt, and in this connection a number of reactions with special organic reagents are given, together with the sensitiveness of the reagents. The book deals at great length in its closing section with the intermetallic compounds and the alloys of cobalt. Here are described the cobalt alloys with antimony, bismuth, beryllium, magnesium, calcium, zinc, cadmium, mercury, aluminium, thallium, tin, titanium, chromium, molybdenum, tungsten, manganese, and nickel. The high-speed cobalt alloys are described. The section closes with a table which gives the composition, name, uses, and discoverer of some 60 alloys of cobalt.

The volume is an exceedingly useful one; it has been carefully and accurately compiled, and will be indispensable not only to chemists, but also to engineers.

Section B of system number 58 deals exclusively with the complex derivatives of cobalt. These derivatives are treated with great thoroughness, commencing with an introductory section on the history of the discovery, the development of the structural formulation, and the isomerism of the compounds. The material is considered in two main groups: (i) compounds containing divalent cobalt, (ii) compounds containing tervalent cobalt. The latter group is subdivided into: (a) compounds containing a single cobalt atom, (b) compounds containing more than one cobalt atom, (c) compounds of undetermined constitution. The simple cobaltous compounds (inorganic and organic) are considered in order with the various basic substances that form complexes with them, some 36 pages being devoted to them. The remainder of the monograph, some 320 pages, is given up to the description of the cobaltic derivatives. The treatment is systematic, clear, and very complete, several thousand compounds being described. The collection of such a large number of complex derivatives will be of the greatest service to those wishing to study this type of compound, and the present collection is undoubtedly the best and most complete yet produced. This volume, dealing as it does with both inorganic and organic derivatives, has a value which cannot be over-estimated. The worth of the volumes which have preceded it has never been in doubt, but great as is their value, that of this volume is greater. It has a unique value in the manner in which it presents its material. It is a volume to which sufficient praise cannot be accorded, and it must of necessity find a place in the library of serious students of all branches of chemistry.—JAMES F. SPENCER.

Festschrift zum fünfzigjährigen Bestehen der Platinschmelze G. Siebert G.m.b.H., Hanau. Herausgegeben von H. Houben. Med. 8vo. Pp. xxiv + 338, with numerous illustrations. 1931. Hanau: G. M. Albert's Hofbuchhandlung.

This valuable little book has been published by the well-known German firm of platinum refiners, G. Siebert, G.m.b.H., to celebrate the fiftieth anniversary of its foundation. It con-

tains a brief history of the firm, which since 1930 has been a subsidiary of the Deutsche Gold- und Silber Scheideanstalt, a short summary of its activities, and twenty papers dealing with original work on the precious metals, twelve of which are almost entirely of metallurgical interest. Abstracts of these twelve have already appeared in this *Journal*. The attention of members of this Institute is particularly directed to the papers on age-hardening of gold-platinum alloys by addition of small quantities of iron, on the stability of precious and base-metal thermocouples (in which several new types of couple have been studied), on the relation between the rolling texture and deep-drawing properties of silver, copper, and aluminium, and on the equilibria in the systems silver-palladium, gold-palladium, gold-platinum, platinum-palladium, and rhodium-palladium. From the information given in the first-named paper it would appear that further examination of the iron-platinum-gold system will produce facts of considerable importance in the interpretation of age-hardening phenomena. The author of this paper has been unable to obtain a satisfactory explanation of the hardening observed on the basis of any of the existing theories; the subject therefore should repay the attention of research workers in this field.

All the papers in the book are of a high order of scientific merit, and the book itself is a valuable addition to the literature of the platinum group of metals; it is well printed on good paper and contains numerous graphs, illustrations, and diagrams, including some excellent photomicrographs of the structure of various precious metal alloys.—A. R. POWELL.

Das Rhenium. Von W. Schröter. Mit einer Einleitung von W. Noddack. (Sammlung chemischer und chemisch-technischer Vorträge. Begründet von F. B. Ahrens. Herausgegeben von H. Grossmann. Neue Folge 11.) Med. 8vo. Pp. 59. 1932. Stuttgart: Ferdinand Enke. (R.M. 5.50.)

In this small monograph the author has gathered together the existing information on the element rhenium. The work opens with an historical account of the discovery of the element, which is followed by a theoretical discussion of the probable properties of the element and its compounds and a comparison of these with the properties actually found. The next section deals with the concentration of rhenium in products obtained from the minerals containing rhenium and the production of pure metallic rhenium. The technical production of rhenium compounds follows in the next section. The preparation of rhenium and the consideration of the properties of the metal occupy the next 7 pages, and include an account of rhenium-tungsten alloys. The following 10 pages are devoted to the preparation and properties of rhenium compounds, whilst the analytical behaviour of rhenium occupies a further 4 pages. The occurrence of rhenium in minerals is dealt with at considerable length. A complete bibliography containing 63 references completes the volumes.

This is a very useful authoritative and capably written monograph which may be confidently recommended.—JAMES F. SPENCER.

Gmelin's Handbuch der anorganischen Chemie. System-Nummer 29: Strontium. Herausgegeben von der Deutschen Chemischen Gesellschaft. Bearbeitet von R. J. Meyer. Achte völlig neubearbeitete Auflage. Sup. Roy. 8vo. Pp. xviii + xii + 239, with 24 illustrations. 1931. Berlin: Verlag Chemie G.m.b.H. (R.M. 41; subscription price R.M. 36.)

The present section of Gmelin's handbook deals with the element strontium and its derivatives. Following the plan adopted in the earlier sections, the work opens with an historical account of the discovery of strontium and the history of the preparation of the metal and its pure compounds. This is followed by a fairly exhaustive survey of the occurrence of strontium minerals and their topographical distribution. A description of the minerals is next given, and this includes details of the composition, places of origin, crystallographic data, and the physical properties. The following section deals with the preparation of strontium compounds from the naturally occurring sources and their purification. The various methods of preparation of the element are next described, and this is followed by a very complete account of its physical properties, which includes the properties of the atom and those of the molecule, the latter properties are treated under five headings: (i) mechanical, (ii) thermal, (iii) optical, (iv) magnetic, and (v) electrical properties. The electrochemical behaviour of strontium is treated in the next section, and here details of a number of electrolytic cells in which strontium amalgam acts as one electrode are given. The chemical behaviour of metallic strontium towards water, non-metals, non-metallic compounds, acids, metals, metallic compounds, and organic substances is dealt with in considerable detail, and this is followed by an account of the behaviour of the strontium ion towards alkali hydroxides, various acids and their salts, and organic substances. The treatment of the strontium compounds follows in the order hydride, oxide, hydroxide, chloride, azide, amide, imide, hyponitrite, nitrite, nitrate, the fluorides, chlorides, hypochlorite, nitrate, chlorate, perchlorate, the bromides, brom-amine, mixed halides, iodides, iodate, periodate, sulphide, hyposulphite, sulphite, sulphate, pyrosulphate, persulphate, thiosulphate,

telluride, tellurite, tellurate, selenide, selenite, boride, borates, borofluorides, carbonate, carbide, thiocarbonate, perthiocarbonate, cyanide, cyanamide, salts of a number of organic acids, silicides, silicates, phosphide, phosphite, phosphates, arsenide, arsenite, arsenate, compounds with antimony, and double compounds with salts of other metals. The description of the compounds is very full, a wealth of physical and chemical data is included, and in many cases equilibrium diagrams are given of the systems which contain a strontium compound. The work of compilation of this volume has been carried out with care and discretion, and a book of the greatest value has been produced. The book merits the warmest commendation, and it may be recommended as a thoroughly useful and accurate account of the chemistry of strontium.—JAMES F. SPENCER.

Practical Microscopy. By L. C. Martin and B. K. Johnson. (Blackie's "Technique" Series.) Cr. 8vo. Pp. vii + 116, with 10 plates. 1931. London, Glasgow, and Bombay: Blackie and Son, Ltd. (3s. 6d. net.)

As the authors state in the preface, the book is intended "to bring together the information necessary to apply in practice the technique of modern microscopy. For the proper understanding of the use of the microscope, a knowledge of the optical principles and physical limitations involved is essential; and it has been felt that if these were put down in a simple and concise form, it would help the microscopist to use his instrument to better effect. The book is intended to be of a practical nature." The object of the book has certainly been attained. There has long been a need for a simple, practical explanation of the principles of microscopy in the metallurgical field, and this book should be available in every institution where metallographic work is carried out.

The first chapter deals with magnification, and explains how this value is arrived at. Successive chapters describe the principal parts of the microscope, objectives, eye-pieces, and the various methods of illumination, &c. A chapter is devoted to the metallurgical microscope and another to photomicrography. The inclusion of a description of ultra-violet microscopy is opportune, in that this method of illumination is again receiving attention and proving extremely useful.—ROOSEVELT GRIFFITHS.

Röntgenforschung in der Metallkunde. Von Ulrich Dehlinger. (Ergebnisse der Exakten Naturwissenschaften. Herausgegeben von der Schriftleitung der *Naturwissenschaften*. Sonderabdruck aus Band X.) Med. 8vo. Pp. 325-386, with 23 illustrations in the text. 1931. Berlin: Julius Springer.

The development of the methods of X-ray crystal analysis, and their application to the study of metallic structures has led to investigations in so many directions that it has become increasingly difficult for any one person to keep in touch with the subject as a whole. We must therefore acknowledge our gratitude to Herr Dehlinger for his book, in which an attempt is made to review the data, and to point out some of the general principles which are now becoming apparent. The review is to some extent incomplete, since the author concentrates chiefly on work which has appeared in German periodicals. Thus, out of 143 references, no less than 115 refer to work published in the German literature, and this restriction has in some cases rather curious results. The deformation of single crystals, for example, is described without any reference to the work of Taylor, Elam, or Gough, and in other sections readers in touch with the subjects will be conscious of further omissions. But even with these restrictions, Herr Dehlinger's book is greatly to be welcomed, and readers will find much of interest in this review of X-ray work.

The book begins with a description of the crystal structures of the elements, and an interesting account of the attempts made to apply the principles of thermodynamics to polymorphic transformations. Successive sections deal with solid solutions and intermetallic compounds, the gold-copper alloys receiving much attention. The structure of phases not in thermodynamic equilibrium (e.g. martensite), are then described, and are of particular interest. The concluding sections deal very briefly with deformation of crystals and orientation effects such as the structures of drawn wires, and with etching structures.

Taken as a whole, the book is rather uncritical, and there is perhaps a tendency, noticeable in other quarters, to accept the results of X-ray investigations a little too readily, and without a consideration of the other factors involved. X-ray crystal analysis is a powerful instrument in metallurgical research, but its very sensitivity makes its application dangerous unless full precautions are taken in connection with factors such as annealing. From a personal study of this kind of work, the reviewer is aware that in some cases the X-ray evidence is slender, or the heat-treatment unsatisfactory, and in such cases the present conclusions may require considerable modification. But in the meantime an attempt must be made to master the results as a whole, and for this purpose Herr Dehlinger's book is an admirable survey of what has appeared in the German literature, and of some of the results published elsewhere.

—W. HUME-ROTHERY.

Cold Metal Working; an Introductory Course to the Metal Trades. By E. Perry van Leuven. Med. 8vo. Pp. x + 275, with 159 illustrations. 1931. New York: McGraw-Hill Book Co. Inc. (\$2.25); London: McGraw-Hill Publishing Co., Ltd. (13s. 6d. net).

A field which is neither machine-shop work nor forging, and which requires a craftsman's skill with tools, is one which few books describe. The author gives working sketches and detailed directions for making a large number of useful and ornamental articles using light gauge material and hand tools. The application of each tool is explained and the correct method of using it described. The book is a fund of information of use to every engineering apprentice; the illustrations are perfectly clear, and even the tabulated instructions fail to make the book uninteresting. The standards and specifications refer, however, to American practice, and, to most apprentices, the price will seem high, although the value is certainly good.

—H. W. G. HIGNETT.

Notions pratiques de soudure autogène oxy-acétylénique et d'oxy-coupage. Suivies de 150 questions et problèmes de la pratique. Demy 8vo. Pp. 112, with 100 illustrations in the text. [1932.] Paris: Office Central de la Soudure Autogène, 32 Boulevard de la Chapelle. (6 francs.)

This booklet is intended for the operator or apprentice, and confines itself to practical considerations. The appliances used for oxy-acetylene welding and the means of supply and control of the gases are described in detail. Common faults, their detection, causes, and prevention, are carefully explained. Brief notes are given on the special technique required for welding cast-iron, aluminium, copper, brass, bronze, nickel, &c. There is a short chapter on brazing, another on electric welding by arc and resistance, and two on oxygen cutting. There are then 30 pages of questions, to 50 of which detailed answers are given. The illustrations are admirably simple and clear.—H. W. G. HIGNETT.

Les Organismes de l'Acétylène et de la Soudure autogène. Med. 8vo. Pp. 48, illustrated. [1932.] Paris: Office Central et Institut d'Acétylène et de Soudure Autogène, 32 Boulevard de la Chapelle.

The new building is described, in which the following bodies have their headquarters under one roof: Office Centrale de l'Acétylène et de la Soudure Autogène, Institut de Soudure Autogène; École Supérieure de Soudure Autogène; Chambre Syndicale de l'Acétylène et de la Soudure Autogène, Société des Ingénieurs Soudeurs, and Commission Permanente Internationale de l'Acétylène et de la Soudure Autogène.

Brief particulars of these associations are given and their objects are explained.

—H. W. G. HIGNETT.

Science in Action. A Sketch of the Value of Scientific Research in American Industries. By Edward R. Weidlein and William A. Hamor. Med. 8vo. Pp. xlii + 310, with 32 illustrations. 1931. New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd. (18s. net.)

The U.S.A. has undoubtedly preceded Europe in the widespread adoption of industrial research, so that a popular account of its organization and of some of its successes in that country should be welcomed by the non-technical business man. The brief descriptions of a large number of new industries and products which have resulted from definitely planned research, since this is doubtless scarcely recognized by the uninitiated, make this book almost "a thriller."

The Research Association activities in the U.S.A. are well covered, as might have been expected from the authors' connection with the well-known Mellon Institute, but their account includes also the wider field of the research departments of individual American companies.

It is noteworthy that the authors devote considerable space to an account of the progress of scientific management and planning, and the following quotation indicates how clearly they appreciate that technological progress through research cannot attain its full effect without the adoption of scientific methods throughout the whole business.

"We do not regard scientific management merely as the sentinel of technology: we look upon such management as the field-marshal of the industries and upon industrial research as the intelligence department of this industrial leader."

The Quest for Power from Prehistoric Times to the Present Day. By Hugh P. Vowles and Margaret W. Vowles. Roy. 8vo. Pp. xv + 354, with numerous plates and illustrations in the text. 1931. London: Chapman and Hall. (15s. net.)

The authors, in their own words (p. 340), are examining "the possibilities of extending man's dominion over the forces of Nature . . ." and state that "whether this extension will prove to

be a blessing or a curse depends very largely upon the extent to which the dark and disturbing forces of human nature are also brought under control. . . . and that, after all, "the abiding problems of life are not technical, but moral." Finding solace in Francis Bacon's words on the subject, with the motto "The best is yet to be," they begin to unfold before the reader the long list of man's engineering achievements (Book I, "Apprenticeship of Toil"). Chapter II describes irrigation works in Egypt and Mesopotamia, and Chapter IV, on "Early Structural Achievements," the Pyramids and the erection of obelisks. In the chapter on "Engineering in Antiquity" interesting mention is made of a strikingly modern taxi-meter by Heron of Alexandria, after Vitruvius (p. 108), and in a further section, on the coming of the steam age, the authors cite Seneca, on the appliances for heating baths, when he says that "thin copper pipes (are) laid in descending spiral coils . . . to make the water meet the same fire over and over again and flow through a space sufficient for heating it up" (p. 147). From such beginnings, not inconsiderable in themselves, the authors lead us step by step to the modern steam or electric plant, with their limitless possibilities of improvement and expansion.

Part 2 deals with "The Age of Power," Chapter II being devoted to "The Triumph of the Steam Engine," Chapter III to the "Internal Combustion Engine," Chapter IV to "Water Power Plant" and the next two chapters to "Mechanical Transmission of Power" and to "Electrical Generation and Transmission of Power." All these chapters are written in a very clear and concise manner, and make very good reading. Sketches and illustrations are well chosen, and add much to the enjoyment of the book. The next section (Part 3) deals with "The Materials of Power," coal, oil, and metals, ferrous and non-ferrous; a brief summary on metal manufacture, which is well illustrated, is added, and even an introduction to the micro-structure and heat-treatment of steel. The book undoubtedly fills a gap in the existing textbooks. However, should a new edition become necessary, some suggestions might be made relating to the chapters on metallurgy.

Thus, with reference to the definition of steel (p. 278), we think that the old definition of Tschernoff, "the father of the Metallography of Iron," that steel is such an iron-carbon alloy as can both be hardened and forged, still holds good for carbon steels, and is especially useful in treatises of a general character. On the same page the authors mention wootz (Damascene steel), but deal with it rather summarily and dismiss it in a few sentences, saying that "the composition of the metal made in this way varies considerably" (p. 279). Analyses of Damascene blades prove just the contrary; the product was very uniform in chemical composition, of excellent quality, and, moreover, its watering led to the first "macroscopic" examinations and tests, which are mentioned in a thirteenth-century treatise by a famous Arab writer, Emin-ed-din. In a treatise devoted to man's strife for "power," Damascene steel ought to have its place. Wootz, or, as it was then often called, Indian steel, played a part in Faraday's research, thus linking up man's early endeavours with those of the creator of a new era in engineering. On the other hand, the existence of two varieties of carbon in steel was established by Guyton de Morveau three decades before Faraday's time, and the first quantitative analysis of cementite (from Birmingham nails) was made by Priestley, on Guyton de Morveau's advice, in the last years of the eighteenth century (*J. Iron Steel Inst.*, 1918, 98, 194 and *Rev. Mét.*, 1914).

Whilst aviation engines and aviation materials are mentioned, one would like more space to be devoted to that particular chapter of modern engineering.

Minor details, such, for instance, as the absence of the names of Tschernoff and Osmond on p. 301, when their critical points are discussed at some length; and the fact that on p. 299 Professor Le Chatelier's name is given in the rather unfamiliar form of le Chatelier, might be mentioned; but these minor points in no way detract from one's enjoyment of a very useful and pleasant book.—N. T. BELAIEV.

Repertorium Technicum. An International bi-monthly bibliography of books and of articles appearing in periodicals on technical and allied subjects. Vol. I. Fasc. 1-8. Pp. 1-63, 64-109, 110-205, 206-291, 292-399, 400-507, 508-602, 603-690. [1931-1932.] Den Haag: Nederlandsch Instituut voor Documentatie en Registratuur, Carel van Bylandtlaan 30. (£3 per annum.)

This bibliography succeeds the "Bibliographie technique" and each bi-monthly issue appears in two numbers, the second of which contains a short alphabetical subject index and at the end of the year it is proposed to issue an author index and a list of abbreviations of names of periodicals. Each entry is prefixed with the classification number adopted from the universal decimal classification and includes the name of the author, the title of the article or book, its source of publication and a reference to some journal in which an abstract of the paper may be found.

The books are mimeographed on one side of the paper only and the entries are made under broad subject group headings, generally, but not always, with the title in the language in which the article is written; when translation of the title has been made it usually appears

in French. Surely it would be better to adopt a standard procedure, all titles in French or all titles in their original language; there seems to be no point in putting English titles in some cases and translating them into French in others. Again, it is a pity that the abbreviations adopted for journal names are not included in the first issues as some English readers, at any rate, will find difficulty in interpreting a number of the abbreviations. Nevertheless the books should prove useful for reference even if it requires some little practice to appreciate the value of the method adopted in the arrangement of the entries which is not alphabetical either by names or subjects.—A. R. POWELL.

Chemisches Fachwörterbuch. Deutsch-Englisch-Französisch, für Wissenschaft, Technik, Industrie, und Handel. Zweiter Band: Englisch-Deutsch Französisch. Herausgegeben von A. W. Mayer. Sup. Roy. 8vo. Pp. xiii + 943. 1931. Leipzig: Otto Spamer (Geh., R.M.70; geb, R.M. 75.)

This is the second volume of this trilingual technical dictionary, and contains the German and French equivalents of English technical words; thus it is of less importance to English readers than the first volume, which was reviewed in this *Journal*, 1929, 41, 734, as only rarely is it necessary for an Englishman to translate a technical article into German. What was said in the review of volume I applies equally well to this volume. Although no doubt the book will be very useful to a foreigner, there are many English words and phrases which he will never meet in English technical journals, and these could therefore have very well been omitted, thereby reducing the enormous bulk of the book. Again, many technical English words listed are not really "King's English" in spite of the author's statement in the preface, thus, for example, thiocyanates and their derivatives are never called "rhodanates," nor is nitrous acid referred to as "saltpetrous acid." Some of the explanatory notes appended to English technical terms are quite misleading, thus tantalic acid is stated to be a "mixture of an acid with the salt of any one of the tantalum oxides" and rhabdite is described as "a nickeliferous iron phosphate . . . sometimes answering to the formula Fe_2NiP_4 ."

There is little doubt, however, that taken as a whole the German or French chemist will find the book very useful in reading English chemical literature, but a second dictionary will be required for most non-technical words.—A. R. POWELL.

Laboratories, their Planning and Fittings. By Alan E. Munby. With an Historical Introduction by the late Sir Arthur E. Shipley. Second Edition. Cr. 4to. Pp. xix + 224, with 134 illustrations. 1931. London: G. Bell & Sons, Ltd. (30s. net.)

The author, who is well known as the architect of many of the modern school and college laboratories in the United Kingdom, has the advantage of having himself been a science teacher before entering the profession of architecture; he has moreover kept in close touch with research in several branches of science.

His book is one which all who are concerned with the building and equipment of educational or research laboratories will find indispensable, for in planning an up-to-date specialist building of such a nature the experience and the faults of those who have tackled similar problems should be of the greatest assistance. The chapter on the scope and inception of a building scheme emphasizes how essential is the co-operation with the architect of the teachers and investigators who have to use the laboratory and who alone can prescribe their requirements.

The author's ripe experience on the general needs of space equipment and fittings for chemistry, physics, biology, &c., are set out fully in following chapters. A large number of plans which are given of typical school and college laboratories in this country, in Germany, and in America, will also be appreciated. Metallurgy receives rather scanty attention, although the up-to-date character of the book is shown by the inclusion of an illustration of some furnace equipment at the new British Non-Ferrous Metals Research Association laboratory.

The author is evidently anxious to secure a clearer expression of the views of experienced teachers and scientists of their requirements in equipment and services. Almost every new University or Research Laboratory is described in some publication or other, and in most cases these laboratories comprise at least some novel items of equipment, which have been planned by those with just the sort of experience of which the author is seeking an expression. It seems possible that both the author and his readers would have benefited by the inclusion in this book of a classified bibliography of such publications, going back to the beginning of the century; such references as are given are unduly limited.

Jahrbuch des Forschungs-Instituts der Allgemeinen Elektrizitäts-Gesellschaft. Zweite Band: 1930. Demy 4to. Pp. 332, with numerous illustrations. 1931. Berlin: Julius Springer.

This volume contains a selection from the papers which have appeared in the scientific and technical press between December 1929 and January 1931, by members of the staff of the

Research Laboratories of the A.E.G. The first volume, covering the period 1928-9, appeared in 1930, and this volume is arranged in the same way. The papers are grouped together according to subject, each group being preceded by a short introduction. The wide range of research covered by these laboratories is shown by the variety of subjects dealt with, which include acoustics, talking films, electric cooking, mercury vapour rectifiers, atomic and electronic physics, photoelectric cells, and two papers on corrosion of metals. A supplementary index gives reference to the publication in which each article first appeared, together with a complete list of all the papers published by the laboratory during the period under review. The volume is beautifully produced and profusely illustrated.—C. J. SMITHELLS.

Beiträge zur Geschichte der Technik und Industrie. Im Auftrage des Vereines deutscher Ingenieure. Herausgegeben von Conrad Matschoss. 1931-1932. 21 Band. 4to. Pp. iv + 188, with 185 illustrations in the text. 1932. Berlin: V.D.I.-Verlag G.m.b.H. (Lw. R.M. 10.80; f. V.D.I.-Mitgl., R.M. 9.70.)

The appearance of another volume in this series of historical works is welcome. The placing on record of the progressive evolution of the arts and sciences is both interesting and desirable. In these volumes the stories are not all of the greatest and most obvious subjects, but include some on lesser known avenues of scientific and technical development. The present collection contains historical discussions on the following, among others—magnetic induction, electrical heating, reinforced concrete, precious stones, paper making, papier maché, science in ancient Egypt, &c. The various articles are well illustrated and, if only for their general interest, are well worthy of perusal.—W. A. C. NEWMAN.

Annual Reports of the Society of Chemical Industry on the Progress of Applied Chemistry. Volume XVI, 1931. Demy 8vo. Pp. 742. 1932. London: Society of Chemical Industry. (Members 7s. 6d., post free; non-members, 12s. 6d., post free.)

This annual publication of the Society of Chemical Industry, as in previous years, is divided into twenty-four sections, each of which deals with the advances made during 1931 in a number of special branches of applied chemistry. Each section has been prepared by a specialist on the subject dealt with in the section. The sections of applied chemistry which are of interest to members of the Institute of Metals are: (i) General, Plant and Machinery (pp. 5-24), by R. E. V. Hampson and J. N. Vowler; (ii) Fuel (pp. 25-54), by J. G. King; (x) Refractories, Ceramics, and Cements (pp. 267-279), by J. H. Chesters and W. J. Rees; this section contains accounts of the advances in connection with fireclay, refractory materials for glass making, silica, magnesite and magnesia refractories, the testing of refractory materials, porcelain and whiteware, cement, the setting of cement, oxychloride cements and building bricks; (xi) Iron and Steel (pp. 280-299), by A. L. Norbury and F. K. Neath; (xii) Non-Ferrous Metals (pp. 300-330), by A. R. Powell; this section contains articles on ore dressing, the extraction of metals from ores, preparation and refining of metals and alloys, properties of metals and alloys, constitution of alloys, corrosion and protection of metals and alloys; (xiii) Electrochemical and Electrometallurgical industries (pp. 331-357), by H. T. S. Britton and R. A. Robinson; this section contains articles on molten electrolyses (aluminium, thorium, tantalum, tungsten), electrodeposition from aqueous solutions (copper, silver, gold, cadmium, tin, antimony, columbium, tantalum, chromium, nickel, tungsten, the platinum metals), general electrolytic processes, primary cells, storage cells, rectifiers, induction furnaces, electric furnace refractories, arc furnaces, resistor furnaces, and electrostatic precipitation; (xv) Paints, Pigments, Varnishes, and Resins (pp. 386-424), by Members of the Oil and Colour Chemists Association.

The volume is completed by a subject and an author index, both of which are very complete. It is noticed with regret that this year there is no section on the advances in connection with explosives.

The accounts of the progress in the fields enumerated are carefully and accurately compiled and furnish an exceedingly good and useful résumé of the advances made in the year 1931. This volume, as were its predecessors, is one which is essential to all workers in the vast domain of applied chemistry; it can be most warmly recommended.—JAMES F. SPENCER.