

XIV.—FOUNDRY PRACTICE AND APPLIANCES.

For keys to abbreviations used, see pp. 356 and 370.

America's Foundry Conditions. U. Lohse (*Z. V. d. I.*, 1926, **70**, 357-360).—A number of observations of foundry arrangements in America, made during a tour of instruction, are communicated.—G. S.

Some Notes on Current American Foundry Practice. J. E. Fletcher (*Found. Trade J.*, 1926, **34**, 363-366).—An address to the Birmingham Branch of the Institute of British Foundrymen.—W. H. D.

Impressions of American Foundries. S. H. Russell (*Found. Trade J.*, 1927, **35**, 3-6).—Read before the East Midlands Branch of the Institute of British Foundrymen.—W. H. D.

The Fourth Foundry Exhibition in Düsseldorf. C. Irresberger (*Stahl u. Eisen*, 1925, **45**, 1666-1670, 1809-1815, 2009-2013; 1926, **46**, 105-110).—A very complete report on the individual sections of the Exhibition.—G. S.

A Modern Metallurgical Plant. Anon. (*Brass World*, 1926, **22**, 87).—Gives illustrations and a brief description of the new plant of the Niagara Falls Smelting and Refining Corporation, Buffalo, N.Y.—W. H.-R.

The Present State of Our [Foundry] Industry. R. J. Shaw (*Found. Trade J.*, 1926, **34**, 307-312).—Presidential Address to the London Branch of the Institute of British Foundrymen, and the discussion upon it.—W. H. D.

Notes on Foundry Progress. S. G. Smith (*Found. Trade J.*, 1926, **34**, 349-352, 375-376).—Presidential Address to the Lancashire Branch of the Institute of British Foundrymen.—W. H. D.

Non-Ferrous Foundry Practice. Arthur Logan (*Found. Trade J.*, 1926, **34**, 505-507, 526-528).—An extract from a paper read before the Middlesbrough Branch of the Institute of British Foundrymen. L. considers bronzes at some length, and also brasses, manganese-brass, and "aluminium-bronze."—W. H. D.

Cutting Costs in Non-Ferrous Plant. B. Finney (*Iron Age*, 1926, **118**, 1471-1476).—A detailed description of a new American plant.—W. A. C. N.

The Commercial Aspect of Foundry Work. J. Wolstenholme (*Mech. World*, 1926, **79**, 249-250, 269-271).—Read before the Junior Institution of Engineers. The economics of the foundry are discussed, specific reference to cast iron only being made.—F. J.

Controlling Quality in a Brass Foundry. Reg. Micks (*Canad. Found.*, 1926, **17**, (9), 19-21).—An illustrated description of the foundry of the Sully Brass Foundry, Ltd., Toronto, which deals with copper, brass, bronze, and aluminium alloys.—W. H.-R.

Foundry Planning for Economical Production. Evan J. Ross (*Proc. Inst. Brit. Found.*, 1924-25, **18**, 624-659).—See *J.*, 1925, **34**, 612.

Applying Science in the Foundry. C. H. Ridsdale (*Found. Trade J.*, 1926, **34**, 475-476, 499-504, 519-522).—A long descriptive article showing how it is necessary to know, not only the ordinary analyses of metals, but also their structural constitution. The application of science in the foundry requires

knowledge of the fundamental physical and chemical principles, and of the results of certain procedure. The results of academic investigations can be successfully applied by men whose sense of proportion and commercial perceptions have been developed by sufficient practical experience and responsibility in works.—W. H. D.

The Examination of Metals. W. H. Poole (*Proc. Inst. Brit. Found.*, 1924-25, **18**, 529-542).—A paper which commences with observations on the occurrence of graphite in cast irons, and concludes with some remarks on heavy core oil tests.—W. H. D.

The Engineer and the Foundry. Anon. (*Engineer*, 1926, **142**, 200-201).—An address.—B. B.

Brass Foundry Uses Innovations. Anon. (*Foundry*, 1926, **54**, 288).—A number of practical features in the furnace lay-out and crucible handling are described. An iron-grating runs parallel with the row of oil-fired furnaces, and serves to minimize dangers ensuing when a crucible of molten metal breaks, also to facilitate recovery of spilled metal. The crucibles are manipulated in tongs, the handles of which are bent at right angles, facilitating transfer to any part of the foundry adjoining the melting room and obviating the inconvenience of standing over the furnace. Furnace covers are counter-weighted, and provision made for running out any metal spilled in the furnace through a hole in the back of the latter into ingot moulds.—F. J.

Making a Special Pipe Connection. J. H. List (*Found. Trade J.*, 1926, **34**, 435).—A short illustrated article which does not lend itself to abstracting.
—W. H. D.

The Production of Secondary Aluminium and Aluminium Alloys from Scrap. Robert J. Anderson (*Mining Mag.*, 1926, **35**, 142-154).—Covers the same ground as the recent series of articles by A. in *Metal Ind.* (N. Y.). (Cf. *J.*, 1925, **34**, 625; 1926, **36**, 635.)—A. R. P.

Saving in Foundry Handling with the Electric Industrial Truck. H. J. Payne (*Amer. Found. Assoc.* (Advance Copy), 1926, Sept. 1-16).—Many standard types of material-handling equipment have a legitimate field of application in the foundry. Each in its place is best. While this paper is concerned primarily with the performance and operation of the industrial electric truck, it is not maintained that this equipment is a panacea for all material-handling problems encountered in the foundry. Such a contention would discount the very real merits of the storage battery and truck tractor in this type of service. Sand, pig, scrap, cores, flasks, molten metal, semi-finished castings, annealing pots and finished castings, together with waste, can, however, be handled effectively with the industrial truck in most cases. The practice of the Erie Malleable Iron Co. is described in detail, and since this concern has made effective use of this equipment in handling all of these materials, the manner of successful application of the equipment is clearly defined. Reference is made particularly to the performance of the pot-charging truck and to the higher capacity lift truck units now coming into extensive service. The use of auxiliaries, such as special skids, scales, forks for converting standard elevating platform equipment to pot-handling trucks, is brought out. The point is made that the life of this equipment, properly maintained, runs to 12 years or more; that the total cost of operation does not exceed \$5.00 in ordinary foundry service; that the average per man increase in capacity obtained through its use runs from 5 to 15 times. A special effort has been made to suggest ways and means for improving the synchronization of the storage battery truck and tractor with other types of handling equipment of proved utility in the foundry.

The Conveyance of Material in the Foundry (with Special Reference to the Production of Light Castings). J. M. Primrose (*Proc. Inst. Brit. Found.*, 1924-25, 18, 567-570).—A short paper advocating the use of an elevated mono-rail carrying system in foundries as a manual labour-saving device.

—W. H. D.

Lifting Loads that Slow up Production. E. T. Bennington (*Canad. Found.*, 1926, 17, (7), 18, 28).—Describes the advantages of mechanical hoists and overhead carriers in the foundry.—W. H.-R.

Handling Materials in a Foundry. E. T. Bennington (*Found. Trade J.*, 1926, 34, 293-294).—Read before the American Foundrymen's Association. (See *J.*, 1926, 36, 629).—E. C.

Electric Hoists a Factor in Efficiency. John Morris Combs (*Canad. Found.*, 1926, 17, (3), 14-16).—Describes the various uses of electric hoists in the foundry and shows how economies may be effected by the use of these.

—W. H.-R.

Foundry Trestle. Anon. (*Found. Trade J.*, 1926, 34, 362).—A note describing an efficient but inexpensive trestle for supporting moulds, cores, &c.—W. H. D.

Modern Pattern Making. J. A. Stevenson (*Proc. Inst. Brit. Found.*, 1924-25, 18, 308-319).—Pattern-making practice is discussed under the following headings: plates, oil-sand cores, flanged couplings, ring-oiling pedestals, pinion-housings, pipes, grooved rope pulleys, large fly-wheels, weaving-shed pulleys, and exhaust casings.—W. H. D.

The Making of Thin Section Patterns. T. W. Markland (*Proc. Inst. Brit. Found.*, 1924-25, 18, 807-817).—Describes the making of a plate pattern, with a few hints on camber.—W. H. D.

Pattern Economies. Anon. (*Mech. World*, 1926, 79, 12-13, 67, 124-125, 168-169).—The two principal factors entering into the cost of patterns are quantity of timber used and time occupied in construction. The cost can sometimes be reduced without a concomitant increase of costs in the foundry, but such an increase may generally be expected to accrue. Economies are classified and discussed.—F. J.

The Old Pattern Problem. Anon. (*Mech. World*, 1926, 79, 47).—A brief article on the storage of patterns.—F. J.

Fitting Irregular Pattern Shapes. J. McLachlan (*Canad. Found.*, 1926, 17, (8), 14-15).—Describes methods used in the preparation of circular and elliptical patterns.—W. H.-R.

Gives Pattern Detail and Method of Moulding Axle Box. Joseph Horner (*Foundry*, 1926, 54, 242-243).—A well-illustrated article describing the making of pattern and mould for bearing boxes for British railway cars.

—F. J.

The Pattern Plate. Adolf Haug (*Stahl u. Eisen*, 1925, 45, 1301-1306).—The development of the pattern and its present forms are described.—G. S.

Pattern Plates. E. Ronceray (*Found. Trade J.*, 1926, 34, 89-92).—Read before Czecho-Slovakian Foundrymen's Association. Many illustrations with detailed descriptions.—E. C.

A Scribe for Patternmakers. Anon. (*Found. Trade J.*, 1926, 34, 78).—Details given of a simple and useful tool.—E. C.

Core Making with Electric Heat. Anon. (*Elec. World*, 1926, 88, 1226).—The findings of the power committee of the N.E.L.A. on the advantages of electric heat for core making are summarized.—C. J. S.

The Effects of Moisture Absorption on the Properties of Dry-Sand Cores. H. L. Campbell (*Amer. Found. Assoc. (Advance Copy)*, 1927, June, 1-8).—

This paper deals with an investigation made to determine the changes in strength and permeability of dry-sand cores when placed in greensand moulds for different periods of time. Nine core-sand mixtures were used, the binders being linseed oil, rosin, pitch, cereal flours, sulphite liquor, molasses, and dextrin. Conclusions reached were that the deterioration in strength is dependent on the type of binders used and length of time left in moist mould. The permeability is not changed on exposure to moist air for periods of time up to 24 hrs., and the amount of moisture absorbed by dry-sand cores from closed greensand moulds is relatively small.

Core Supports in Large Castings. Ivan Lamoreux (*Amer. Found. Assoc.* (Advance Copy), 1926, Sept., 1-7).—A description of the precautions to be taken in providing efficient core supports in casting large iron articles (such as pipes for chemical factories), including diagrams showing correct and incorrect ways of using the supports.—A. R. P.

A Standard Sand for Use in Testing Core Binders. H. L. Campbell (*Amer. Found. Assoc.* (Advance Copy), 1926, Sept., 1-7).—In the development of methods for testing core binders, it has been necessary to determine the influence of the size and shape of sand grains on the properties of cores. The purpose of this investigation was to establish a specification for sand which could be recommended for general use in testing core binders. Twenty-four representative samples of core sands were collected from natural deposits, or from foundries, and were tested for grain-size. The effect of grain-size on dry bond and permeability was determined. From the results of the tests it was concluded that sand for testing purposes should be limited to one sieve size, which, according to C.'s opinion, is that sand which passes a 60-mesh sieve and is retained on a 70-mesh sieve.

Methods for Determining the Properties of Cores made with Cereal Binders. H. L. Campbell (*Found. Trade J.*, 1926, 34, 327-329).—Read before the American Foundrymen's Association (abstract above).—W. H. D.

Core Oil Specifications. V. A. Crosby (*Amer. Found. Assoc.* (Advance Copy), 1927, June, 1-6).—C. discusses the properties of core oils, which are examined to determine the quality of the oils purchased. Specifications used are listed, and the reasons for the items of the specifications are discussed.

Foundry Blacking. D. G. Anderson and A. N. Ogden (*Amer. Found. Assoc.* (Advance Copy), 1927, June, 1-10).—The authors discuss the need for a test for foundry blackings which will give some definite idea of the quality for foundry use. Chemical and microscopical examinations are not satisfactory, though they give some idea of the value of the material. After some experimental work a method was developed to test the electrical resistance of a specimen under a standard pressure. This latter method has proved to be of value in determining the quality of purchased plumbago. A method of using compressed air to keep the graphite in suspension as a liquid carrier is described.

Gates and Risers. F. C. Edwards (*Proc. Inst. Brit. Found.*, 1924-25, 18, 751-772).—See *J.*, 1925, 34, 624.

The Production of Bronze (Rotguss) Cylinder Liners. Gustav Krebs (*Z. ges. Giesserei-Praxis: Das Metall*, 1926, 47, 191-192).—The alloys, moulding, cores, and casting heads are discussed.—B. B.

Increasing Output with Moulding Machines. Reg. Micks (*Canad. Found.*, 1926, 17, (6), 17-19).—Describes the working of the different types of moulding machines, and emphasizes the savings resulting from their use.—W. H. R.

Describes Loam Moulding Methods. Ben Shaw and James Edgar (*Foundry*, 1925, 53, 955-958, 999-1002; 1926, 54, 21-23, 55-58, 112-115, 137-141,

184-187, 225-228, 275-279).—A series of articles in which methods of loam moulding are amply illustrated and described. In article VI. (pp. 137-141) the manner in which straw rope is applied to core barrels and the purpose it serves in casting, the venting of barrels, need for gauge sticks, &c., are discussed. A line-drawing of a belt-driven machine for making loam cores in a wide range of sizes may interest tube-makers. In article IX. (pp. 275-279) the essential features of making moulds for propellers are described.—F. J.

The Reduction of Moulding Losses. R. A. Greene (*Amer. Found. Assoc. (Advance Copy)*, 1927, June, 1-11).—The problem G. considers is what can be done to get closer union or co-operation between the moulders, instructors, foremen, metallurgists, engineers, and other groups, with the main idea of producing quality castings with a low loss. The plan put into practice at the Ohio Brass Company works is described in detail. Accurate records are stated to be the nucleus of the system, and publicity creating interest and attracting attention to these records is an important follow-up point. By means of these records there has been developed a friendly rivalry amongst the men and instructors to compete in reducing losses. By means of this system the losses have been cut from a yearly average of about 8.5% to about 4.5%, which in their plant means a saving of some 200,000 lb. of castings.

Small Work Moulding in Green and Dry Sand. J. D. Nicholson (*Proc. Inst. Brit. Found.*, 1924-25, 18, 516-528).—See *J.*, 1925, 34, 619.

Influence of the Wall Thickness of Moulds on the Casting. F. Leitner (*Stahl u. Eisen*, 1926, 46, 629-631).—Casting tests with iron in moulds of different wall thicknesses show the best structure with medium wall thicknesses in almost the same cooling time as with the thickest moulds.

—G. S.

The Mould—Its Function and Preparation. J. E. Fletcher (*Found. Trade J.*, 1926, 34, 389-392, 413-415).—Read before the Manchester Metallurgical Society, and including F.'s own method of testing sands.—W. H. D.

Water-Cooled Metal Moulds. O. Junker (*Z. Metallkunde*, 1926, 18, 312-314).—The action of a water-cooled copper mould with a thickness of 20 mm. is described, and its advantages in comparison with a mould of cast iron are referred to.—M. H.

Notes on Moulding Sands. J. E. Fletcher (*Bull. British Cast Iron Res. Assoc.*, No. 14, 1926, 3-7).—The different screen or sieve tests for moulding sands are discussed. The brass wire, square-meshed sieves recommended by the Institute of Mining and Metallurgy are satisfactory if kept clean, but for regular work brass or copper sieves perforated with circular holes are better. Sieves passing 0.6, 0.25, and 0.1 mm. are suitable for rough foundry work. The grading of moulding sands and the connection between chemical composition and grain-size are discussed and illustrated graphically. The ratio silica : alumina decreases regularly as the grains become finer. The nature and origin of the Moxley sand are discussed; this sand in some ways resembles a mixture of fine quartz and fuller's earth.—W. H.-R.

Moulding Sand. Anon. (*Automobile Eng.*, 1926, 16, 176).—A short account of the essential requirements in regard to texture and composition of sand suitable for various types of foundry casting. The essential requirements of good moulding sand are enumerated, under headings of permeability, infusibility, removability to leave a clean, smooth skin, firmness when rammed in a mould, and compact enough to resist pressure of liquid metals. For light brass castings the % of silica recommended in a moulding sand is about 80% compared with 85% for cast iron and 95% for steel castings.—J. P.

The Present Status of the Laboratory Investigation of Sands. H. Ries (*Proc. Inst. Brit. Found.*, 1924-25, **18**, 32-55).—See *J.*, 1925, **34**, 622.

Moulding Sand for Aluminium Foundries. Anon. (*Aluminium*, 1926, **8**, (19), 7).—The most suitable sands for aluminium foundries are the so-called "fat" sands to which a small proportion of coal dust has been added. Building sand or other lean sand bonded with linseed oil, molasses or dextrin is best for making the cores. The necessity for the provision of numerous risers in making moulds for aluminium castings is emphasized.—A. R. P.

Sand Control in the Foundry. H. W. Dietert and H. W. Wakefield, jun. (*Amer. Found. Assoc.* (Advance Copy), 1926, Sept., 1-23).—A brief description is given of the application of the various sand tests recommended by the A.F.A. to the moulding sand used in a large American cast-iron foundry. Dry sand strength and permeability are the two most important factors in reducing casting losses. The former may be increased by using a higher percentage of water in the greensand or by the addition of up to 3% of pitch, and the latter by reducing the fineness of the sand mix.—A. R. P.

The Preparation of Moulding Sands in the Foundry. A. Baillet (*Fonderie mod.*, 1926, **20**, 68-71).—A critical examination of the American, German, and French methods of moulding sand preparation. It is stated that the process generally adopted in French factories yields a sand as suitable for moulding purposes, yet in fewer steps, than those in operation in other countries.

—W. A. C. N.

Preparation of Foundry Sand. G. Piron (*Fonderie mod.*, 1926, **20**, 135-137).—The main qualities to which attention is drawn are plasticity, permeability, refractoriness, and homogeneity. It is also to be remembered that no amount of physical preparation will give to any sand which has not a suitable chemical composition, those qualities which are necessary for good moulding. Plant is described which has been designed to prepare sand under semi-automatic control, and which, in one machine, serves to give to the granules and the matrix a consistency which brings their physical properties into better relationship and thus ultimately produces a finer working material.—W. A. C. N.

Foundry Progress in Sand Preparation. C. D. Hollins (*Canad. Found.*, 1926, **17**, (4), 20-21).—Reviews the introduction of mechanical sand mixers and cutters in the foundry industry.—W. H.-R.

Preparation and Use of Industrial Special Sands. W. M. Weigel (*Trans. Amer. Inst. Min. Met. Eng.*, 1926, **73**, 434-447).—See *J.*, 1926, **35**, 807.

Mining and Preparation of Eastern Moulding Sands. R. M. Bird (*Trans. Amer. Inst. Min. Met. Eng.*, 1926, **73**, 381-388).—An illustrated description of methods of foundry sand production typical of the New York and New Jersey areas.—R. G.

Mining and Preparation of Eastern Moulding Sands. R. M. Bird (*Min. and Met.*, 1926, **7**, 61-64).—See abstract above.—A. R. P.

Securing Perfectly Conditioned Sand. F. A. Smith (*Canad. Found.*, 1926, **17**, (4), 13-14).—Emphasizes the importance of thoroughly well mixed sand in foundry work, and the great value of mechanical mixers and sand-cutting machines.—W. H.-R.

The Grading of Moulding Sands. C. A. Hansen (*Amer. Found. Assoc.* (Advance Copy), 1926, Sept., 1-30).—The character of the distribution of grain-sizes in moulding sands is analysed and described. A simple method of determining the average fineness of grain is proposed as a basis for grading sands in respect of fineness of grain. The relation between this proposed fineness scale and the grade numbers assigned by commercial sand producers in the Albany district (U.S.A.) is analysed. The relations between fineness of grain, as determined by the proposed method, and various physical properties

of sands, are discussed, with particular reference to establishing an acceptable basis for the selection of sands for typical classes of foundry work.

The Use of Standard Tests of Moulding Sands. H. Ries (*Trans. Amer. Inst. Min. Met. Eng.*, 1926, 73, 394-397).—See *J.*, 1926, 35, 806.

A Practical View of Facing Sands. Anon. (*Found. Trade J.*, 1926, 34, 79).—Description and composition of mixtures of these sands for different classes of mouldings.—E. C.

Heat Transference of Moulding Sands. Franz Roll (*Giesserei-Zeit.*, 1926, 23, 298-301).—Tests on casting iron in dry and green sand showed that no direct relation can be established between the composition of the sand and its heat conductivity. The proportion of clay in the sand, however, seems to play an important part in restraining the rate of heat transmission through the mould, but the presence of water in greensand moulds has little effect on their heat conductivity.—A. R. P.

Permeability of Moulding Sands. J. G. A. Skerl (*Bull. British Cast Iron Res. Assoc.*, No. 14, 1926, 20-23).—Describes the effects of different factors on the permeability of moulding sands. An "ideal" sand consisting of spherical grains of equal diameter will have a porosity of about 47% (i.e. about 47% of the bulk will be air spaces), and this is independent of the size of the grains. But the permeability to gases decreases as the grains become smaller, owing to the increase in surface which increases the frictional resistance to the air. The amount of bonding material should be just sufficient to cover the surface of each grain; any excess over this amount is harmful, as it tends to become separated from the grains and clogs up the pores. The advantage of uniform grain-size is emphasized. Ramming should be carried out so as just to bring the bond envelopes of the sand grains into contact; any further ramming is harmful, as it tends to detach the bond material from the grains. The use of coal dust does not increase the effective permeability, as the coal dust itself gives off much gas when in contact with the hot metal. One of the most frequent causes of "scabbing" is the patching of the mould with sand, which is more moist than the sand of the mould.—W. H. R.

The Practical Utilization of Apparatus for Measuring the Permeability and Cohesion of Moulding Sands. R. Lemoine (*Met. Ind. (Lond.)*, 1926, 29, 85, 86, 111, 136, 156-158).—Read before Institute of British Foundrymen (Discussion, pp. 35-36). See *J.*, 1926, 36, 632-633.—E. C.

Practical Utilization of the Apparatus for Measuring the Permeability and Cohesion of Moulding Sands. R. Lemoine (*Fonderie mod.*, 1926, 20, 155-162).—Apparatus and methods are described which have been applied in large scale practice for testing moulding sands, particularly with reference to the complex properties such as permeability. The regularity in composition and texture of the sands used is most desirable, and the author advocates frequent works' tests in order to control these.—W. A. C. N.

The Relations of Grain-Size and Grain Form to the Gas Permeability of Moulding Sand. E. Diepschlag and H. Pannek (*Stahl u. Eisen*, 1925, 45, 649-653).—The gas permeability of moulding sand depends on the size of the grain as well as on the grain form. With sands with a content of sharp-cornered grains the gas permeability is lowest if about 45% of coarser grain is present. With higher contents of coarse grain the gas permeability increases rapidly. With sands of round grains the permeability increases apparently with the contents of coarse grain.—G. S.

The Effect of Mulling on the Physical Properties of Foundry Sands. A. V. Leun (*Amer. Found. Assoc. (Advance Copy)*, 1926, Sept., 1-34).—Tests on a number of American foundry sands show that mulling is in all cases beneficial, but that the optimum period of mulling varies somewhat for different sands.

In general, the permeability, tensile strength and compressive strength increase with the time of mulling; for fine sands 15 minutes' treatment is usually sufficient, whereas 10 minutes will suffice for medium and coarse sands. Mulling should be done on every batch of sand at least once a week at the same time as new or waste sand is added to the heap. The best results are obtained when the moisture content is somewhat below the optimum, especially if the sand is fine and contains 15% or more of clay; this type of sand is completely spoilt if mulled too wet for 10-20 minutes.—A. R. P.

Magnetic Separator Pulleys in Foundries. C. H. S. Tupholme (*Found. Trade J.*, 1926, **34**, 76-77).—Separator for removing ferrous particles from non-ferrous metals and sands.—E. C.

British Foundry Turns to Gas. Anon. (*Brass World*, 1926, **22**, 231-232).—Describes the die foundry of R. W. Coan, Ltd., Goswell Rd., London, E.C. Gas-firing is used both for melting furnaces and drying ovens, &c. The work carried out is chiefly with aluminium alloys for the motor and aeroplane industries.—W. H.-R.

Modern Induction Furnace Brass-Melting Practice. G. F. Hughes and P. L. Green (*Found. Trade J.*, 1926, **34**, 103-104).—Extract from *Brass World*, 1925, **21**, 205-207 (*J.*, 1926, **36**, 652).—E. C.

Electric Furnace Practice in the Bronze Foundry. F. C. Heath (*World Power*, 1926, **5**, 61-62).—Abstract of a paper read before the American Electrochemical Society (*J.*, 1925, **33**, 537).—T. B. C.

The Conveyance of Air-Blast to Cupolas and Forced-Draught Furnaces. Walter J. May (*Mech. World*, 1926, **79**, 28-29).—Technical details concerning the pipe lines for conveying air under pressure to furnaces are illustrated and discussed. Pipes must be smooth internally, preferably solid drawn, and should be provided with radiused joints and bends. Branch pipes should undergo a change in diam. by means of tapered sections and not by stepped reductions, which present sharp edges to hinder the air flow. Methods of making joints and of cutting off the air supply are discussed. An air current should not be split, if this can be avoided; a separate fan or blower to each air line giving greater efficiency. Water should be kept out of the pipes.

—F. J.

Electric Melting Pot. Anon. (*Railway Rev.*, 1926, **79**, 501).—A brief illustrated description of a 1000-lb. pot manufactured by the General Electric Co. for melting metals at temperatures below 850° F. It is fitted with three 5 kw. immersion heaters.—J. C. C.

Metal Melting. — (*Met. Ind. (Lond.)*, 1926, **29**, 580-582).—A general discussion at the conjoint meeting of the Birmingham Local Section of the Institute of Metals and kindred societies.—W. H. D.

Visual Judgment of Non-Ferrous Metal Temperatures. R. R. Clarke (*Amer. Found. Assoc. (Advance Copy)*, 1926, Sept., 20-24).—The variation in the surface colours of copper and copper alloys with the temperature are described in detail, and the viscosity changes of the metal are discussed. Considerable information as to the temperature of a brass or bronze melt may be obtained by dipping a skimmer bar into the metal and observing the way the metal runs off the bar as it is withdrawn, or by dipping a bar of the same alloy into the melt and observing the rate at which it melts into the bulk.

—A. R. P.

Application of Fluxes, &c., in the Foundry. Walter J. May (*Mech. World*, 1926, **79**, 266-267).—A few general observations on the use of fluxes are given.—F. J.

Granulation of Slags. B. Bogitch (*Compt. rend.*, 1926, **183**, 1291-1292).—Further precautions to be observed in granulating slags by B.'s method

(*J.*, 1926, **36**, 423) consist in seeing that the jet of molten slag falls into the centre of the granulating tank, and, to avoid explosions with certain cobaltiferous slags, in raising the temperature of the furnace just before pouring and maintaining the water at 35°–40° C.—E. H. T.

The Accumulation of Admixtures by Repeated Meltings. Ig. Pavloff (*J. Russ. Met. Soc.*, 1926, Part I., (2), 245–265).—[In Russian.] How the constancy of the composition of alloys is affected by repeated meltings, when some scrap is used in addition to the pure alloying metals, is discussed. After theoretical discussion of the process of the accumulation of admixtures P. has deduced a formula

$$S_n = \frac{C(1-a)}{1-a-k} + \left(\frac{a}{1-k}\right)^n \left[S_0 - \frac{C(1-a)}{1-a-k}\right]$$

where S_n = % of bad admixture in the alloy after n meltings; S_0 = % of bad admixture in the alloy produced by the first melting; C = % of bad admixture in the alloy before the first melting; a = % of scrap used in each melting; k = loss of metals in each melting; n = number of meltings. P. also describes the application of this formula for various cases in practice of ferrous and non-ferrous alloys.—B. B.

Boronic Alloying Metals. Anon. (*Met. Ind. (Lond.)*, 1926, **28**, 378–425).—A brief description of the use of boron, in the form of a special alloy, as a deoxidizer. The boronic alloys are made in many forms, the boron being alloyed with various metals.—E. C.

Magnesium by Melting—Castings—Foundries. R. de Fleury (*Rev. Mét.*, 1926, **23**, 649–657).—The production of certain parts of aviation engines constitutes a considerable, if not inevitable, field of application for magnesium castings. The price of the metal, the cost of production, and the difficulty of treatment should not stand in the way of its use. Its low density is of importance when its other properties are suitable for the work. The relation between the price of the metal and that of aluminium is discussed. The difficulties of melting and casting are considered at length, with reference to the oxidation and nitrogenization of the charge and its fluidity. A “superheat” of 70° C. to 50° C. above the melting point is considered to be necessary for the clean casting of the metal or Mg-rich alloy. The necessity for using perfectly dry moulds is emphasized, on account of the liberation of hydrogen if the hot metal comes into contact with moisture. Sand moulds are difficult to use on this account; and sand free from clay, desiccated, mixed with tar, and heated, gives the best results. Fluxes are considered, and the one recommended is a mixture of fluoride and chloride of magnesium. Calcium fluoride is also used in small quantity, and is said to be decomposed in part, with passage of calcium into the alloy. Zinc has been used as an alloying metal, but small percentages of calcium are much more effective and improve the mechanical properties both of the cast and worked metal. In feeding the moulds the metal should be perfectly fluid, the runners as short as possible, and every effort must be made to exclude the viscous covering formed by the suspension of the oxide in the superficial layer of metal. Technical details of melting practice and of remelting scrap and recovering metal from waste are given, and the industrial aspects of magnesium-founding are discussed.—F. J.

Some Problems of Casting Metals and Alloys. C. A. Edwards (*Bull. British Non-Ferrous Metals Res. Assoc.*, No. 17, 1926, 11–20).—A large amount of recent work on the effect of gases in metals is reviewed, with special reference to copper, for which the important gases are oxygen, sulphur dioxide, hydrogen, and perhaps some of the lighter hydrocarbons, such as methane. In general, gases are more soluble in liquid than in solid metals, and hence gas is given up

on solidification with resulting unsoundness. The slower the cooling the greater is the chance of the liberated gas collecting into bubbles; hence chill-castings are more easily obtained sound than sand-castings. Different methods for improving castings of copper, bronze, &c., are discussed. The method of remelting used by Archbutt for aluminium has some effect with copper, but is hardly practicable commercially; similar remarks apply to melting in a vacuum. If molten copper is treated with excess of copper oxide to oxidize the hydrogen, and the excess of oxide removed by reduction, castings of density 8.7 to 8.8 can be obtained. Passing an inert gas through the metal enables castings of density 8.8 to 8.86 to be obtained, but is hardly practicable in the foundry. E. suggests blowing air through molten copper covered with charcoal; the air will oxidize the hydrogen, and the charcoal will reduce the resulting copper oxide. The effect of sulphur dioxide and water vapour equilibria are discussed. For making sound bronze castings E. recommends melting the copper under oxidizing conditions to remove the hydrogen, adding wood charcoal and a very little phosphorus (as phosphor-copper), the zinc and tin being added after complete deoxidation.—W. H.-R.

Contraction Stress: Cause and Remedies. F. C. Edwards (*Proc. Inst. Brit. Found.*, 1924-25, **18**, 426-439).—See *J.*, 1925, **34**, 629.

Contraction in Alloy Casting. H. C. Dews (*Found. Trade J.*, 1926, **34**, 541-544, 561).—Read before a joint meeting of the London Local Section of the Institute of Metals and the Institute of British Foundrymen. An account is given of the ways in which the soundness of a casting is related to the volume changes brought about by change of temperature. By control of the temperature gradient, so that it slopes evenly from the remotest points to a feeding point, sound castings should be obtainable in most alloys irrespective of the length of the freezing range.—W. H. D.

Wasters. J. J. McClelland (*Found. Trade J.*, 1926, **34**, 483-485).—Read before the Wales and Monmouth Branch of the Institute of British Foundrymen. The various types of wasters are discussed under the following heads: runouts, short pours, scabs, crushes, cold shuts, cross-joints, lifting and breaking of cores, contraction cracks, dirt and slag.—W. H. D.

Scabs: Their Cause and Remedy. H. S. Newton (*Found. Trade J.*, 1926, **34**, 167).—The views of a practical man, with special reference to brass castings.—E. C.

An Analysis of Defective Castings. E. Longden (*Proc. Inst. Brit. Found.*, 1924-25, **18**, 599-623).—See *J.*, 1925, **34**, 632.

Primary Crystallization in Chrome-Nickel Steel; its Influence and Importance in Faults. F. Leitner (*Stahl u. Eisen*, 1926, **46**, 525-533).—By means of casting tests it is shown that the smallest crystals are formed in the mean cast temperature. Large crystals are detrimental on account of the collecting of impurities and the inclination to holes.—G. S.

The Casting of Aluminium Alloys. Practical Notes on the Process. Anon. (*Chem. Age (Lond.)*, 1926, **14**, Monthly Met. Sect., 3).—For making an aluminium-zinc-copper alloy for casting purposes a "hardener" containing copper and zinc in the desired ratio is first prepared, and this is then dissolved in several times its weight of molten aluminium. The alloy so prepared is analysed and the requisite amount added to the molten aluminium contained in an iron pot. The pot should be made of a high-carbon iron low in phosphorus, sulphur, and silicon, and should have a smooth interior. The alloy should be cast at as low a temperature as possible into warm moulds, care being taken not to interrupt the flow of metal during pouring, so as to avoid inclusion of oxide films. The more rapidly the metal is cooled the finer is the crystalline structure and the stronger the alloy.—A. R. P.

The Relation of Casting Temperature to the Properties of Aluminium Alloys. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1926, **47**, 122-123).—The properties and casting of various aluminium alloys at different temperatures are dealt with.—B. B.

The Casting of Aluminium. Anon. (*Brass World*, 1926, **22**, 255-256).—A general account of the conditions necessary for the successful casting of aluminium.—W. H.-R.

The Casting of Aluminium. Anon. (*Mech. World*, 1926, **80**, 483-484).—Review of an article in the *Brass World* (abstract above).—F. J.

Aluminium Casting Output and its Difficulties. Reg. Micks (*Canad. Found.*, 1926, **17**, (9), 32-39).—Reviews the development of the metallurgy of aluminium, and describes some of the alloys in common use. Furnaces, fluxes, and general foundry practice are discussed; the use of chloride of zinc as a flux is advocated. Mechanical moulding machines and the methods of die-casting are described.
—W. H.-R.

Aluminium Alloy Castings. S. L. Archbutt (*Proc. Inst. Brit. Found.*, 1924-25, **18**, 201-230).—See *J.*, 1925, **34**, 416.

Aluminium Castings. C. Dicken (*Proc. Inst. Brit. Found.*, 1924-25, **18**, 345-350).—See *J.*, 1925, **34**, 632.

Modern Problems and Developments in Engineering Bronze Founding. Francis W. Rowe (*Proc. Inst. Brit. Found.*, 1924-25, **18**, 453-470).—See *J.*, 1925, **34**, 614.

Prevention of Porosity and Improvement in the Physical Properties of Gun-Metal. W. Reitmeister (*Found. Trade J.*, 1926, **34**, 177-180; *Met. Ind. (Lond.)*, 1926, **29**, 81).—Paper read before the Verein Deutscher Giessereifachleute giving results of tests on bronze (copper 83, tin 5, zinc 9.5, lead 2.5) cast under different conditions, and tests on the wear of alloys of a somewhat similar composition.—E. C.

German Silver Castings. Anon. (*Found. Trade J.*, 1926, **34**, 168).—Moulding, melting, and pouring details in connection with nickel-brass alloys.—E. C.

Casting of Locomotive Bearings with Calcium Lead Alloys and "Lurgi" Hardened by the Addition of Alkaline Earth Metals. H. Münster (*Glaser's Ann.*, 1924, **95**, 155-159).—The alloy is cast into the bearing, and after cooling the core is pressed by hydraulic pressure against the bearing at a temperature of 200° C.—M. H.

Casting a 35-Ton Lead Keel. Reg. Micks (*Canad. Found.*, 1926, **17**, (5), 21).—Discusses the best methods for casting a 35-ton lead keel made in three sections of which the heaviest weighed about 12 tons. M. recommends casting in a skin-dried sand mould or core mould. Chills or iron plates can be placed on the heavier parts to ensure even cooling. A closed mould will produce a better and cleaner casting than an open mould. Ordinary oil-sand cores with a coating of blackwash are suitable for coring the bolt holes; alternatively very slightly tapered smooth iron rods coated with plumbago and oil can be used. Large risers are necessary to provide for shrinkage.—W. H.-R.

Still Casting of Metals. P. H. G. Durville (*Amer. Inst. Min. Met. Eng. (Advance Copy)*, 1927, Feb., 1-6).—The effect of the presence of small quantities of aluminium in alloys in producing a tenacious surface film of alumina, insoluble in the metal, is discussed. Evaporation of zinc from brasses and nickel silver is reduced by the addition of aluminium to the alloys in amounts as small as 0.25 to 0.30%. The presence of the alumina film, however, necessitates special precautions against agitation during pouring, in order to avoid spongy or drossy regions in the casting. The method of using a strainer gate gives bad results. Successful casting of alloys containing

aluminium has been secured by two "still casting processes," (1) the tilting process and (2) the bottom-pouring process. In the tilting process the ingot mould and ladle are rigidly attached to each other. The molten metal is poured into the ladle, is skimmed, and transferred to the mould by smoothly tilting the whole system. This method cannot be applied to certain delicate alloys, and sometimes it is difficult to tilt slowly enough to minimize shrinkage; there are, however, important advantages, such as the good surface quality given to the ingot. The other method, known as bottom-pouring, is carried out by means of a gate which is built up to its full height during the pouring operation, so that the height of fall of the molten metal is always small. Pouring can be very slow, so as to reduce shrinkage to the minimum, and very large castings can be made. The process can be mechanically operated.

—R. G.

Chill-Cast Bronze Gears. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1926, 2, 92-93).—An account of an article in *Iron Age*, 1926, 117, 616-618 (*J.*, 1926, 35, 820).—R. G.

Some Notes on the Development of the Centrifugal Casting Process in Great Britain and Europe. J. E. Hurst (*Amer. Found. Assoc.* (Advance Copy), 1926, Sept., 1-15).—A short note on the early development of the centrifugal casting process in Great Britain from the year 1809 is included in the paper, with special reference to the work of Joseph Whitley. The application of the process to the production of pipes in Great Britain and Belgium by the Lavaud system is discussed together with some notes of the development of other centrifugal pipe-casting processes. The Hurst-Ball system, of which H. is the joint inventor, is specially mentioned. This process is being developed, and has already been used to produce 35 in. diam. standard pipes, which are probably the largest castings ever produced by any centrifugal process. The special development of the centrifugal process as applied to the production of castings for cylinder liner and piston rings is dealt with, and the properties of centrifugally cast material for these special purposes is fully described. The development of the application of the centrifugal process to the production of castings in steel and *non-ferrous alloys*, and its application to the lining of pipes with concrete and other materials, is dealt with.

Some Notes on the Development of the Centrifugal Casting Process in Great Britain and Europe. J. E. Hurst (*Met. Ind. (Lond.)*, 1926, 29, 319-321, 345-347; *Found. Trade J.*, 1926, 34, 290-292).—Read before the American Foundrymen's Association. See abstract above.—W. H. D.

Worm-Wheel Castings. C. J. Fitzpatrick (*Automobile Eng.*, 1926, 16, 500).—The casting of bronze worm gear blanks by the centrifugal process is compared with the method of using chill rings and complete dies. The latter are claimed to compare favourably in structure and strength with the former, provided the chilling effect is sufficient to act completely through the section of the casting without tapering off towards the centre, the conditions to ensure which are detailed. Some difficulties encountered with the centrifugal method of casting are discussed, such as freezing in layers, erosion of the inner refractory core, difficulty of casting teeth in the blank, difficulty in providing risers to carry off dirt from the inner surface. In America, it is claimed, semi-permanent mould castings have been adopted in preference to centrifugal castings on account of less costly plant being involved and sufficiently high-grade, uniform metal being produced. The tin-bronze generally used contains 10-12% of tin with 0.1 to 0.3% phosphorus, and impurities 0.5% max. The beneficial effect of from 2 to 3% nickel is claimed in the tensile strength without adversely affecting the coeff. of friction.—J. P.

Centrifugally Cast Bronze Gears. C. J. Fitzpatrick (*Found. Trade J.*, 1926, **34**, 258).—Observations based on modern methods in the U.S.A. The bronze used is essentially: tin, 11.0; lead, 0.25; phosphorus, 0.25; copper, remainder.—W. H. D.

Bronze Worm-Gear Blanks Produced by Centrifugal Casting. C. J. Fitzpatrick (*Engineering*, 1926, **122**, 395, 443).—A discussion of the paper by F. W. Rowe read before the Institute of Metals (*J.*, 1926, **36**, 191–203).—B. B.

Centrifugal Casting and its Problems. L. Frommer (*Mech. World*, 1926, **80**, 383–384).—Reprinted from a translation in *Iron Age* of an article which originally appeared in *Z. Metallkunde*, 1925, **17**, 245–250, 289–293 (*J.*, 1926, **35**, 814).—F. J.

Centrifugal Casting. Anon. (*English Mechanics*, 1926, **123**, 217–218, 229).—(1) An interesting account of a method of reproducing small models, ornaments, insects, &c., in any metal by centrifugally casting into a plaster mould which has been made by immersion of the “original” in liquid plaster. The method is hardly of commercial application, but of possible use in special cases. (2) Details are given for touching up and polishing the diminutive castings made as described in the first part of the article.—T. B. C.

A Permanent-Mould Process. H. A. Schwartz (*Amer. Found. Assoc. (Advance Copy)*, 1926, Sept., 7–19).—The paper deals with a permanent-mould process where the temperature condition of the moulds during operations is stabilized within close limits at a predetermined range by the regulated circulation of oil through the mould sections. This regulation serves, first, materially to prolong the serviceable life of the mould structure by minimizing internal stresses induced by fluctuating temperatures, and, secondly, maintains an effective control over the cooling velocity of the forming castings, and thereby making possible uniform results as to casting structural characteristics. Especial reference is made to the possibility of materially shortening the annealing operation on malleable cast iron produced in permanent moulds operating under the process, because of the effective control over primary graphitization made possible by the regulation of the cooling velocity of the forming castings.

Permanent and Long-Life Moulds. Richard Moldenke (*Amer. Found. Assoc. (Advance Copy)*, 1926, Sept., 1–8).—M. summarizes the position of the permanent and long-life mould in the foundry industry. The economical aspects of the developments are discussed, together with the utility of permanent moulds. Possible mould materials and trends of experimental work are reviewed.

Permanent and Long-Life Moulds. Richard Moldenke (*Found. Trade J.*, 1926, **34**, 439–440).—Read before the American Foundrymen’s Association (abstract above).—W. H. D.

Aluminium Alloy Permanent-Mould Castings. Robert J. Anderson (*Amer. Found. Assoc. (Advance Copy)*, 1926, Sept., 1–29).—A permanent-mould casting is defined as a semi-finished (or, it may be, practically finished) casting made by pouring a liquid alloy into a metal (usually cast-iron) mould, the alloy entering the mould solely under the force of gravity. One object of this paper is to indicate to foundrymen the directions which have been taken by the more recent developments in aluminium alloy permanent-mould casting, and to present such information, and to indicate where additional information will be found, as well as to assist them in taking up the production of castings by the permanent-mould process. Another object of the paper is to discuss briefly the properties, mode of manufacture, and fields of application of aluminium alloy permanent-mould castings and to give comparison with

sand-castings and die-castings, thus assisting the consumer of castings in making a judicious choice of the correct kind of castings for specific purposes. Comparison is made of the sand-, die-, and permanent-mould casting methods for producing aluminium alloy castings, and the characteristics of the products obtained by these three methods are described. It is shown that aluminium alloy permanent-mould castings have greater soundness, finer grain-size, greater strength and hardness, greater resistance to impact and alternating-fatigue stresses, and greater resistance to corrosion than sand-castings. The general and specific fields of application for permanent-mould castings are discussed. The kinds of alloys used for casting in permanent moulds are considered, and the mechanical properties of permanent-mould cast alloys are compared with sand-cast alloys. Brief details are given of the permanent-mould process, and the question of mould design and methods of gating are taken up. The sizes and weights of castings being made by the permanent-mould process are indicated, and the question of casting tolerances is discussed. Finally, the occurrence of defects in castings and methods for the elimination of wasters in production are described.

Conflicting Foundry Methods [Die-Casting of Brass and Bronze]. Joseph G. Kaiser (*Brass World*, 1926, **22**, 263-264).—The machines used for the die-casting of low melting alloys of lead, tin, and zinc are not suitable for the higher temperatures of brasses and bronzes, owing to shrinkage, action of hot metal on dies, &c. K. has invented a machine which overcomes these difficulties, and enables complicated castings of brass or bronze to be made by two men in from 20 to 30 seconds per casting. No details are given.—W. H.-R.

Die-Casting of Aluminium and Brass. G. A. Fritze (*Gewerbefleiss*, 1926, **105**, 189-191).—A short description of different types of machines.—M. H.

The Effect and Cost of Zinc and Aluminium on Die-Castings. Anon. (*Machinery* (N. Y.), 1926, **32**, 567).—In order for die-castings to compete with iron castings, the savings due to the reduction of machining operations must be greater than the additional cost of the metals. Recent increases in the price of zinc and aluminium have seriously affected the die-casting industry.

—J. C. C.

The Production of Pressure Die-Castings.—I. Eustace J. Bedford (*Machinery* (Lond.), 1926, **28**, 33-36).—Discusses the die-casting of aluminium, zinc, lead, and tin alloys. Tables are given of the compositions of the chief alloys of each type, together with design data and notes on their uses. In die-casting aluminium alloys, the difficulty is to obtain a satisfactory method of applying the pressure. Compressed air is expensive and tends to produce blowholes, while plungers tend to seize in the pump and to erode. However, plunger-operated machines are now being worked satisfactorily in England.

—J. C. C.

Pressure Die-Casting Processes, Pressure Die-Casting Machines. A. Kaufmann (*Z. V. d. I.*, 1926, **70**, 285-290).—A number of die-casting machines for the manufacture of articles from tin, zinc, and aluminium alloys are described. With zinc and zinc alloys a tolerance of ± 0.02 mm. can be obtained; with aluminium alloys it is ± 0.05 mm. Brass die-casting is not possible at present, as no material can withstand the high strains.—G. S.

The Die-Casting Process. John W. Harriman (*Technograph*, 1921, **33**, 99-102).—A review, showing the possibilities and limitations of the process.

Upgrading of Foundry Apprentices. C. Howard Ross (*Amer. Found. Assoc.* (Advance Copy), 1927, June, 1-6).—R. outlines the method used in upgrading the various classes of moulder apprentices of the Union Malleable Iron Co. The method used is called the "earn and learn" method. The apprentices are grouped into 3 classes.

XV.—FURNACES AND FUELS.

For keys to abbreviations used, see pp. 356 and 370.

FURNACES.

Fuels and Furnaces in Europe. W. Trinks (*Fuels and Furnaces*, 1926, 4, 19-30).—The article contains a description of recent European developments in the liquefaction and pulverizing of coal at the pit-head, of improvements in material-handling devices, furnace refractories and annealing furnaces (chiefly for steel), and of modern types of welding torches and atmosphere regulators for furnaces.—A. R. P.

Industrial Furnaces Heated by Fuel—Heat-Treatment and Melting of Metals in England. Anon. (*Metallwirtschaft*, 1926, 5, 685-686).—A short description is given of various furnaces of the Incandescent Heat Co., Ltd., Birmingham.—B. B.

When is Electric Heating Advisable? Anon. (*Met. Ind. (N.Y.)*, 1926, 24, 58-59).—A full, illustrated abstract of a serial report of the power committee of the National Electric Light Association, New York. It attempts to point out a few of the steps in the development of industrial electric heating, together with the reasons for them, and the general plan of future development. Various industrial heating processes are listed in tabular form, and opposite each are tabulated the corresponding temperatures involved, the load range (kw.), the power factor (%), and an indication as to whether the adoption of electric heating is standardized or might incur development charges, and whether its adoption is desirable, undesirable, or questionable. The report is interesting, and should be of use to those who may be contemplating installation of electric power for heating.—T. B. C.

Furnaces and Combustion. Anon. (*Engineer*, 1926, 141, 102).—A general discussion on the relation between the volume of a furnace and a proper combustion of solid, pulverized, and liquid fuels, and on recent improvements for the accelerating of the combustion.—B. B.

Radiant-Heat Furnaces. Anon. (*Engineering*, 1926, 121, 106-108).—The phenomenon of surface combustion, which is applied now to industrial heating processes, has the advantages of enabling high furnace temperatures to be obtained in conjunction with perfect combustion, high thermal efficiency, and with complete absence of flame. Certain operations for which muffles or crucibles have normally to be employed can be carried out in open furnaces of this type. Messrs. Krupp of Essen developed a series of various industrial furnaces, employing the principle of surface combustion, and called them radiant-brick furnaces. They are made for practically all industrial processes, such as reheating, forging, welding, annealing, tempering, hardening, melting, &c. Any kind of clean gas can be used as fuel. The heating element which is employed in all cases is described. An illustrated description of some typical examples of furnaces is given. Stein and Atkinson, Ltd., 47 Victoria Street, London, S.W. 1, have acquired the right to carry out the construction of these furnaces in Great Britain.—B. B.

Radiant-Heat Furnaces. T. G. Tulloch (*Engineering*, 1926, **121**, 166).—T. discusses the Krupp radiant-heat furnaces, and finds that a true surface combustion principle is not employed in this furnace. It appears to him that the Krupp design is only another form of a blowpipe where no catalytic surface action occurs, which should be in case of surface combustion. [See also a letter of J. S. Atkinson (*ibid.*, 1926, **121**, 273) and a reply of T. G. Tulloch (*ibid.*, 376), which both contain interesting discussion.]—B. B.

The Krupp Radiant-Brick Furnace. F. Muhlert (*Apparatebau*, 1926, **38**, 259–261).—Gas furnaces are described in which the lining of brick is heated by surface combustion of an intimate mixture of gas and air. Too early combustion is prevented by a special contrivance. The time of heating with furnace temperatures of 1000° to 1600° is 5 to 20 minutes. The efficiency measure in production is 30 to 50%.—G. S.

Heating and Cooling of Metals by Radiation. G. Moressée (*Rev. univ. Mines*, 1926, [vii.], **11**, 175–186).—Mathematical. The heating or cooling of metals by radiation follows a logarithmic law—i.e. $T_1/T_2 = e^k t$, where T_1 is the initial and T_2 the final temperature (abs.) after the lapse of time t .—A. R. P.

Utilizing Waste Heat from Crucible Furnaces, &c. Walter J. May (*Mech. World*, 1926, **80**, 359–360).—The two most important ways in which the waste heat from crucible furnaces could be utilized would be for heating the core oven (e.g. cores of tube ingots), drying pickled castings, and warming crucibles. So long as the gases in the chimney are at a temperature of 320° to 375° C., there will be sufficient “pull” to effect the highest rate of combustion of the fuel. Any excess of heat in the furnace gases above that required to maintain such a “pull” may be safely utilized. The general design of flues, their position and cross-sectional area, are discussed and illustrated. The complete abstraction of heat from the furnace gases is a positive advantage where a suction fan is used to induce furnace draught, as the fan would have a longer life. The supply of heated water is another form of utilization of waste heat. The cupola offers little scope for economical utilization of waste heat.—F. J.

Heating Phenomena in Muffle Furnaces. B. V. Starck (*J. Russ. Met. Soc.*, 1926, Part I, (2), 184–198).—[In Russian.] The processes of heating and cooling are described. The heating of a body in a furnace is mainly effected

Body heated from 0° C. up to	Temperature in the Vertical Muffle Furnace, ° C.							
	617.	717.	817.	917.	1017.	1117.	1217.	
100°	16·5	10·5	7·0	5·0	3·5	...	...	Time of heating in seconds.
200°	33·0	21·5	14·5	10·0	7·5	...	...	
300°	51·5	32·5	22·0	15·5	11·0	8·0	...	
400°	72·5	45·0	29·0	20·6	15·0	...	8·0	
500°	101·5	59·5	39·0	26·5	18·0	...	...	
600°	176·0	80·0	50·0	33·5	23·0	17·0	...	
700°	...	133·5	65·0	41·0	28·0	...	...	
800°	...	...	104·0	52·0	34·0	24·0	17·5	
900°	...	...	...	82·5	43·0	28·5	...	
1000°	...	...	...	...	66·5	35·5	24·5	
1100°	...	...	...	...	...	54·5	30·0	
1200°	...	...	...	...	...	...	45·0	

by four processes: radiation, convection, conduction through the furnace atmosphere, and conduction through the arrangements for the supporting of the heated body. Of these processes the first two are the most important. After a theoretical discussion of these processes, S. concludes that the heated body reaches the temperature of the furnace at a quicker rate when the latter is higher. This conclusion is also supported by experiments of N. I. Belaïev and P. F. Butirin, conducted at the Putiloff Works at Petrograd. Time and speed of heating of a body in a furnace up to different temperatures at different temperatures of the furnace are given in the form of tables and diagrams. In the above table the time of heating is given in seconds.—B. B.

Recuperator. Anon. (*Chem. and Met. Eng.*, 1926, **33**, 565).—A recuperator built of metal is designed so that part of the air, on first entering, comes in contact with the hottest surfaces. This is said to give a greater rate of heat transfer, and to ensure that the metal in the region of the hottest gases is always cool enough for safe working. The recuperator, which is illustrated, is marketed by the Mantle Engineering Co., Pittsburgh, Pa.—F. J.

Interlocking Tiles for Furnace Roofs. Anon. (*Found. Trade J.*, 1926, **34**, 336).—An illustrated description of an interlocking furnace roof tile which has been designed and patented in the U.S.A. Among other advantages, broken pieces, if of appreciable size, cannot slip free or fall out.—W. H. D.

Suspended Open-Hearth Roofs. Anon. (*Iron Steel Canada*, 1926, **9**, 93-94).—A description of the suspended type of furnace roof. Two sets of silica bricks are used, one being hung from the furnace roof and the other set acting as fillers and fitting in between the suspended bricks. The entire weight of the roof is suspended vertically, and the bricks are thus relieved of the crushing pressure involved in the sprung arch construction. Arrangements are made to allow for expansion and contraction.—W. H.-R.

A New Incandescent High-Temperature Melting Furnace. Anon. (*Met. Ind. (Lond.)*, 1926, **29**, 60-61).—An account of a small gas-fired furnace for the crucible melting of metals and alloys. A low-pressure—6-10 in. water-gauge—heated air-blast is used with ordinary main pressure gas. A special feature of the furnace is the recuperative down-draught tower at the back of the melting chamber. The furnace develops temperatures up to 1700° C. rapidly. This type of furnace can be oil-fired.—E. C.

Town Gas-Fired Plate and Bar Reheating Furnace. Priest Furnaces, Ltd. (*Gas J.*, 1926, **176**, 290).—A plate and bar reheating furnace of the regenerative-recuperative type, 58 ft. long and fired by town's gas, is briefly described. The gas consumption of the furnace on starting up is about 15,000 cu. ft. per hr.—J. S. G. T.

Burner Selection Involves Study of Entire Heating Problem. Anon. (*Iron Trade Rev.*, 1926, **79**, 576-577).—An abstract of a publication (*Bull.* No. 270; W. S. Rockwell Co., New York) on oil and gas burners, the object of which is to indicate briefly the conditions governing selection and application of suitable burners.—T. B. C.

Novel Ideas Feature: Home-Made Brass Furnaces. Anon. (*Foundry*, 1926, **54**, 28-30).—A battery of oil-fired crucible furnaces for melting non-ferrous metals, as designed by C. Franz, is illustrated and described. A special feature is the cast-iron frame brick-lined cover, pivoted and counterpoised to facilitate manipulation. This is described in detail, only a slight pressure being required to lift the whole cover, which weighs 400 lb. There are 4 furnaces, each designed to hold 4 crucibles, but actually restricted to 3, the space for a fourth being used for preheating or drying crucibles. The oil is gravity fed, and air at 1 lb./in.² is used. Either a light distillate oil or waste oil from

automobile filling stations is used, the oil consumption being 1.97 gall. per 100 lb. metal melted.—F. J.

Improved Oil Fuel Burners. Anon. (*Amer. Machinist (Eur. Edn.)*, 1926, 64, 54E).—The "Alcosa" oil burners, having improved features, are illustrated and described. They are made in various sizes for operating with low-pressure fan-blast, high-pressure air, or with dry steam. In the larger forms micrometer adjustment is provided for regulating both air and oil supply, two separate hand-wheel adjustments being fitted.—F. J.

The Use of Electric Furnaces at Niagara Falls, 1902-1926. F. A. J. FitzGerald (*Amer. Electrochem. Soc. (Advance Copy)*, 1927, April, 47-50).—This paper presents figures showing the remarkable growth of furnaces used in certain electrothermic processes at Niagara Falls during the past 25 years.

Electric Furnaces for Smelting. F. W. Freise (*Revista Brasil. Eng.*, 1925, 9, 46-49; *Eng. Index*, 1925, 248).—Discusses the application of electric furnaces to copper, tin, zinc, and their alloys; their advantages, power consumption, and comparative cost data.

The Electric Furnace in the Metal Industry. T. Metzger (*Z. V. d. I.*, 1926, 70, 349-356).—The latest designs of electric furnaces used in the metal industry are described. Induction furnaces with an efficiency from 88 to 90% are much in use for brass. Bronze and red brass can be melted in the electric arc furnace. High-frequency furnaces are used for alloys with a high melting point; the efficiency is about 65%. In order to get a good mixing of the bath, special mechanical or electrical contrivances are provided.—G. S.

The Complete Electrification of the Foundry Industry. Leonard W. Egan (*Proc. Assoc. Iron Steel Elect. Eng.*, 1923, 17, 377-420).—Details of equipment are given. The most comprehensive review covers the types and performances of the chief forms of electric melting furnaces available for foundry use, particularly for non-ferrous metals and alloys. The reclamation of castings by various methods of electric welding is discussed in the light of the best practice in particular cases.—J. P.

Twenty-Five Years of Non-Ferrous Electrothermics; Fifteen Years of Electric Brass Melting. H. W. Gillett (*Amer. Electrochem. Soc. (Advance Copy)*, 1927, April, 229-249).—Aside from electric reduction in fused salts and the making of ferro-alloys, electrothermic reduction of ores of the non-ferrous metals is not commercially practised in America. Electrothermics finds some application in annealing and heat-treatment of non-ferrous alloys, but its chief application is in melting. About 25% of the type metal is electrically melted. Electric melting is practically standard for nickel and its alloys. About 90% of the output of brass, bronze, and "nickel-silver" from the rolling-mills and nearly 30% of the output from foundries is melted in electric furnaces. The proportion of electrically melted metal is much greater in the brass industry than in the steel industry. Electric brass melting is now practically standardized upon three specific types of furnaces. Of all the 1000 individual electric brass furnaces that have been built in America, both for domestic and export trade, more than 80% have been of these three types. About 675,000 tons of brass, bronze, and "nickel-silver" were electrically melted in 1926, requiring 180 million kw.-hr. Electric brass furnaces used \$3,000,000 worth of electric energy in 1926, used 40,000 fewer tons of fuel to generate the electricity than would have been used direct in fuel-fired furnaces, and saved 13,500 tons of metal that the fuel-fired furnaces would have lost. The saved metal is worth \$2,500,000 a year. The development of electric brass melting to the present point, where about 625 electric furnaces are in

active use in the United States and Canada by about 175 different firms, G. states to have been wholly brought about by American electro-metallurgists.

The Use of Electric Furnaces in Alloy and Non-Ferrous Metal Foundries. Albert Levasseur (*Bull. Soc. franç. Elect.*, 1926, [iv.], 6, 893-913).—The reasons which have delayed the introduction of electric furnaces for alloy melting are discussed. The principal types are described, and tables showing the energy consumed in melting various alloys are given and compared with non-electric furnaces. It is concluded that their use will become as general in France as it is in America.—C. J. S.

The Electrical Melting of Metals with High Thermal Conductivity. R. Horn (*Elektrotech. Anzeiger*, 1926, 43, 189-190).—An electric furnace designed for melting metal with a high thermal conductivity is described. Furnaces in which iron and steel are melted in an electric arc are not suitable for copper or zinc and similar metals on account of the loss of material by vaporization. The furnace described is fed by 3-phase current using carbon electrodes, and the heat is transferred to the metal at a number of points so that the whole bulk of the metal becomes heated without any one point becoming too hot. For furnaces of capacity 1-5 tons a current of 2500-4200 amp. and 18-40 v. is used.—J. F. S.

Notes on Furnaces for Electrochemistry. — Bergeon and — Bunet (*Bull. Soc. franç. Elect.*, 1926, 6, 873-892).—The design of transformers for metallurgical furnaces is discussed, particularly with respect to the power factor of the installation. An empirical formula for calculating the power factor of a furnace is developed.—C. J. S.

Electric Melting Furnaces. J. A. Seede (*Proc. Assoc. Iron Steel Elect. Eng.*, 1924, 18, 735-748).—The developments in electric furnaces have been partly due to refinements in design, accessories and operation, and to increasing the productive capacity of the furnace. Details are given of the working and power consumption of several types of commercial furnaces, the multiple melting form on a turn-table being a novelty. The activities in melting and heat-treatment of metals and alloys show that the electric furnace is assuming its proper position as a factor of great industrial importance. In view of the economies effected, convenience and precision of operation and comparative quality of product, such progress is inevitable.—J. P.

New Tilting Type Electric Furnace. Anon. (*Western Mach. World*, 1925, 16, 464-465; *Eng. Index*, 1925, 248).—Describes the Kay patented furnace. The body is mounted to rotate on substantially horizontal axis, with a spout at each end for the pouring of metal.

The Miguet Electrode and the Miguet Furnace. Marcel Arrouet (*Amer. Electrochem. Soc.* (Advance Copy), 1927, April, 351-354).—For high-power electric furnaces, 3-phase has been preferred in the past. However, A. shows that when properly designed large single-phase furnaces are practical and will operate efficiently. A feature of the new furnace is A.'s improved continuous electrode of large cross-section. The bottom of the electrode is about 20 cm. above the bath, leaving a spacious zone for carrying out various reactions, such as refining and alloying.

Electric High-Temperature Furnaces up to 3300° C. by Geheimrat Professor Dr. Tammann, Göttingen. E. Löwenstein (*Z. anorg. Chem.*, 1926, 154, 173-177).—The short circuit furnaces with coal or graphite tubes, known as "Tammann" furnaces, are briefly described.—G. S.

A 100,000 Ampere Electric Furnace. Anon. (*Elect. Rev.*, 1926, 99, 597).—It has been found that large furnaces can be operated more economically than small ones. In a furnace of several thousand kw. capacity 1 ton of

carbide is produced per 3500 kw.-hrs., whilst in a 500-kw. furnace 4500 kw.-hrs. are required. The furnace described has a single carbon electrode 7 ft. 6 in. in diameter and 4 ft. high. An empirical formula is given for the power factor, $\sin \varphi = 3BIf \cdot 10^{-6}/nU$, where B is the length of the loop in metres, I the current, f the frequency, n the number of separate circuits connected to the electrodes, and U the voltage at the secondary terminals of the transformer.

—C. J. S.

The 100,000 Ampere Furnace at Saint-Julien de Maurienne. Paul Bergeon (*Bull. Soc. franç. Élect.*, 1926, **6**, 75–80).—Details of construction of this furnace, which has a single carbon electrode, are given. Steps taken to reduce the inductance are described, and an empirical formula for calculating the power factor of a furnace, independent of the dimensions, is given.

—C. J. S.

Electric Brass Melting Reduces Costs. H. C. Thuerk (*Elect. World*, 1925, **85**, 357–358).—The installation of electric furnaces in place of coke-fired pit furnaces in 2 brass foundries reduced the melting costs from \$15 to \$12 per ton in one case, and from \$19 to \$15 per ton in the other. The furnaces had a capacity of 750 lb. each.—C. J. S.

Electrification of the International Nickel Coy.'s Works for Monel Metal. F. C. Watson (*Proc. Assoc. Iron Steel Elect. Eng.*, 1922, **16**, 415–460).—Two electric refining furnaces are installed of 3 and 7 tons capacity. Details are given of plant lay-out, and power distribution to various mills and motors. The furnaces are run on two voltages as required, using 3-phase current. In operation they are charged with cold metal, and the power consumption varies from 642 to 714 kw.-hrs. per ton of melted metal. The furnaces have been in successful operation for some time with good results, and both have a power factor averaging 0.90.—J. P.

Electric Heat Applied to Type Castings. Anon. (*Elect. World*, 1926, **88**, 706).—A plea for the greater use of electricity in heating type-metal melting pots.—C. J. S.

Small Electric Smelting Furnace for White Metal, Aluminium, Magnesium, and their Alloys. W. Rohn (*Eng. Progress*, 1925, **6**, 71–72).—Translated from *Z. Metallkunde*, 1924, **16**, 396–398. (*J.*, 1925, **34**, 637.)

Electric Furnace for Silicon-Manganese. Anon. (*Four elect.*, 1926, **35**, 165–166).—The furnace absorbs 1250 kw. and has two electrodes in series. Arrangements have been made by special suspension devices to reduce the time necessary to change an electrode to a minimum (about 13 minutes). Each electrode is of square section, 350 mm. side. Graphite is consumed at the rate of 90 kg. per ton of silicon-manganese, containing 50% of manganese, produced. About 5500 kw.-hrs. are absorbed per ton of alloy produced.

—W. A. C. N.

Electric Furnaces for Castings and Ingots. Edward T. Moore (*Elect. J.*, 1926, **23**, 279–284).—A description of a 15-ton 3-electrode steel-melting furnace.—C. J. S.

Electrically Heated Tinning Pots. Anon. (*Elect. World*, 1926, **88**, 807–808).—Electrically heated sheet metal tinning pots are described. Advantages claimed are: Uniform thickness of tin deposited, automatic control, and lower tin losses due to better temperature control.—C. J. S.

Medium and Low Temperature Applications. E. A. Hurme (*Proc. Assoc. Iron Steel Elect. Eng.*, 1924, **18**, 771–798).—The classification of furnaces for 1000° to 2000° F. is given as medium, and ovens operating below 1000° F. as low-temperature units. The construction and automatic control of small and medium-sized furnaces are described. The figures given also include operating

costs in comparison with gas. Numerous applications of the low-temperature heating are given, including preheating for rolling operations and foundry drying and pattern plate heating.—J. P.

Medium Temperature Furnace Installations. C. F. Cone (*Proc. Assoc. Iron Steel Elect. Eng.*, 1924, 18, 747-770).—Numerous practical instances are quoted to show the certainty and efficiency of the resistor type of electric annealing and baking ovens for many purposes. Both intermittent and continuous forms are illustrated, some of the latter being rotary in action. The use of these furnaces has been found to raise the plant power factor by a large amount (up to 30%) with consequent decreased cost per kw.-hr. for the whole plant. Power consumption for various operations and furnace sizes are given for each type.—J. P.

Electric Heat-Treating Furnaces. Anon. (*Siemens Z.*, 1926, 6, 166-168).—A review.

Electric Annealing at Walworth Plant. J. L. Faden and J. D. McManus (*Elect. World*, 1926, 88, 215-218).—Oil-fired furnaces have been replaced by resistance furnaces for annealing steel forgings. A 180-kw. furnace, divided into 8 chambers, is used, and the forgings are carried through on hydraulically operated cars. A much better temp. control is obtained, and the annealing cycle reduced from 1 week to 6 hrs. The operating costs, with power at 1.25 cents per unit, are reduced by 25%.—C. J. S.

Electric Heat-Treating of Steel Castings. L. E. Everett (*Elect. World*, 1926, 87, 1233-1236).—The practical advantages of electric furnaces for annealing purposes are discussed.—C. J. S.

Electric Heat for the Machine Shop. P. F. Creasy (*Amer. Machinist (Eur. Edn.)*, 1926, 64, 865-868).—Various applications of electricity for heating appliances are described and illustrated. These include furnaces for the bright hardening of steel wire, lead baths, ovens, crucible furnaces, &c. The flexibility of design permitted by the use of metallic resistor electric heating elements gives this form of heating a decided advantage over the more cumbersome and unwieldy fuel-burning designs for special applications. This feature, combined with other inherent advantages (which are enumerated), accounts for the rapid growth in the use of electric heat for mechanically operated and continuous types of furnace, such as the wire hardening furnace above mentioned. Special electric furnaces are now supplied for low melting point alloys—e.g. solders, Babbitt, type metals, lead, and zinc.—F. J.

Electric Furnaces at Works of Auto Machinery Co., Ltd. Anon. (*Amer. Machinist (Eur. Edn.)*, 1926, 65, 26-28E).—Various types of electric furnace, as installed for heat-treatment of steel, are illustrated and described.—F. J.

Electric Annealing and Heat-Treating Furnaces. George P. Mills (*Proc. Assoc. Iron Steel Elect. Eng.*, 1921, 15, 1-20).—Details are given of the construction and use of a Nichrome ribbon resistor type of furnace, which is very efficient, and showed no deterioration after two years' service. The space occupied by the furnace is small compared with other types, and no fuel storage space is required. Working conditions are excellent in the absence of fumes, dirt, and noise. Two important considerations in laying out a new furnace were stated as: (1) The relation of furnace size to output, as it should be loaded to full capacity at all times; variation in production should be met by installing two or more furnaces to ensure capacity operation in those that are running. (2) Handling equipment and devices should be co-ordinated nicely with the furnace; high-grade work can easily be spoiled in handling from the furnace, regardless of the fact that the furnace itself might be working perfectly.—J. P.

Foundry has Electric Ovens. Anon. (*Iron Age*, 1926, 117, 1703-1707).—The Ross-Meehan Foundry is completely equipped, from melting to heat-treatment plants, with electric furnaces. They are used mostly for the manufacture of steel products. The melting furnace is a 3-electrode tilting type with a nominal rating of 3 tons per heat. Up to 12 tons, however, has been melted in it by reducing the thickness of the lining. Moulds and cores are dried in electric ovens, a temperature variation of only 5° F. being attained. The time of heating is controlled automatically by clocks fitted in the heating circuit. The moulds are fed in on trucks, and heating units are placed in the side walls and in a pit underneath the truck. Castings are annealed in a car-bottom type furnace with a capacity of 10 tons.—W. A. C. N.

Heating Element. Anon. (*Chem. and Met. Eng.*, 1926, 33, 435).—In the Backer process for insulating the element of an electrical heating device, applicable to water-heaters and hot plates, "Pyrox" is used (name derived from pyrochroite, a white manganese oxide crystallizing in the rhombohedral system). It is obtained by the conversion of metallic magnesium into hydroxide by the application of steam at 300 lb. pressure. The hydroxide is then changed to oxide by heating. The details of manufacture of the element are briefly described, and the advantages of the heaters equipped therewith discussed.—F. J.

Resistor Tubes for Small Furnaces. Anon. (*Chem. and Met. Eng.*, 1926, 33, 641).—Alundum tubes for supporting the molybdenum resistance wire have been found satisfactory in tubular furnaces used for wire-drawing in the manufacture of incandescent lamp filaments. The molybdenum wound tube is surrounded with magnesia, through which hydrogen can be passed to prevent oxidation of the molybdenum. Temperatures up to 1700° C. can be reached. Longitudinal and transverse sections of the furnace are illustrated.—F. J.

A General Method for Calculating the Properties of 3-Phase Y-Connected Arc Systems. A. E. R. Westman (*Trans. Amer. Electrochem. Soc.*, 1926, 49, 313-324).—See *J.*, 1926, 35, 831.

The Power Factor of Electric Furnaces. P. Bergeon (*Bull. Soc. franç. Élect.*, 1926, 6, 292-296).—The empirical formula given for the power factor is $\sin \phi = 3bIf \cdot 10^{-6}/Un$, where b is the length of the loop in metres, I the current, f the frequency, U the voltage of the secondary of the transformer, and n the number of separate circuits to the electrodes.—C. J. S.

The Power Factor of Electric Furnaces. — Bergeon (*Four élect.*, 1926, 35, 115-116).—The power absorbed by a furnace is $P = UI \cos \phi$, where U is the potential across the furnace terminals, I is the current, and ϕ is the angle in the vector diagram comprising the elements U , RI , and $L\omega I$. $\sin \phi$ is given by $\frac{L\omega I}{U}$; hence the power factor may be found provided L (the self-inductance) be known. B. develops these formulæ and applies them to known cases.—W. A. C. N.

Vector Diagram for Electric Furnaces. J. Berthenod (*Rev. Gén. Élect.*, 1926, 10, 697-698).—It is shown that the operation of electric furnaces can be studied very completely by means of a "circle" diagram analogous to that used for induction motors.—C. J. S.

Automatic Regulation of Electric Furnaces. Anon. (*Four élect.*, 1926, 35, 51-53, 100-102).—The Thury regulator is described in detail, and diagrams, both of the individual machine and the lay-out when connected to an arc furnace, are given. It consists essentially of the following parts: Solenoid, automatic commutator, bipolar switches, an additional supply of direct

current, and a transformer in the furnace circuit. Regulation of either tension or the current intensity may be accomplished by coupling the apparatus at different points in the circuit. The second regulator studied is the B.B.C. (Brown Boveri), in which hydraulic power is employed. The water pressure varies between 4 and 10 atmospheres.—W. A. C. N.

Auxiliary Equipment for Electric Furnaces. J. O. Keller (*Fuels and Furnaces*, 1926, 4, 49-56, 661-672, 789-794).—Illustrations with brief descriptions are given of various types of switch gear, fuse boxes, a.c. contactors, control panels, relays, meters, transformers, and temperature control gears for operating electric furnaces, and in some cases wiring diagrams are also shown.—A. R. P.

The Theory of Electric Arc Furnaces According to Recent Investigations. E. de Loisy (*Rev. Mét.*, 1926, 23, 253-268).—The remarkably rapid development of the arc furnace during the last 30 years is noted, and its effects on industrial processes, such as the manufacture of calcium carbide and ferro-alloys. It is pointed out that it is probably on account of this rapid practical progress that the complete theory of the arc furnace had not been thoroughly investigated until recently. The various factors concerned in the working of the furnace are mathematically considered. The work of Bergeon is quoted in the general exposition, whilst that of E. Riecke is translated in full, and included as a separate part of the memoir.—F. J.

Electrode Regulation in Electric Arc Furnaces. Ernst Blau (*Helios*, 1926, 32, 289-292).—Control of the current in electric arc furnaces depends upon the arc length, which may be regulated automatically. Several systems are in use and 3 are described in detail. The electrode winding motors may be controlled: (1) By relay; (2) by Tirrill regulator; (3) the electrodes are hydraulically operated but controlled electrically.—C. J. S.

The Detroit Electric Rocking Furnace for Melting Metals and Metallic Alloys. Hans Nathusius (*Giesserei-Zeit.*, 1926, 23, 509-511).—The Detroit electric rocking furnace is of the indirect arc type and appears to be extensively used in America for melting copper, bronze, and brass. The manufacturers claim a low power cost per ton of metal, a high electrical efficiency, low metal losses, and accurate control of casting. In support of this claim the author quotes the working details of several American foundries and compares the power consumption, &c., with that of other types of electric furnace.

—A. R. P.

Electric Resistance Furnaces. W. Y. Anderson and W. P. Conly (*Elect. Rev.*, 1926, 99, 178-179).—An electric resistance furnace installed by the Birmingham Electricity Department is described. The heating chamber is 60 in. long by 40 in. wide by 20 in. high. The body of the furnace is made of mild steel sheet and angles, and the internal face is lined with refractory brick. Between this is an insulating layer of firebrick. Nichrome spirals carried in grooves in the refractory are used for the heating element. Data on power consumption is given. Radiation losses are 11 kw. at 500° C. and 23 kw. at the maximum temp. of 900° C. The furnace takes 3 hrs. to heat up from cold, consuming 51 kw. per hr. The furnace can be operated automatically by means of a time clock and thermo-regulator.—C. J. S.

High-Speed High-Frequency Inductive Heating. E. F. Northrup (*Amer. Electrochem. Soc. (Advance Copy)*, 1927, April, 497-513).—H. F. inductive heating permits of almost unlimited speed of heating of a continuous conducting mass. The new 300-lb. (136 kg.) commercial alloy melting furnace is described. It is especially designed for melting ferrous alloys. Power is supplied by a 150-kva. generator at 1920 cycles and 900 v. The very rapid heating gives

a very high melting efficiency. Various examples are cited and efficiency calculations appended. Nichrome required 462 kw.-hrs. per metric ton.

On High-Frequency Furnaces. J. Bronn (*Z. Metallkunde*, 1926, **18**, 333-338).—The transformation of usual a.c. into high-frequency current, and the construction as well as the manner of acting of a high-frequency furnace of the Compagnie Electro-Thermique, are fully described. The work of G. Ribaud on the influence of different factors on the grade of action of high-frequency furnaces is discussed in detail. The dependence of the reception of heat of the metal within the furnace upon its electrical conductivity, the number of periods, the relation of the diameter and the height of the body to the diameter and the height of the coils of the furnace, the number and closeness and the cross-section of the coils are considered. The capacity of action, the economy of high-frequency furnaces in relation to induction furnaces, and some other advantages are referred to.—M. H.

The High-Frequency Electric Furnace. M. Gutmann (*Four élect.*, 1926, **35**, 65-67).—Credit is given Messrs. Schneider in France for the conception of the first ideas on high-frequency furnaces, and to Northrup for developing the furnace on slightly different lines, to a satisfactory working proposition. The adoption of a high-frequency generator has not yet made great strides in France, but in America the Westinghouse Co. have been able to supersede the old spark gap arrangement by a stable generating set. The advantages of the high-frequency furnace are well known—purity of product, attainment of high temperatures, and facility of fusion. The current consumption for nickel melting is said to be 350 kw.-hrs. per ton, and charges up to 150 kg. are now being melted in this type of furnace.—W. A. C. N.

Electrical High-Frequency Induction Furnaces for Very High Temperatures. G. Ribaud (*Compt. rend.*, 1925, **180**, 1733-1735).—The heating space is a graphite tube supported vertically and terminating at one (or both) ends in a cylindrical piece of porous carbon, which is closed by a plug (also of carbon) provided with a glass window and bored to admit a current of inert gas, and to allow it and gaseous products to escape. If the cylindrical piece and the plug are at least 8 cm. long, their thermal conductivity is so low that the plug may be removed by hand, even when the interior is at 3000° C. With a consumption of 10 kw., a temperature of 3000° can be attained in a furnace holding 100 c.c., 2500° in a 500 c.c. furnace, and 1800° in one containing 3000 c.c. The porous carbon plug is very durable.—E. H. T.

High-Frequency or "Ironless" Induction Furnaces. Anon. (*Nature*, 1926, **117**, 760-762).—A description of an ironless induction furnace, the theory and applications. The article closes with a short bibliography of the subject.—J. F. S.

The Ironless Induction Furnace. W. Fischer (*Z. tech. Physik*, 1926, **7**, 513-518).—The theory of high-frequency furnaces is developed and some examples described (see Franz Wever and W. Fischer, *Mitt. K.-W. Inst. Eisenforschung*, 1926, **8**, 149-170—abstract below).—G. S.

The High-Frequency Induction Furnace. F. Wever (*Stahl u. Eisen*, 1926, **46**, 533-536).—A new arrangement for high-frequency plant, built after the principle of radio plant, is described, whereby the coreless induction furnace has a higher efficiency. Other advantages of the furnace are: Quicker bath reaction in consequence of the electro-mechanical motion of the bath, and the possibility of melting in vacuum or in certain atmospheres.—G. S.

Information on the High-Frequency Induction Furnace. I.—Theory and Construction of Ironless Induction Furnaces. Franz Wever and Wilhelm Fischer (*Mitt. K.-W. Inst. Eisenforschung*, 1926, **8**, 149-170).—Coreless

induction furnaces, which are heated by high-frequency energy, promise to become more important in the factory as well as in the laboratory. The influence of the different factors, such as frequency, nature of the material to be melted, as also the size of the furnace, are examined mathematically and the conditions for the highest efficiency obtained. Small furnaces require frequencies up to 8000 periods/sec.; with larger furnaces it is possible to go down to 500. A description and working results of furnaces of 3 and 30 kw. are given. The furnace efficiency reaches 55% under the best conditions.

—G. S.

Information on the High-Frequency Induction Furnace. II.—On the Metallurgy of Ironless Induction Furnaces. F. Wever and H. Neuhaus (Mitt. K.-W. Inst. Eisenforschung, 1926, 8, 171-179).—Tests with melting of iron and nickel show the value of high-frequency furnaces in manufacturing high percentage metals and alloys. The advantages of the furnaces lie in the rapid movement of the bath caused by the electrical processes.

—G. S.

Induction Furnace Produces Superior Brass. G. C. Heisterman (Elect. World, 1925, 85, 617).—Low metal loss and greater uniformity of product are caused as the result of installing induction furnaces for brass melting.—C. J. S.

Radio-Operated Furnace Melts Precious Metals. Anon. (Sci. American 1926, 135, 134-135).—A high-frequency furnace operated from six 250-watt valves has been installed in the Metallurgical Division of the (U.S.) Bureau of Standards. A short description of the principle of high-frequency furnaces is given, but the usual spark-gap and condenser converter only is described, no particulars being given of the valve installation.—J. C. C.

FUELS.

On the Theory of Heating [by Fuel]. Henry Le Chatelier (Rev. Mét., 1926, 23, 629-648).—Le C. discusses at length the production and utilization of heat derived from the combustion of fuel. The transfer and utilization of heat are regulated by the laws of energy. The reasoning of Sadi Carnot on the mechanical power of heat is equally valuable in dealing with its heating power. Lord Kelvin pointed out that all operations of heating by fuel, carried out according to a strictly reversible process, give the maximum calorific return, and recommended the application of the Carnot cycle as far as possible. The work of Siemens in connection with recuperation and regeneration is also mentioned. Carnot compared the utilization of heat falling from a high temperature to a lower one with that of a mass of water falling from a high to a low level. The passive resistances met with in each case resemble one another. The furnaces selected for furnishing the data upon which the extensive calculations of the author are based are of the cylindrical type, this being the type which gives the highest thermal efficiency. The calcination of quartz in the ceramic industry, the melting of pig iron, and the calcination of limestone are taken as typical operations. In each case the various reactions are fully discussed by the aid of diagrams and equations. The utilization of heat by leading the hot gases from the top of the furnace to the bottom for mixing with the air used for combustion is theoretically wrong, but has certain indirect advantages. In cylindrical furnaces the heat changes are regulated by the laws of energy, and can be calculated strictly if small losses due to thermal conductivity are neglected. The subject is very thoroughly discussed.—F. J.

Selection of Fuel for the Heat-Treatment of Metal. — (*Met. Ind. (N.Y.)*, 1926, **24**, 112).—Abstract of a publication of the W. S. Rockwell Co., New York. Great stress is laid upon the contention that the selection of a fuel (or electricity) for heat-treating metal, if based upon an abstract comparison of the heating value of different forms of fuel, is misleading, and that if real economy and efficiency are to be attained in this connection, due consideration of the overall cost and the nature and quantity of the particular line of finished goods upon which a manufacturer is concentrating should be given. The abstract, however [and possibly the original paper—*Note by Abstractor*], falls short of actual illustrations of the application of this principle to actual instances, thereby lessening its value, and rather lamely concludes with a table which merely expresses the cost, in dollars, per million B.th.u. of various fuels of stated calorific values.—T. B. C.

Selection of Fuel for the Heat-Treatment of Metal. J. A. Doyle (*Machinery (N.Y.)*, 1926, **32**, 503).—It is emphasized that no one fuel is best for all conditions. Each problem must be considered separately, and all circumstances taken into account.—J. C. C.

Factors Affecting Selection of Fuel. Anon. (*Blast-Fur. and Steel Plant*, 1926, **14**, 141-145).—An excellent and well-illustrated review. The ultimate choice should be based on cost per unit of goods manufactured and not on fuel costs alone. Hence furnace design must be fully considered with relation to the fuel and its character. The method of considering the relative costs and efficiencies of various fuels (including electricity) is indicated.—W. L. K.

Fuel Economy in the Foundry. A. Campion (*Met. Ind. (Lond.)*, 1926, **29**, 63-65).—Heat generation, temperature of gaseous current, heating reverberatory furnaces, annealing operations, drying moulds, etc., are discussed.—E. C.

Fuel Economy and the Metallurgical Industry. E. W. Smith (*Gas World*, 1927, **86**, 240-242).—[Read before the Co-ordinating Committee of the Staffordshire Iron and Steel Institute, the Birmingham Metallurgical Society, and the Birmingham Local Section, Institute of Metals.] Differential charges for town's gas used for industrial and domestic purposes, waste-heat boilers, blast-furnace gas, and the thermal insulation of plant by aluminium paint, are briefly discussed.—J. S. G. T.

Comparison of Gas and Electricity for Industrial Heating. R. C. Gosreau (*Chem. and Met. Eng.*, 1926, **33**, 337-339).—The cost of heating in a process should not be based on the purchase price per cu. ft. of gas or kw.-hr. of electricity, but should be calculated in accord with the degree of utilization possible of the potential energy in the source of heat. Thus the laboratory test which determines the calorific value of a gas gives no clue to the results of its utilization or efficiency. A gas-burner may have an efficiency, *e.g.*, of only 72%. Another important factor is rate of heat absorption by the work, which is, in general, greater the larger the chamber in which the work is placed, provided that the chamber walls are hotter than the work. The tendency is to build the setting so that the maximum of heat generation may be effected in a minimum of space, which minimizes the heat losses and accelerates the process. Gas-fired furnaces at working temperatures from 540° to 1000° C. often have a large ratio of furnace volume to size of work. The reasons are given. Gas suffers in calculations of heat losses and heat utilization, owing to their approximate nature and exclusion of consideration of practical conditions. In some equipments, heating by direct flame radiation is attempted, and this is more economical than indirect heating, if direct impingement of the flame does not injure the work. General considerations of applying electricity to heating are given, and the significant points which constitute good designs for electrical

radiation heating apparatus are enumerated. Economic and commercial considerations, supported by calculations, disclose that many electrical industrial furnaces are operating with an overall utilization of the potential energy consumed approaching 85%, whereas the utilization value of gas may be as low as 50%. As the unit value of energy in any fuel increases, the percentage of utilization must increase or its use becomes prohibitive. Thus the cost of a fuel is not the determining factor but the degree of utilization.

—F. J.

Industrial Heating by Town's Gas. C. M. Walter (*Gas World*, 1927, **86**, 267–270).—[Read before the Midlands District Conference, British Commercial Gas Association.] The design of industrial heating plant, the use of town's gas for heating water and solutions, for steam raising, metal melting, drying and general heat-treatment, with special reference to operations carried out in Birmingham, are briefly referred to.—J. S. G. T.

Heat-Treatment Industrial Laboratories. Anon. (*Met. Ind. (Lond.)*, 1926, **29**, 290–291).—Description of the heat-treatment and research laboratories at the Birmingham Gasworks which are available for the use of manufacturers.

—E. C.

Burning Fuel Oil Efficiently. Max Sklovsky (*Foundry*, 1926, **54**, 196–198).—Abstract of a paper read before the American Iron and Steel Institute. The type of furnace and continuity of operation are important factors in operating oil-fired industrial furnaces. Three distinct directions of effort may be applied for obtaining fuel economy—viz. (1) proper combustion efforts; (2) better furnace adaptation and construction; (3) better attention to the furnace. An average efficiency of 15% should be attainable in practice.

—F. J.

Oil Burning for General Uses. F. Burgess (*J. R. Trans. Junior Inst. Eng.*, 1926, **36**, 300–310).—The use of oil burning for both land and sea purposes is described. The four essentials in the proper burning of oil are: (1) Atomization of the oil to a fine mist; (2) complete combustion of the oil before it comes into contact with a solid; (3) the correct amount of air; and (4) combustion in the presence of a refractory which reflects heat back into the combustion zone and so maintains a higher temperature at the point of combustion. The relative advantages and disadvantages of oil compared with coal burning are discussed, and the steam jet, air jet, and pressure jet types of burners are described.—W. H.-R.

Oil-Fuel Burning Systems. Anon. (*Mech. World*, 1926, **80**, 103–110).—General principles of burning oil as a fuel are discussed, and many types of oil-burning equipment on the market are described and illustrated.—F. J.

Who Uses Fuel Oil—How Much—Where? H. J. Struth (*Oil Trade*, 1925, **16**, (2), 42–44, 83; *C. Abs.*, 1925, **19**, 1344).—Fuels used in industry, exclusive of fuels consumed by railways and steamships, are classified as follows: manufactured gas 2, natural gas 4, anthracite coal 5, oil 12, coke 14, bituminous coal 63%. The consumption of fuel oil in millions of barrels is: ocean transportation 65, railways 55, electric power 50, petroleum refining 41, gas manufacture 32, iron and steel industry 14, foundries 5, car builders 5, sugar refining 5, smelting and refining 5, cement industry 3, ice manufacture 3, paper industry 3, slaughtering and meat industry 3, copper and brass industry 2, shipbuilding 2, brick plants 2, automobile manufacture 2, chemical and dye industry 2, flour mills 2, lumber mills 2, woollen mills 2, miscellaneous industries 17.

The Combustibility and Strength of Metallurgical Coke with Larger Granulation. F. Häusser (with R. Bestehorn) (*Stahl u. Eisen*, 1925, **45**, 878–

885; also *Glückauf*, 1925, **6**, 693-700).—Of the numerous factors influencing the combustibility of coke, the size of the grain is the most important. The direct production of small coke is to be desired. The strength of the coke is, above all, important for practical working. Good commercial blast-furnace coke is distinguished less by its high combustibility than by good strength properties.—G. S.

The Testing of Coke.—I. G. E. Foxwell and R. V. Wheeler (*Fuel*, 1925, **4**, 353-356).—An account of certain physical tests to be applied to coke. The tests considered in the present article are those connected with the real and apparent sp. gr., the shatter test, tumbler test, and the crushing strength. The method of sampling is also considered. In determination of the real sp. gr. the sample should be powdered to pass a 200 mesh. The apparent sp. gr. is best determined in a viscous liquid, such as glycerine, for this prevents the easy loss of gases from the coke. The porosity is best obtained by calculation by means of the formula: Porosity = $\frac{\text{true density} - \text{apparent density}}{\text{true density}} \times 100$.

The shatter test is probably the best test for giving a measure of the mechanical strength of coke. The tumbler test cannot at present be accepted as a standard test. The results obtained from the crushing strength test are not of sufficient practical importance to justify the expenditure of labour and time necessary to obtain them.—J. F. S.

Isotherms of the Flame-Stream in Metallurgical Furnaces. Roman Dawidowski (*Stahl u. Eisen*, 1925, **45**, 1265-1273).—In connection with the question of the applicability of the laws of hydraulics to gas stream in furnaces, temperature measurements were carried out at different points of a test furnace. For comparison, corresponding flow movements on models were studied. A considerable resemblance resulted. The difference between the specific weight of colder and warmer gas layers upon the gas current is of little importance; the chief action depends on the feed draught. The results of the test for a suitable form of furnace chamber are discussed.—G. S.

Foundry Fuel Economics. Walter J. May (*Mech. World*, 1926, **79**, 450-451).—Points of economic importance in the purchase of coke for melting purposes are discussed. The breaking of large pieces entails the production of "smalls," which are difficult to use. The screening and utilization of this material as well as of incompletely burnt coke from melting furnaces are also discussed. "Burnt" coke should be washed to remove adherent ash before using again as fuel. Fine coke ash makes an inferior abrasive or, with lime, a fairly good mortar. The chief form of economy is to have good furnaces.—F. J.

An Investigation of the Behaviour of Solid Fuels during Oxidation. I.—**The Ignition of Solid Fuels.** Burrows Moore and F. S. Sinnatt (*Fuel*, 1925, **4**, 194-198).—Experiments have been made to determine the rate of combustion of coal under standard conditions, based on the assumption that the tendency of a coal to ignite spontaneously depends on the rate of production of heat. The combustible capacity of a coal is defined as the capacity to evolve heat on combustion, and it is a function of the actual amount of heat evolved and the rate of evolution. A small amount of a coal was placed in excess of oxygen at a definite temperature, and the increase in temperature determined as a function of the time, over the pre-glowing period and during the glowing period up to the completion of the combustion. Every coal was subsequently examined at the minimum glowing temperature. The minimum glow temperature is the same as the minimum temperature at which the coal increases in temperature in oxygen, and is characteristic of the coal. On plotting the

temperature against the time the curve first shows a slight fall, which is followed by a rapid rise to a maximum, after which it declines. The portion of the curve running between the minimum temperature to the glow point is practically a straight line, the slope of which represents the rate of heat evolution during oxidation and before actual ignition. The slope is, therefore, a measure of the relative tendencies of coals to ignite spontaneously. Expressed in degrees rise of temperature per sec., it is termed the ignition factor. Five coals gave ignition factors 2.5-4.9.—J. F. S.

The Analysis of Solid Fuels. Reported by the Belgian National Chemical Committee. — Huybrechts (*Compt. rend. 6^e conférence internat. chim. (Bucarest), 1925, 320-361; C. Abs., 1926, 20, 3342*).—Abstracts of work published on this subject during the last 25 years, comprising 142 items (including a few treatises on analytical chemistry) with alphabetical author index.

Method Proposed by the Determination of Volatile Matter in Coal. S. de Waard (*Chem. Weekblad, 1925, 22, 525-530*).—A method is described, with drawings of apparatus, which is used by the Rijks-Instituut voor Brandstoffen-Economie (Dutch Institute of Fuel Economy) for the estimation of volatile matter in coal. The method consists shortly of heating 1 grm. of coal (B20 mesh) in a polished Ir-Pt crucible 26×30 mm. supported by a Ni-Cr triangle in an open cylindrical furnace. The furnace is heated by a Meker burner which gives a flame 18-20 cm. high, the temperature reached being 950° . After heating for 7 minutes the crucible is cooled over H_2SO_4 in a desiccator. The error does not exceed 1%.—J. F. S.

X-Ray Studies of Coal and Coke. Ancel St. John (*Trans. Amer. Inst. Min. Met. Eng., 1926, 74, 640-652*).

Tentative Definitions of Terms Relating to Coal and Coke [D121-26T]. Anon. (*Proc. Amer. Soc. Test. Mat., 1926, 26, (I.), 903-905; also Amer. Soc. Test. Mat. Tentative Standards, 1926, 604-606*).—Definitions are given of: Proximate analysis; ultimate analysis; moisture; ash; volatile matter; fixed carbon; coke; beehive coke; by-product coke; coke breeze; dry coke.

Surface Combustion and Its Application. W. M. Hepburn (*Proc. Assoc. Iron Steel Elect. Eng., 1923, 17, 537-552*).—In attaining this method of high-temperature combustion the correct ratio of air and gas has to be maintained, also an intimate mixing of the air and gas, followed by a restricted and definite controlled zone of combustion. The latter is accomplished by using either a furnace of the refractory bed type or one of the tunnel type. The former uses any granular refractory capable of withstanding temperatures over 3400°F. , and combustion occurs in the interstices, thus raising the mass to incandescence. Heating is done by radiation. In the tunnel type the furnace lining is a highly refractory cement, which radiates the heat, as in a pot type, the working details of melting in which show a considerable saving.—J. P.

Non-Complete Combustion and Firing Control. D. Haarmann (*Feuerungstechnik, 1922, 10, 173-176*).—The application of registering apparatus for the control of the temperature and carbon dioxide content of the flue gases is discussed. Even low content of CO_2 does not exclude the possibility of the presence of CO and other combustible gases in the chimney, therefore the question of proper combustion is fully considered, and the analysis of the flue gases for CO besides O_2 and CO_2 is advocated.—B. B.

Theoretical and Recorded Pressures in Oxygen Bomb Determinations. M. J. Bradley, C. Z. Rosecrans, and R. M. Corbin (*Indust. and Eng. Chem., 1926, 18, 307-309*).—Pressures developed within the oxygen bomb during the combustion of different weights of crude petroleum, coals, benzene,

kerosene, and benzoic acid have been measured and photographic records made. Assuming a heat loss of 50% of the heat of combustion of the fuel, up to the time of maximum pressure, a theoretical pressure can be calculated which will be safely above any actual pressure developed. By this method an estimate may be made of the weight of fuel and the initial oxygen pressure which can be safely employed. The rate of combustion, and therefore the maximum pressure, is controlled by the condition of the fuel and the size and shape of the containers in the bomb. A rapid method for the determination of the % of carbon and hydrogen in the fuel has been developed.

The Pocket Gas Tester. An Apparatus for Gas Investigation in a Dry Way. H. Strache and K. Kling (*Feuerungstechnik*, 1922, 11, 13-15).—A new apparatus for the determination of carbon dioxide in gas mixture is described.
—B. B.

Pulverizing Coal in a Foundry. A. de Young (*Canad. Found.*, 1926, 17, (5), 24).—Describes a coal pulverizing plant in use at the Kuebler Foundries, Easton, Pa. The apparatus comprises a receiving hopper, a bucket elevator, a vertical waste-heat dryer, the pulverizer itself, which supplies air to carry the pulverized coal away from the pulverizer, and a secondary exhauster which supplies additional air for combustion.—W. H.-R.

Pulverized Fuel in Metallurgical Furnace Practice. L. P. Sidney (*Met. Ind. (Lond.)*, 1926, 29, 215-220).—Illustrated description of the Buell system, with its dispersive burner and method for overcoming the dust difficulty. The application of this system to metallurgical furnaces appears practical, efficient, and economical.—E. C.

Pulverize Coal at the Furnace. E. C. Kreutzberg (*Foundry*, 1926, 54, 7-8).—A new type of coal pulverizer directly connected to the furnace and known as a unit pulverizer is illustrated and described. It is claimed that it effects a saving of more than 25% in total melting costs as compared with hand-firing. In general, the apparatus consists of a receiving hopper, a bucket elevator, a vertical waste-heat dryer, the pulverizer itself, which supplies air to carry the pulverized coal away from the pulverizer, and a secondary exhauster which supplies additional air for combustion. Illustrations show the equipment attached to a furnace for melting iron for malleable castings. A more rapid attainment of the required temperature and easier control of temperature than in hand-firing are claimed.—F. J.

Pulverized Coal as Fuel for Copper-Refining Furnaces. E. S. Bardwell and Roy H. Miller (*Trans. Amer. Inst. Min. Met. Eng.*, 1926, 74, 592-599).—See *J.*, 1925, 34, 645.

Pulverized Coal as a Fuel for Copper-Refining Furnace. E. S. Bardwell and Roy H. Miller (*Iron Steel Canada*, 1925, 8, 232-233).—Extracts from a paper read before the American Institute of Mining and Metallurgical Engineers. See *J.*, 1925, 34, 645.—W. H.-R.

The Process of Combustion in the Firing of Pulverized Coal. F. Schulte (*Glückauf*, 1924, 60, 971-978).—A review and discussion of the general chemical, physical, and mechanical principles.

Tentative Method of Test for Fineness of Powdered Coal [D197-26T]. Anon. (*Proc. Amer. Soc. Test. Mat.*, 1926, 26, (I.), 898-902; also *Amer. Soc. Test. Mat. Tentative Standards*, 1926, 599-603).

The Combustion of Fuel in Dust Form. A. B. Helbig (*Feuerungstechnik*, 1924, 12, (11), 86; *Ceram. Abs.*, 1924, 3, 228).—Attempts to increase burning efficiency and approach the highest temperatures theoretically possible with various fuels under ideal conditions have so far been hampered owing to lack of a suitable refractory for the furnace linings. The softening point of fireclay

brick is given as from 1200°–1400° C., and of silica brick 1600°–1650° C., followed by very rapid softening above this temperature. Magnesite bricks start to soften at 1500° C. but very gradually, so that at 1700° C. they still have some resistance long after silica bricks have melted down. This has led to the development of the Delbag pressure furnace, the side walls of which are built of refractory brick perforated with very fine holes (4200 per sq. m.). The entire furnace is surrounded by an air jacket under slight static pressure ($\frac{3}{8}$ –2 in. water). Pulverized fuel, oil, or gas are introduced into the furnace with just sufficient air for suspension of the particles, the balance of the air for combustion being introduced through the pinholes in the walls. Advantages claimed are: (1) Brick lining cooled below softening point; (2) layer of air covering surface of bricks protects them from deposits of products of combustion; (3) incoming air is preheated as it passes through the bricks in a thin stream and combustion is extremely rapid on entering the furnace; (4) losses through radiation and conduction extremely low on account of air film covering furnace walls. With this furnace continuous temperatures considerably over 1700° C. have been reached.

XVI.—REFRACTORIES AND FURNACE MATERIALS.

For keys to abbreviations used, see pp. 356 and 370.

Joint Committee on Foundry Refractories. Preliminary Report of Sub-Committees on Survey of Refractories in the Malleable, Steel, and Non-Ferrous Foundries. — (*Amer. Found. Assoc.* (Advance Copy), 1926, Sept., 53 pp.).—The first two reports deal with the composition and construction of furnaces, ladles, and moulds for the cast iron and steel industries, and the third with current melting practice, with especial reference to refractories, in the American brass industry. The last named embodies a summary of a questionnaire sent to all the brass foundries in the U.S.A., of whom about 37% replied. The larger plants use either open flame furnaces with oil fuel or electric furnaces of the indirect arc or induction type, whereas the smaller plants use chiefly coal- or coke-fired crucible furnaces or, to a smaller extent, gas- or oil-fired crucible furnaces. In the coke-fired furnaces destruction of refractories is chiefly due to the personal element, in gas- or oil-fired crucible furnaces to the cutting action of the flame, and in open flame furnaces to spalling, fluxing action of slags, or mechanical injury in charging. Indirect arc furnaces are usually lined with diaspore bricks; in this case spalling and penetration of metallic vapours into the lining are the chief causes of its destruction.—A. R. P.

A Review of the Work of the British Refractories Research Association, Mainly from the Users Point of View. J. W. Mellor (*British Clayworker*, 1926, 35, 67-69).—Research has been conducted on conductivity of furnace materials, radiation from furnace walls, insulation of furnaces and kilns, effect of mechanical stresses on refractories, conductivity of silica brick, action of gases on refractories, sillimanite bricks, grog bricks, and the bonding of silica bricks.—C. J. S.

Refractories Makers extend Research Activity. L. S. Longenecker (*Iron Trade Rev.*, 1926, 78, 24-25).—A review of the American refractories industry in 1925, with special reference to research problems.—W. L. K.

Specifications for the Manufacture of Refractory Materials. A. Popoff (*Corriere Ceramisti*, 1926, 7, 35-37; *Ceram. Abs.*, 1926, 5, 316-317).—P. prepares specifications for refractories from their softening cone, flux content, iron content, porosity, compressive strength, volume changes, resistance to temperature changes, resistance to slag and coke, and resistance to heat. A tolerance of $\pm 2\%$ is allowed. The composition and fineness of grain of the refractory mortars are also specified.

Standardization Suggestions for the Refractory Industry. L. Litinsky (*Feuerfest*, 1926, 2, 1-4).—The definition of the term "refractory" is dealt with. The classification and nomenclature of refractories are discussed, and the advantages of standardizing are considered. The standards of dimensions and form, testing methods and specifications, are examined.—B. B.

The Rôle of Specific Heat in the Selection of Refractories. A. Ernest MacGee (*J. Amer. Ceram. Soc.*, 1926, 9, 374-379).—A brief discussion of sp.

heats is given in which particular emphasis is placed upon its determination at high temperatures, the methods which have been used in the past for its determination, and the application of the values in the selection of refractories. The need of determining physical properties of bricks which have been in service is pointed out.

Porosity and Specific Gravity of Refractory Materials. E. Pressler (*Corriere Ceramisti*, 1926, 7, 3-5; *Ceramic Abs.*, 1926, 5, 259).—The various methods of determining porosity and sp. gr. are described, and the accuracy of each method brought out. Reasons for the air porosimeter being the best are given.

The Determination of the Bulk and Pore Volumes of Refractory Materials. M. L. Hartmann, O. B. Westmont, and S. F. Morgan (*J. Amer. Ceram. Soc.*, 1926, 9, 298-310).—A new sand displacement method for the determination of the bulk volume and bulk sp. gr. of refractory or other material is described. A gas porosimeter with a vertical U-tube manometer for the determination of pore volumes of materials is also described, together with calculations of possible errors. The porosities, bulk sp. gr., and calculated true sp. gr. of 15 types of refractory bricks obtained by means of these two methods, and the usual water absorption method, are tabulated for comparison.

The Mercury Balance—An Apparatus for Measuring the Bulk Volume of Brick. A. E. R. Westman (*J. Amer. Ceram. Soc.*, 1926, 9, 311-318).—A new apparatus for measuring the bulk volume of bricks, called the mercury balance, is described, and its method of operation is given in detail. Its great accuracy and other advantages would recommend its use when a large number of very accurate measurements of bulk volume are required.

The Effect of Atmospheric Conditions on the Load Test for Refractories. Leonard Francis Sheerer (*J. Amer. Ceram. Soc.*, 1926, 9, 279-289).—The literature relative to the investigation was reviewed and criticized. Iron pyrite was added to clays in amounts varying from 0 to 5%. Test-pieces $2 \times 2 \times 4.5$ in. were made by the stiff-mud and dry-press processes. After firing to cone 8 these were subjected to load tests at 1350°C . under oxidizing, neutral, and reducing conditions. Expansion and contraction values were plotted against time and temperature. Results under reducing conditions. Expansion and contraction increased with increase of pyrite content.

Some Furnace Brick Tests. Anon. (*British Clayworker*, 1926, 35, 161).—Practical tests for comparing the quality of different kinds of refractory brick are reviewed. The roof of a large steel furnace is recommended as the most crucial position for testing refractory bricks.—C. J. S.

A New Process for the Testing of Refractory Material by Dyeing. Eduard Steinhoff and Fritz Hartmann (*Ber. V. d. Eisenhüttenleute: Werkstoffausschuss*, 1925, No. 49; *Stahl u. Eisen*, 1925, 45, 337-343).—By dyeing refractory materials with organic dyes their texture can be extensively loosened. The firing temperature of fired clay and fireclay bricks, the local distribution of impurities, and the transformation of quartz can be determined in this manner.—G. S.

The Resistance of Refractory Materials to Change of Temperature. W. Steger (*Ber. V. d. Eisenhüttenleute: Werkstoffausschuss*, 1925, No. 52; *Stahl u. Eisen*, 1925, 45, 249-259).—The temperature constant of refractory materials depends not only on the material, but also on the external form and the inner texture of the bricks. A series of bricks was examined by different processes as to their resistance and a temperature chart drawn up. The great difference of fireclay bricks depends on the different quantities, grain-size, and crystal form of the silica modifications. The sensitiveness of silica bricks depends on the cristobalite transformation.—G. S.

Contribution to the Question of Refractory Bricks when Burning Coal Dust. E. Steinhoff (*Mitt. Dortmunder Union*, 1924, 1, 160-165).—The behaviour more especially of compact silica bricks when firing with coal dust is investigated. In consequence of the sensitiveness against change in temperature and poor binding qualities of the bricks, they have not proved satisfactory. As a new test, the heating of cylindrical specimens in small coal furnaces, when blowing through coal dust, is recommended.—G. S.

Refractories for Blast-Furnaces and Coke-Ovens. M. C. Booze (*Blast-Fur. and Steel Plant*, 1926, 14, 86-88).—A review of general interest to all users of refractories.—W. L. K.

The Selection of Refractory Materials Used in Industrial Chemistry. Alfred B. Searle (*Indust. Chemist*, 1926, 2, 51-53).—A discussion of the properties and appropriate uses of a large number of refractory substances. Recuperators and regenerators should be made of aluminium fireclay, so as to be able to withstand the sudden changes in temperature to which they are subjected. The general characteristics of many refractories are considered.—J. F. S.

Thermal Insulation of Electric Furnaces. M. L. Hartmann and O. B. Westmont (*Amer. Electrochem. Soc. (Advance Copy)*, 1926, Oct., 155-176).—The thermal insulation of various types of electric furnaces is discussed. The thermal conductivities of fused alumina, fused magnesia, fireclay, and a high-temperature insulating refractory are given in addition to the published data on silicon carbide (carborundum) and silica. Mean specific heat curves for these refractories are also given. The temperatures, heat losses, and heat capacities of 13 types of electric furnace linings are tabulated, with the inside surface temperatures assumed to be 1600°, 1400°, and 1200° C. The object of this paper is to suggest possibilities of energy conservation in electric furnaces by properly designed composite walls. The discussion is purposely made general, for specific design features of individual types of electric furnaces would require a detailed study of each case.

Refractories for Induction Furnaces. M. Unger (*Amer. Electrochem. Soc. (Advance Copy)*, 1926, Oct., 41-46).—The requisites for a commercial furnace lining of induction furnaces are detailed and discussed. Of the various materials studied, magnesium oxide proved to be the one refractory more nearly fulfilling the conditions than any other. Proper grading of the magnesium oxide is very important. Pitch was selected as the best bonding material. For continuous operation on steel and a slag analysing 20 to 25% silica, the magnesium oxide lining will last through 400 heats.

Refractories for Induction Furnaces. M. Unger (*Met. Ind. (Lond.)*, 1926, 29, 416-417).—Read before the American Electrochemical Society. See abstract above.—W. H. D.

Highly Resistant Fireproof Coatings. F. Hartmann (*Ber. V. d. Eisenhüttenleute: Werkstoffausschuss*, 1926, No. 92, 1-7).—As a protection against local destruction of furnace material, coating substances are used which have a high melting point, are not susceptible to attack by the flue-dust and slag, and which possess good ceramic properties at all temperatures. The theory of the protective action is developed in detail. As test of the quality, a test of softening under pressure is proposed. The particular works conditions must determine the choice to be made of the protective substances obtainable commercially.—G. S.

Refractories for Melting Pure Metals: Iron, Nickel, Platinum. Louis Jordan, A. A. Peterson, and L. H. Phelps (*Amer. Electrochem. Soc. (Advance Copy)*, 1926, Oct., 115-124).—The (U.S.) Bureau of Standards has carried out a very systematic investigation of the refractory materials best suited for the melting

of pure iron, nickel, and the platinum metals. The nature or composition of the pure metal or alloy to be melted, and the conditions under which it is required or is convenient to melt it, must be known before a proper choice of refractory for holding the molten mass can be made. Pure magnesia crucibles are suitable for pure iron and iron alloys, but usually the magnesia crucibles contain too much sulphur, readily absorbed by the iron. Zircon added to the magnesia greatly increases the strength of the crucibles. The zircon must be low in phosphorus. Pure iron melted in zirconia crucibles was found to have taken up large amounts of silicon. Crucibles made of "RR Alundum" contaminated the iron by as much as 0.07% silicon. Crucibles made of c.p. MgO with $MgCl_2$ as binder proved to be most satisfactory for pure iron and iron alloys. The making of these MgO crucibles is described. These crucibles are likewise best suited for melting pure nickel. Crucibles made of zirconia, freed from carbon and acid soluble iron, are suitable for melting pure platinum and platinum-rhodium alloys, provided that the melting is done under oxidizing conditions. The manufacture of zirconia crucibles is described. They are very hard and mechanically strong. They withstand temperatures up to 2000° C., but must be heated and cooled slowly.

Refractories for Melting Pure Metals. Iron, Nickel, Platinum. Louis Jordan, A. A. Peterson, and L. H. Phelps (*Met. Ind. (Lond.)*, 1926, **29**, 367-369).—Read before the American Electrochemical Society. See abstract above.—W. H. D.

Fireproof Materials for the Iron and Metal Manufacturing Industry. E. H. Schulz (*Z. V. d. I.*, 1926, **70**, 408-410).—A brief survey is given of the requirements for fireproof building materials, and methods for the investigation and examination of their properties are outlined.—G. S.

Investigation and Testing of Fireproof Building Material for the Metallurgical Industry in Germany. E. H. Schulz (*Ber. V. d. Eisenhüttenleute: Werkstoffausschuss*, 1924, No. **54**; *Stahl u. Eisen*, 1925, **45**, 1733-1739, 1777-1781).—The general requirements for fireproof building material and the methods of testing are discussed. Besides chemical analysis, determination of mechanical strength, porosity, change of volume on cooling and heating, the melting test and the examination of structure come under consideration as acceptance tests.—G. S.

Foundry Refractories. M. C. Booze (*Fuels and Furnaces*, 1926, **4**, 1071-1076).—The action of slags, flame impingements, and thermal expansion on the life and efficiency of refractories is discussed, with especial reference to cupola linings.—A. R. P.

Clays for Graphite Crucibles. Anon. (*British Clayworker*, 1926, **35**, 214-215).—Some notes on the kind of clays most suitable for mixing with graphite in the manufacture of crucibles for melting various metals and alloys. Crucibles for melting brass should be made with bond clays having high crushing strength at 1100° C. and no structural change below 1250° C.—C. J. S.

Refractory Articles from Tungsten Powder. J. Hårdén (*Chem. and Met. Eng.*, 1926, **33**, 543-544).—For high-frequency heating a crucible of good electrical conductivity, having a high melting point and no free carbon, is needed. H. has made such crucibles from commercial tungsten powder, ground to 80 to 90 mesh and mixed with 25% glucose water (warm) until plastic. The mass is kneaded and stamped in a tubular mould, extruded, heated to 60° to 80° C., and then shaped under pressure into a crucible in a special mould, which is illustrated and described. After drying by gradual heating to 350°-400° C., the crucible may be handled. If heated to 600° C. in a non-oxidizing atmosphere and cooled, it may be drilled, filed, turned, or

even screened. Hardness and durability are obtained by heating in a carbon tube furnace to 1000° C. Elec. resistance and sp. gr. were determined.

—F. J.

Comparative Tests of Some American and German Fireclay Brick. R. F. Geller and W. L. Pendergast (*J. Amer. Ceram. Soc.*, 1926, 9, 370-373).—The (U.S.) Bureau of Standards has recently completed a short investigation, comprising comparative tests of 5 brands of German-made bricks and 6 brands of American-made bricks. The results indicate that the German bricks are practically the equal of the American bricks.

Fireclay Brick: Their Manufacture, Properties, Uses, and Specifications. Anon. (*U.S. Bur. Stand. Circ. No. 282*, 1926, 1-50).—A brief history is given of the manufacture of fireclay brick and of the growth of technical research, and of the industry in the U.S.A., together with essential information regarding the manufacture of fireclay bricks and the classification, properties, and uses of the finished product. Since the quality of firebricks and the uses to which they are adapted depend largely on the raw clays used, a brief discussion is also given of the geology of these materials, their classification, and the characteristic properties of each class. In addition, the history of the development of the U.S. Government Master Specification for Fireclay Brick, together with this specification and a list of the principal references to literature on the subject of fireclay bricks, is given.

Fireclay Refractories. J. F. Hyslop (*Roy. Tech. Coll. (Glasgow) Met. Club J.*, 1926, No. 5, 30-32).—A survey is made of the changes occurring in the structure of fireclay as the result of heating to various temperatures, the effect of different firings causing the final constitution to vary and produce several changes in degree of refractoriness. X-ray examination of refractory materials is stated as very useful in identifying constituents difficult or impossible to recognize by petrographic methods. Six X-ray diffraction patterns are reproduced, illustrating constitutional changes in silicate bodies.—J. P.

Fireclay Bricks. Edmund R. Thews (*Found. Trade J.*, 1926, 33, 339-341).—An article reviewing this subject.—E. C.

A Comparison of the Uniformity of Strength and Texture of Firebrick made by Different Processes. A. E. R. Westman and W. H. Pfeiffer (*J. Amer. Ceram. Soc.*, 1926, 9, 626-632).—By assuming that the "deviations from the average" of the strengths and permeabilities of individual bricks of any one brand are governed by the laws of chance, a comparison of the uniformity of strength and texture of a number of brands of brick made by different processes is obtained. Of the brands examined, those made by the stiff-mud process are found to be more uniform in strength and less uniform in structure than those made by the dry-press process. The hand-made bricks show quite a variation in both strength and texture, whereas one brand of brick made by a semi-dry process (English type machine) shows good uniformity in both strength and texture.

United States Government Master Specification for Clay, Fire. Anon. (*U.S. Bur. Stand. Circ. No. 298*, 1926, 1-6).—Federal Specifications Board Specification No. 334A. This specification was officially promulgated by the Board on Oct. 1, 1925, for the use of the departments and independent establishments of the U.S. Government in the purchase of fireclay.

United States Government Master Specification for Refractories, Fireclay, Plastic. Anon. (*U.S. Bur. Stand. Circ. No. 297*, 1926, 1-5).—Federal Specifications Board Specification No. 335A. This specification was officially promulgated by the Board on Oct. 1, 1925, for the use of the departments and independent establishments of the U.S. Government in the purchase of plastic fireclay refractories.

United States Government Master Specification for Brick, Fireclay. Anon. (*U.S. Bur. Stand. Circ. No. 299*, 1926, 1-7).—Federal Specifications Board Specification No. 268A. This specification was officially promulgated by the Board on Jan. 22, 1925, for the use of the departments and independent establishments of the U.S. Government in the purchase of fireclay brick.

Fusion Points of Firebrick-Coal Ash Mixtures. L. C. Hewitt (*J. Amer. Ceram. Soc.*, 1926, 9, 575-582).—Six types of refractory bricks were tested with 5 types of coal ash, the cone fusion-points of the brick-ash mixtures being determined over a range of 10% brick, 90% ash, to 40% brick, 60% ash. A departure was made from previous methods in that high ash mixtures were studied rather than high brick mixtures, in the belief that boiler slags contain a relatively low proportion of the refractory. Sintered mixtures of the refractory and ash tend to give higher fusion points than the raw mixtures do. Any determinations made in an uncontrolled atmosphere indicate that the "cone-slag test" is of very limited value as a means of selecting refractories for boiler service.

Rational Analysis of Clay.—II. J. Spotts McDowell (*J. Amer. Ceram. Soc.*, 1926, 9, 61-65).—A review of the literature on the subject. The methods of determining the rational analysis are shown to be inaccurate. A bibliography of 13 references is appended.

Cyanite-Clay Refractories.—I. H. C. Harrison (*J. Amer. Ceram. Soc.*, 1926, 9, 257-271).—The dissociation of cyanite into mullite was studied. Bricks were made of various mixes and their properties are given. 20% is about the minimum amount of clay which will give the proper bond. It was found desirable in some cases to add MgO in small amounts to promote a crystalline bond between the dissociated cyanite grains and the bonding material.

Equilibrium Considerations of Cyanite-Clay Refractories.—II. W. J. McCaughey and H. C. Harrison (*J. Amer. Ceram. Soc.*, 1926, 9, 271-278).—The phase rule equilibrium relations are discussed.

A Study of Mullite Refractories Formed by Calcining Cyanite, their Industrial Application. M. L. Freed (*J. Amer. Ceram. Soc.*, 1926, 9, 249-256).—This paper is a progress report of an investigation dealing with refractory bodies made of cyanite, either raw or calcined, and which was taken from a recently discovered deposit in India. The bodies were subjected to standard and modified laboratory tests for high-grade refractories. Petrographic analyses indicated complete conversion to mullite in the test-specimens, and the results of the laboratory tests indicate the bodies to be equal in quality to many so-called "super-refractories" now on the market.

A Study of the Shrinkage of Diaspore Clays.—I. S. M. Phelps (*J. Amer. Ceram. Soc.*, 1926, 9, 659-667).—Diaspore refractories often possess the undesirable characteristic of continual shrinkage in service, and since it is not practical to alter such properties in the present manufacturing processes, the object of this study was to devise, if possible, a manufacturing process to overcome this shortcoming. This part of the paper reveals the mechanism of the firing shrinkage and describes the effect of particle size, time, and temperature upon the shrinkage of diaspore clays of various compositions. The properties of the two major constituents of a typical sample are given, as well as photomicrographs of interesting samples. Part II. will describe experimental work conducted to devise shrinkage processes and the properties of the products so made.

Thermal Analysis of Clays and Bauxites. N. S. Kurnakow and G. G. Urazow (*Ann. Inst. anal. Phys.-Chim. (Leningrad)*, 1924, 2, 496-498; *Bur. Chem. Abs.*, 1925, [B], 547).—When pure kaolin, Al_2O_3 , $2SiO_2$, nH_2O ($n =$

about 2), is heated, an endothermic arrest occurs at 558° – 605° owing to the elimination of water, and an endothermic effect (recalcrescence) at 950° – 1000° . Under identical conditions the crystalline monohydrated alumina, diaspor, shows a temperature arrest at 509° – 555° , but, like other hydrated forms of alumina investigated, no exothermic effect. The natural trihydrate (gibbsite) or artificial trihydrate is characterized by two endothermic arrests on its heating curve, at 202° – 296° and about 500° , the latter coinciding with that observed with diaspor. With the richly aluminiferous Tichwinski bauxites containing up to 15% of water and not more than 12–15% of SiO_2 , only one endothermic arrest is found corresponding with that of diaspor (509° – 555°); if the % silica exceeds 12–15% the kaolinite arrest (558° – 605°) is encountered. The latter bauxites evidently consist of a mixture of diaspor and kaolinite; further, bauxites containing more than 14–15% water exhibit also a lower arrest at 200° – 296° , indicating the presence of hydrargillite.

Behaviour of Kaolin at a High Temperature. V. I. Iskjul (*Ann. Inst. anal. Phys.-Chim. (Leningrad)*, 1924, 2, 498–499; *Bur. Chem. Abs.*, 1925, [B], 547).—A sample of kaolin containing 44.16% SiO_2 , 38.24% Al_2O_3 , 13.35% H_2O , and small proportions of various other oxides, lost its water at a dull-red heat and was then readily decomposed by 2% hydrochloric acid solution, but the anhydrous Al_2O_3 , 2SiO_2 , did not decompose. At 1000° – 1100° , this residue was decomposed into a substance of the composition of sillimanite, Al_2O_3 , SiO_2 , and silica, which could be dissolved by 10% potassium hydroxide solution. A second sample of kaolin, containing 48.44% SiO_2 and 34.68% Al_2O_3 , and thus more silica than corresponds with the formula, Al_2O_3 , 2SiO_2 , $2\text{H}_2\text{O}$, exhibited no free silica in the form of granules of quartz; after dehydration this sample behaved towards reagents similarly to the previous one, but when heated to a higher temperature and then treated with 10% potassium hydroxide solution, it left a residue having approximately the composition of the aluminosilicate, $2\text{Al}_2\text{O}_3$, SiO_2 . The basis of this kaolin is, therefore, probably not kaolinite, but either another aluminosilicate or a mixture of aluminosilicates.

Investigation of Silica Bricks.—I. E. Steinhoff (*Mitt. Dortmunder Union*, 1922, 1, 61–67).—On the basis of some investigations of silica bricks of different origin, S. discusses their testing for quality. Besides the usual methods, such as chemical analysis, determination of the Seger cone, &c., an examination of the capability of resisting high temperature is proposed.—G. S.

Contribution to the Study of Silica Bricks. Dilatometric Analysis. Tests of Raw Material.—I. — Travers and — de Goloubinoff (*Rev. Mét.*, 1926, 23, 27–47).—The history and problems of manufacture of silica bricks are reviewed, and the preparation and properties of the varieties of silica (quartz, tridymite, cristobalite, and amorphous silica), together with their allotropic modifications, are discussed. Previous work on the examination of these substances is reviewed as a preliminary to a description of the authors' own work, particularly with the Chevenard dilatometric apparatus, which is illustrated and described. The preparation of test-specimens is also described, and considerable attention paid to the special feature shown by the large number of dilatometric curves accompanying the article.—F. J.

Contribution to the Study of Silica Bricks. Dilatometric Analysis. Tests of Raw Material.—II. — Travers and — de Goloubinoff (*Rev. Mét.*, 1926, 23, 100–117).—Very full descriptions are given of the dilatometric, densimetric, and optical methods of examining silica bricks, and tests of raw material are discussed. The following new observations are made: The dilatation curve shows a transformation at 210°C , and, therefore, a total dilatation higher than previously found. Three discontinuities in the dilata-

tion curve of tridymite are noted, including one at 440°–450°C., not previously established. Above this temperature the dilatation-temperature relationship is linear up to 1000° C., the coeff. of expansion being very small. The conclusion of Endell that the $\beta \rightarrow \alpha$ change in cristobalite takes place sluggishly is not confirmed. The dilatometric method is applied to the estimation of the relative proportions of the constituents in silica bricks with satisfactory results. As regards raw materials, the chemical test for fluxes (alkalis and iron oxide) is very important. The microscopic examination, using polarized light, reveals the distribution of impurities, and confirms the necessity for adequate grinding in manufacture. Dilatometric analysis of the constituents after burning is regarded as one of the most important tests.—F. J.

Contribution to the Study of Silica Bricks. M. Widemann (*Céramique*, 1926, 29, 165–175).—This is a paper giving details of the scientific tests which should be applied to refractories in general, and which have been used in connection with trials of silica brick from many countries. It is concluded that the bricks of French manufacture are equal to those obtained from elsewhere. The investigations into the nature of the raw materials comprise tests on analysis, thermal resistance, fusion temperature, texture, and any transformation points which may arise as the temperature increases. On the finished brick the examination is more extensive, and includes, besides the above, a survey of density, porosity, expansion and contraction, resistance to heat and abrasion, attack by scoria, and specific heat. The article has a number of excellent micro- and macrophotographs of typical bricks.

—W. A. C. N.

The Use of Silica Refractories. P. B. Robinson (*Chem. and Ind. (J. Soc. Chem. Ind.)*, 1926, 45, 29–33T).—A consideration of the properties of silica refractories, including silica bricks, half-ganister, and fireclay, with the object of explaining the difficulties which arise in the use of silica refractories in high-temperature industries. The properties considered are: thermal expansion, thermal conductivity, spalling, and resistance to abrasion by dust and hot gases. In connection with the stocking of silica bricks, the crushing strength of bricks of different densities after various water treatments is given. The jointing of silica bricks is also considered.—J. F. S.

The Use of Silica Refractories. P. B. Robinson (*British Clayworker*, 1926, 34, 393–397).—From *Chem. and Ind. (J. Soc. Chem. Ind.)*, 1926, 45, 29–33T. See abstract above.—C. J. S.

Influence of the Oxide Admixtures on the Physical Properties of Silica Bricks. K. Endell and R. Harr (*Ber. V. d. Eisenhüttenleute: Werkstoffauschuss*, 1925, No. 79; *Stahl u. Eisen*, 1926, 46, 1870–1876).—Additions of calcium oxide, aluminium oxide, and iron oxide to silica bricks increase the specific weight and probably also the resistance to abrupt changes of temperature. The course of the transformation, the porosity, and the mechanical strength are differently influenced. The softening temperature is lowered slightly by iron oxide, and considerably by alumina. From the results it is concluded that an alumina content above 1.5% should be avoided, and that a lime content up to 8% and an iron content up to 4% favours the formation of tridymite.—G. S.

The Effect of Repeated Burning on the Structure and Properties of Lime-Bonded Silica Bricks. W. Hugill and W. J. Rees (*Trans. Ceramic Soc.*, 1926, 25, 82–93).—See abstract from other source, *J.*, 1926, 35, 843.

—C. J. S.

The Addition of Chromium Oxide to Silica Bricks. Sten Sandlund (*Jernk. Ann.*, 1923, 45–52; *C. Abs.*, 1925, 19, 566).—S. has tested a method suggested by Dornhecker for increasing the resistance of silica bricks to the corrosive

action of FeO-bearing slags by adding Cr_2O_3 to the bricks. A protecting layer of the highly refractory chromium spinel, $\text{FeO} \cdot \text{Cr}_2\text{O}_3$, is supposed to be formed at the contact between the brick and the slag. In hand-made silica pots, fired at 1450° , slags of various compositions were melted at temperatures of 1550° – 1600° . Charges of 10 grm. were used. The melting period was 40 minutes. The compositions of the resulting melts are given. Chromium was not found in any of the melts, which shows that Cr_2O_3 does not react to form a fusible compound. An increase from 2 to 5% of Cr_2O_3 in the silica pots has only a small influence on their resistance to corrosion.

Amorphous Silica for Severe Service. William W. Winship (*Chem. and Met. Eng.*, 1926, **33**, 449).—Fused silica is recommended for employment in practically all cases where unusual chemical, thermal and electrical conditions are to be encountered. It has high strength under compression, is light in weight, free from latent strains of manufacture, unique as an electrical insulator, and in the case of clear fused quartz ware is transparent over practically the entire spectrum, affording visibility under high-temperature conditions and allowing free transmission of ultra-violet light. Its ability to withstand extreme temperature changes, its negligible expansion and other characteristics, are discussed. A new composition of similar properties, susceptible of being moulded at low temperatures, is described.—F. J.

An Application of Recrystallized Silicon Carbide. F. A. J. FitzGerald (*Amer. Electrochem. Soc. (Advance Copy)*, 1926, Oct., 279–282).—The use of recrystallized silicon carbide as a refractory material under certain special chemical and physical conditions is described.

Recrystallized Silicon Carbide as a Refractory. F. A. J. FitzGerald (*Chem. and Met. Eng.*, 1926, **33**, 597).—Abstract of a paper read before the American Electrochemical Society. (Abstract above).—F. J.

Thermal Expansion of Graphite. Peter Hidnert and W. T. Sweeney (*U.S. Bur. Stand. Tech. Paper No. 335*, 1927, 223–230).—This paper gives the results of an investigation on the thermal expansion of longitudinal and transverse sections of artificial graphite electrode (99.2–99.7% carbon) over various temperature ranges between room temperature and 600°C . A summary of available data by previous observers on the thermal expansion of graphite (natural and artificial) and of other forms of carbon is included. In the present investigation the coeffs. of expansion of graphite were found to be low. The transverse samples expand considerably more than the longitudinal samples (approx. 45%). For both the longitudinal and transverse samples the coeffs. of expansion decrease slightly as the purity (carbon content) increases. A table in the summary gives a résumé of average coeffs. of expansion derived from the data on all samples for various temperature ranges between 20° and 600°C .

Determination of the Melting Point of Graphitic Carbon. E. Ryschkewitsch and F. Merck (*Z. Elektrochem.*, 1926, **32**, 42–45).—The method used was to measure the temperature of an electrically heated graphite tube at the moment of the appearance of a definite white line across the specimen. This denoted the first point of fusion. The middle section of the tube was reduced in thickness and a hole was bored in the wall at one side opposite to the observation tube, so that approximately black-body conditions were obtained at the point the temperature of which was measured. Arrangements were also made to measure the temperature when the graphite was subjected to various pressures. An atmosphere of argon was maintained in the apparatus during the experiments. No regular alteration in fusion point with increase in pressure was found. A mean value of 3845° abs. was obtained for the fusion point.—W. A. C. N.

Behaviour of Carborundum under Working Conditions. F. G. Jaeger (*Bull. Amer. Ceram. Soc.*, 1926, 5, 309-311).—J. shows how with proper use carborundum will give very fine service over a long period of time. Combustion gases are more severe in their action on silicon carbide refractories when trapped than when freely circulating. "Protected" bricks showed deterioration and swelling where bricks exposed to the heat were unharmed. It is advisable to guard against cracking the surface of a Carbofax muffle through mechanical strains, as there is a greater tendency for gas attack on the remaining refractory body if this happens.

Fused Magnesite. Anon. (*British Clayworker*, 1926, 35, 71).—Magnesite fused electrically is superior to dead-burned magnesite for making basic bricks. The technical difficulties of electrical fusion have been overcome, but cooling must be very slow. Fused magnesite articles are sensitive to sudden temperature changes and tend to shrink in use. They should be protected from reduction by larger graphite or fireclay crucibles. Very small proportions of silica and alumina reduce the refractoriness, but these impurities may be removed by holding the magnesite at the fusion temperature for some time.—C. J. S.

Preparation, Properties, and Analysis of Burnt Magnesite. Alfred Stettbacher (*Chem.-Zeit.*, 1926, 50, 741-742, 771-774).—The paper describes the preparation of magnesia for use in the manufacture of magnesium oxychloride cement.—A. R. P.

On Some Uses of Zirconia as a Refractory. Anon. (*Rev. Chim. ind.*, 1926, 35, 14-16)—A discussion of zirconia as a refractory material. The method of preparation and grinding of the material is described, and the colour changes which take place in the material on heating to 2400° are discussed.

—J. F. S.

Andalusite: a New Refractory. Anon. (*British Clayworker*, 1926, 34, 336).—Large deposits of andalusite are found in California. It is similar to sillimanite, but more plentiful, and firebricks made from it show no change in volume on heating. It softens at cone 35, as compared with cone 32 for ordinary fireclay.—C. J. S.

Sil-O-Cel, an American Heat Isolation Material. E. Hirschbrich (*Feuerfest*, 1926, 2, 25-26).—The importance of the heat isolation is discussed. Sil-O-Cel described. Its properties and qualities are considered. Application of different grades of Sil-O-Cel is dealt with.—B. B.

The Thermal Expansion of Some Fused Oxides Used as Refractories. George E. Merritt (*Amer. Electrochem. Soc.* (Advance Copy), 1926, Oct., 283-291).—The thermal expansions of the oxides of silicon, thorium, and zirconium, of a mixture of one-to-one molecular proportions of thorium and zirconia, and of the refractories made of magnesia, alumina, and zirconia, were measured. The results are exhibited in graphical form and intercompared. From the form of the curves and other evidence, it is concluded that a combination takes place when thorium and zirconia are fused in these proportions.

The Romance of Carbon. Arthur D. Little (*Indust. and Eng. Chem.*, 1926, 18, 444-451).—A comprehensive review of the properties of carbon in its various forms and of their applications.—F. J.

Clear Fused Quartz, its Uses and Manufacture. E. R. Berry (*Trans. Illuminating Eng. Soc.*, 1926, 21, 546-561).—The properties of clear fused quartz, its uses, and data pertaining to its manufacture, are given. A popular lecture.—C. J. S.

The Manufacture of Bricks from Boiler House Ash and Clinker. Anon. (*Eng. Rev.*, 1926, 39, 319-324).—Stationary boiler houses in this country turn

out 10 million tons of ash and clinker per annum. This waste product can be used for the production of calcium silicate bricks. Types of plant are described. The ground clinker is mixed with 6-10% quicklime, agitated, and slaked with steam. After maturing, the paste is pressed into bricks and heated 5-10 hrs. in steam at atmospheric pressure. Bricks obtained in this way have a high compressive strength (200 tons/ft.²), and are free from warping. They have a bluish colour resembling Staffordshire blue brick.

—C. J. S.

Cement for Refractory Bricks Resistant to High Temperatures. Anon. (*Four elect.*, 1926, 35, 84-85).—"Hytempite" is a plastic refractory material, made up of special ingredients with large heat-resisting properties. (The material must not be confused with a chromium-nickel-iron alloy manufactured in England and bearing the same name.) It is said to withstand temperatures up to 2000° C., and may be employed in the form of bricks or as material to be rammed behind formers in lining a furnace.—W. A. C. N.

Investigations with Refractory Bricks. Bruno Schulz (*Feuerfest*, 1926, 2, 33-35).—The fire resistance of Seger's clay mixtures is discussed. The classification of refractory bricks and their composition are considered. The influence of heat and pressure and the relation of the analysis to the refractory properties and to the softening point of bricks are dealt with. The compositions of coal slags as estimated during the experiments in the German Navy and in a Swedish laboratory are given. The main object of this paper is to point out the necessity of standardization and introducing a classification of refractory bricks.—B. B.

The Mechanism of Spalling. F. H. Norton (*J. Amer. Ceram. Soc.*, 1926, 9, 446-461).—A study has been made of the stresses and fractures developed in a solid when rapidly heated or cooled. The stresses were measured in bakelite specimens by the photoelastic method. High stresses in all cases were found to occur near the surface of the solids, but no high tension stresses were present when the specimens were being heated. A number of vitreous clay spheres and bricks were heated and cooled rapidly, and the nature of the cracks was noted. In practically every case the fractures occurred as predicted from the measured stresses. Torque-deflection curves were obtained for a number of firebricks in torsion at different temperatures. The temperature at which plastic flow occurs for every material tested was approximately the same as the temperature of the initial deflection under compressive loads in a standard load test.

The Spalling of Bricks. F. W. Preston (*J. Amer. Ceram. Soc.*, 1926, 9, 654-658).—Spalls in spalled bricks are, under the conditions postulated by F. H. Norton (*ibid.*, 1925, 8, 29-39), tensile, not shear fractures. The surface of separation bears no simple relation to the isothermal surfaces. In a "semi-infinite" slab, the diffusivity has no influence on the tendency to spall, but does influence the location of the surface of parting.

Pneumatic Gun Projects Refractory Cement. Anon. (*Coal Age*, 1926, 29, 181).—A new air or steam gun for the projection of a new refractory cement called "carboplastic" is described. This instrument, which weighs only 12 lb. and operates on either steam or air of 100 lb./in.² pressure, can project refractory cement on to a furnace wall at the rate of 100 lb. per minute. Carboplastic, which chiefly consists of carborundum, inherits the heat-resisting properties of the latter. The principle of the ordinary injector is utilized in the construction of this gun, and it can suck the cement from a pail or bucket. The gun and "carboplastic" are both placed on the market by the Carborundum Company of Niagara Falls, N.Y.—B. B.

XVII.—MISCELLANEOUS.

For keys to abbreviations used, see pp. 356 and 370.

Friedrich Wöhler. B. Rassow (*Z. Metallkunde*, 1927, 19, 1-2).—A biographical sketch, in which references are made to the circumstances of the discovery of aluminium.—M. H.

Friedrich Wöhler, the Discoverer of Aluminium. Anon. (*Metallwirtschaft*, 1927, 6, 6).—An historical review.—B. B.

C. von Bach. To his 80th Birthday. Anon. (*Z. Metallkunde*, 1927, 19, 81).—M. H.

The Life and Work of Ludwig Mond. Harold B. Dixon (*Mem. Proc. Manchester Phil. Soc.*, 1924, 69, 1-18).

Professor Dr. H. Kammerlingh Onnes. W. H. Keesom (*Physica*, 1926, 6, 81-97).—An obituary notice.

Heike Kammerlingh Onnes; the Work and the Man. E. Mathias (*Rev. gén. Sci.*, 1926, 37, 294-298).

H. Kammerlingh Onnes. O. Tomicek (*Chem. Listy*, 1926, 20, 144-148).—An obituary notice.

Sir Edward Thorpe (1845-1925). P. P. B. (*J. Chem. Soc.*, 1926, 1031-1050).—An obituary notice, with portrait.

Metallurgy Fifty Years Ago and Now. W. M. Corse (*Indust. and Eng. Chem.*, 1926, 18, 892-895).—The developments which have taken place in the extraction, purification, and applications of non-ferrous metals during the last 50 years are briefly outlined. The following metals are considered: Copper, zinc, tin, lead, nickel, magnesium, cadmium, antimony, chromium, molybdenum, uranium, tungsten, tantalum, titanium, zirconium, vanadium, manganese, and silicon. The scientific development is attributed mainly to the microscope, pyrometer, X-rays, and the electric furnace.—F. J.

The Development of the Research on Metals after the World War. G. Sachs (*Metallwirtschaft*, 1927, 6, 88-89).—A review.—B. B.

Progress in the Metallurgy of Non-Ferrous Metals in 1924. Van der Putte (*Rev. Univ. Mines*, 1925, [vii.], 6, 37-50).—A review with 110 references.

Progress of Metals in 1925, Outlook for 1926. R. L. Agassiz, and others (*Met. Ind. (N.Y.)*, 1926, 24, 22-24).—A popular review of the progress in 1925 and outlook for 1926 of the following industries: Copper, zinc, lead and tin, aluminium, and nickel.—T. B. C.

Metallurgy as a Profession. Anon. (*Metallurgist (Suppt. to Engineer)*, 1927, 3, 33-34).—Reasons for the dearth of University students in metallurgy are discussed. It is considered that if more and better men are wanted, the profession must be made more attractive.—R. G.

The Metallurgist in Industry. A. H. Munday (*Metallurgist (Suppt. to Engineer)*, 1926, 2, 149-151).—An abridgment of the Chairman's address to the London Local Section of the Institute of Metals.—R. G.

The Metallurgist in Industry. Anon. (*Mech. World*, 1926, 80, 337-338).—Editorial review of A. H. Munday's Chairman's address to the London Local Section of the Institute of Metals.—F. J.

The Metallurgist in Industry. A. H. Munday (*Found. Trade J.*, 1926, **34**, 396).—Chairman's address to the London Local Section of the Institute of Metals.—W. H. D.

Education in the Foundry. George Edginton (*Found. Trade J.*, 1926, **34**, 417-418, 436-437).—Presidential Address to the Sheffield Branch of the Institute of British Foundrymen.—W. H. D.

The Value of Problems in Teaching Metallurgy. C. B. Carpenter (*J. Eng. Education*, 1925, **15**, 695-705).

Practical Deductions from Theoretical Metallurgy. Otto Feussner (*Continental Met. and Chem. Eng.*, 1926, **1**, 99-101).—F. shows how the mechanical properties of the alloys are being changed in some cases if the ideal equilibrium is not reached, and by what means the attainment of the equilibrium may be hastened.—B. B.

Physics and Metallurgy. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1926, **2**, 97).—The increasing importance in metallurgical research of X-ray methods of crystal analysis, spectroscopic methods of chemical analysis, and the use of the high-frequency induction furnace, are discussed.—R. G.

The Engineer and the Study of Metals.—I. W. Roland Needham (*World Power*, 1926, **5**, 303-309).—A well-written and informative article on the application of the "new metallurgy" to problems of engineering. The value of microscopical metallurgy and metallography in indicating the existence (or otherwise) of properties of importance to the engineer is stressed, and the limitations of this branch of investigation discussed. A method of filing the results of each micro-examination is suggested, which in time would lead to an accumulation of data for re-examination and scrutiny as a whole. The result of this re-examination would often help to fill in certain gaps in the "message of the microscope"—gaps which are of importance to the engineer; thus would be removed much prejudice of some engineers against the expenditure of time upon micro-analysis. N. then shows what should be the relation between metallurgist and engineer, and indicates a viewpoint well worth consideration by members of both these professions; an example in this connection is furnished from the study of alternating stresses upon engineering materials. By collaboration with the metallurgist the engineer will learn the limits of the tests which he may have come to regard as yielding wholly conclusive criteria. Even if the results of the two methods of investigation—mechanical tests and microscopic analysis—have not been completely associated, yet the dual investigation—if interpreted sanely—gives rise to greater confidence, and a more thorough knowledge of real mechanical properties. A large portion of the article is devoted to consideration of the relation between tensile, fatigue, and hardness tests, and the valuable information to be obtained from a combined study of these properties. In conclusion, N. lists a number of modern metallurgical facilities which are available for giving the engineer valuable information and help (see following abstract). A few pertinent references are given.—T. B. C.

The Engineer and the Study of Metals.—II. W. Roland Needham (*World Power*, 1926, **6**, 27-32).—Cf. abstract above. N. briefly describes, under separate headings, each of the following "metallurgical facilities" for investigation of engineers' problems: The X-ray examination of materials, the Clink detector for recording internal forging or ingot flaws, the quest for flaws by method of magnetic analysis, the drop of potential method for detecting flaws, the trepanning tool for removing central cores, the micro-stress recorder, and the commercial application of light alloys for forgings, castings, &c. Appropriate references to the literature are given in many cases. [Note

by *Abstractor*.—The information in this portion of the article is most up to date, and though written primarily for engineers, forms a very convenient summary of recent developments in methods of investigation, in which all metallurgists cannot fail to be interested.]—T. B. C.

The British Non-Ferrous Metals Research Association. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1926, 2, 76).—A brief account of the work of the Association.—R. G.

Research in Metallurgical Literature. Richard Rimbach (*Blast-Fur. and Steel Plant*, 1926, 14, 396-399).—If this article had been styled "The Use of Metallurgical Literature in Research" it would have furnished an accurate indication of its contents. A fairly complete list of standard metallurgical text-books is given, classified into the various branches of the subject. This is followed by a list of sources of information regarding titles, dates of publication of books, articles, &c., on metallurgy. Then follows a list of metallurgical publications classified. Trade journals are listed separately in each class, where these exist. [*Note by Abstractor*.—The article should prove useful as a guide to anyone seeking the most recent information on any branch of metallurgy, and includes the literature of the British, American, German, French, Italian, and Russian nations.]—T. B. C.

The Present Position of the Investigation of Metallic Materials. F. Körber (*Z. V. d. I.*, 1926, 70, 491-496).—K. gives a brief summary of the present position of the investigation of metals, with special reference to the latest results obtained by examination with X-rays.—G. S.

Progress in Metal Working in the Year 1925. I.—Chemical Treatment of Metals. R. Horn (*Metallwaren Ind. u. Galvano-Tech.*, 1926, 24, 69-71).—A review.

Standardization of Metals and Alloys. G. Buchner (*Bayer. Ind.-u. Gewblatt.*, 1922, 54, (108), 89-90).—The German nomenclature of the different kinds of brass and bronze is given.—M. H.

Nomenclature. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1926, 2, 50-51).—A general discussion on the subject with reference to non-ferrous metals and the inadvisability of naming micro-constituents after individual research workers.—R. G.

Chemistry in the Metallurgical Division of the [U.S.] Bureau of Standards. H. W. Gillett (*J. Chem. Education*, 1926, 3, 148-156).

The New Metallurgical Laboratories at the Pittsburgh Experiment Station. Anon. (*Science*, 1926, 63, 223-224).—A brief account of the above laboratories, with particulars of staff, organization, &c.—W. H.-R.

The Birmingham Works of H. H. Vivian and Company, Limited. Anon. (*Found. Trade J.*, 1926, 34, 111-114).

The Problem of Secondary Metals in World Affairs. Frederic W. Willard (*Indust. and Eng. Chem.*, 1926, 18, 1178-1182).—Read at the conference on "The Role of Chemistry in the World's Future Affairs" before the Institute of Politics. The metal resources of the world, as indicated by the inventory taken by Professor ter Meulen, will be exhausted in less than 20 years. This is qualified by the belief that fresh sources of metal will be discovered, and also the treatment of low-grade ores and the recovery of secondary metals will be stimulated. The possibilities of the six or seven economic metals, so far as secondary recovery is concerned, are reviewed. Our resources are being dissipated to the extent that (a) some metals are used for purposes which render their recovery in metallic form impossible, and (b) the margin between secondary and primary metal values is too small to pay the cost of collection. A joint Commission of the American Institute of Mining and Metallurgical

Engineers and the Mining and Metallurgical Society of America has published a report which shows that the United States are dependent upon outside sources for antimony, chromium, mercury, vanadium, and zirconium; and have no prospect of providing from domestic ore sources any appreciable proportion of their requirements of nickel, cobalt, platinum, or tin. This points to the importance of conserving and developing their secondary metal resources.—F. J.

Utilization of Old Metals and Metallic Residues. Hermann Dahl (*Giesserei-Zeit.*, 1926, 23, 389-398).—A discussion of the economics of metal recovery from scrap and waste, with especial reference to present conditions in Germany.
—A. R. P.

The Recovery of Scrap Copper. Adolph Bregman (*Met. Ind. (N.Y.)*, 1926, 24, 102-104).—The fourth of a series of articles on the reclamation of copper. The article is divided into: Introduction, extent of the industry, sources of scrap copper, methods of recovering clean copper, eliminating metallic impurities, and refining brass scrap. The two concluding divisions relate to metal melting precautions and recovery of metal from pickling solutions. The information is copious and practicable.—T. B. C.

Scrap Metal Separator Effects Large Annual Saving. Anon. (*Iron Trade Rev.*, 1926, 79, 577).—An illustrated description of a magnetic separator for iron and Monel metal scrap; the prices of these materials, when "pure," being about 1 to 20, whereas mixed scrap sells at much the same figure as if it were all iron.—T. B. C.

Granulation of Slags and Metals. B. Bogitch (*Compt. rend.*, 1926, 182, 1221-1223).—To obviate explosions due to the presence of much metal in the molten slag, compressed air is injected below the surface of the water into which the material is dropped. Tests in which air under 1 kg. pressure was used in granulating an iron-magnesium silicate slag and a molten metal showed that both smaller vessels and a shorter drop could be used with complete safety.—E. H. T.

Contribution to the Knowledge of the Mould Gases of Iron. E. Améen and H. Willners (*Jernk. Ann.*, 1926, 110, 107-124).—The arrangement for the investigation which is described in the article can probably be applied for the collection of the gases formed in the casting of other metals.—Y. G.

Selecting Metal Pickling Equipment. C. A. Crawford (*Inco*, 1924, 5, (2), 12-13).—In acid atmospheres Monel metal sheaths, bolts, and general fitments are advised. They have much longer lives than parts of gun-metal, &c.
—W. A. C. N.

Metal Pickling. T. Lewis Bailey (*Metallurgist (Suppt. to Engineer)*, 1926, 2, 96).—A letter drawing attention to work on the subject carried out by E. Linder and the writer, published in the Fifty-Ninth Annual Report on Alkali, &c., Works, 1922.—R. G.

The Pickling of Tinplate. Anon. (*Metallurgist (Suppt. to Engineer)*, 1926, 2, 100-101).—A summary of a report by the Chief Inspector of Alkali, &c., Works, 1922. The experiments described in the report were made for the purpose of minimizing the amount of hydrogen evolved during the pickling process.—R. G.

The Etching of Metals. Eugen Werner (*Metallwaren Ind.- u. Galvano-Tech.*), 1927, 25, 48-50, 67-68).—A survey of various methods of etching used mainly in the printing industry for aluminium, steel, and zinc.
—B. B.

To Unify Wire and Sheet Metal Gauges. Anon. (*Iron Trade Rev.*, 1926, 128, 866).—An account of a Conference held in New York on March 18, 1926,

with the object of eliminating the confusion occasioned by the use of the 30 wire and sheet metal gauge systems in America; unification was suggested, and a sectional committee appointed to deal with the details of the scheme.

—T. B. C.

Indicator for Wire Gauge. Anon. (*Mech. World*, 1926, 79, 64).—A simple attachment to a wire gauge is described, whereby the latter may be used in a dark store without the necessity of having to refer to the stamped gauge number.—F. J.

The World's Mineral Resources. Monographs Relating to Different Metals.—VII. Marcel Fourment (*Rev. Mét.*, 1926, 23, 132-142).—The occurrence and uses of vanadium are discussed. The preparation and compositions of ferro-vanadium cupro-vanadium, and aluminium-vanadium alloys are briefly discussed.—F. J.

The Aluminium Works in Germany. — Menzen (*Z. Metallkunde*, 1927, 19, 4-5).—Germany produces more than 30,000 tons of aluminium per year. —M. H.

The World's Production of Aluminium Since its Discovery. E. Scheuer (*Z. Metallkunde*, 1927, 19, 6-8).—Interesting details on the development of the world's output of aluminium, especially with regard to the price and to the influence of the different methods of production, are given. The world's production in 1926 is estimated to be about 200,000 tons.—M. H.

Profits in Fabricating Copper. Arthur Notman (*Met. Ind. (N.Y.)*, 1926, 24, 55-57).—A report of a talk at a meeting of the New York Branch of the American Institute of Mining and Metallurgical Engineers. The report is largely financial.—T. B. C.

Profits in the Copper Wire and Brass Industry. Arthur Notman (*Min. and Met.*, 1926, 7, 121-125).—A statistical discussion of the financial position of the copper industry in America.—A. R. P.

Removal of Iron from Copper and Nickel Mattes. B. Bogitch (*Compt. rend.*, 1926, 182, 1473-1475).—To investigate losses of copper and nickel during removal of iron, the powdered mattes was mixed with sand and sodium sulphate (as oxidant) and melted. Analysis of the slags showed that both copper and nickel were oxidized, and that the oxidation increased as the amount of iron diminished. Although nickel oxide has a greater heat of formation than copper oxide, less nickel than copper is lost in the slag: an anomaly due to the great difference in the heats of decomposition of cuprous and nickel sulphides. The last traces of iron are more difficult to remove from nickel mattes than from copper mattes. The more acid (and viscous) the slag, the greater is the loss of copper, due to mechanical entanglement, but this loss should not exceed 4-5% in practice; the ratios nickel oxide to ferrous oxide and cuprous oxide to ferrous oxide do not change.

—E. H. T.

Restoration of Ancient Bronzes. Colin G. Fink and C. H. Eldridge (*Metropol. Mus. (N.Y.) Report*, 1925; *C. Abs.*, 1925, 19, 3433).—An electrolytic method was developed using 2% NaOH solution as electrolyte. The bronze to be treated is made cathode and feeble currents are employed. Basic carbonates and oxides in the crust are slowly reduced in place.

Managing a Brass Shop. W. L. Abate (*Met. Ind. (N.Y.)*, 1926, 24, 11).—A. outlines the necessary personality for the successful running of a brass manufacturing (or other) plant.—T. B. C.

Germanium in a British Mineral. Walter Scutt (*Phil. Mag.*, 1926, [vii.], 1, 1007-1009).—Hitherto, germanium has been found in the scarce Bolivian minerals argyrodite (6-7% Ge), canfieldite (1.8% Ge), and germanite

(5-8% Ge) found in S.W. Africa. The occurrence of 2-4% of germanium in zinc blende derived from a lead mine in the neighbourhood of Devil's Bridge, Aberystwyth, has been ascertained spectroscopically.—J. S. G. T.

Experiments on the Removal of Antimony from Lead by the Dry Method. B. George (*Metall. u. Erz*, 1925, **22**, 27-34).—A series of experiments is described, in which it is shown that by puddling a mixture of antimonial lead and fused litharge it is possible completely to remove the antimony as lead antimoniate with the reduction of a corresponding amount of lead from the litharge. The most efficient removal in the shortest time is obtained by the use of only a slight excess of litharge above the theoretical. With more than a 50% excess the reaction is appreciably retarded, and the quality of the lead obtained is impaired.—A. R. P.

The Production of Nickel. W. R. Barclay (*Met. Ind. (Lond.)*, 1926, **23**, 227-228).—Lecture delivered at a joint meeting of the Birmingham Local Section of the Institute of Metals, Birmingham Metallurgical Society, Staffordshire Iron and Steel Institute, and Birmingham Jewellers and Silversmiths' Association. B. gave a description of his visit to the nickel ore mines, Sudbury, Canada.—E. C.

Alloys of Iron Research. VII.—Preparation of High Purity Silicon. N. P. Tucker (*Iron Steel Inst. (Advance Copy)*, 1927, May, 48-52).—It has been found that in commercial silicon, containing from 93 to 98% silicon, the impurities lie either in distinct strata or in the intercrystalline boundaries. When such material is attacked with acids the impurities, consisting mainly of iron and aluminium silicates and of silicides of iron, calcium, and magnesium, are dissolved, and evil-smelling and inflammable hydrides of silicon are evolved. If the best available commercial silicon is finely powdered and treated successively with *aqua regia*, hydrofluoric and sulphuric acids, and finally with hydrochloric acid, a product is obtained which, in favourable circumstances, contains 99.94% of silicon. Such material, after melting down in a silica crucible, exhibits a microstructure confirming the high purity of the product.

Effortless Silver Cleaning. Roger S. Estey (*Sci. American*, 1927, **136**, 74-75).—Silverware may be cleaned by placing in a hot solution of baking soda and salt contained in an aluminium pan. An experiment showed that tarnish removed in this manner took only about half its weight of silver with it, whereas the usual method of cleaning silver removed about ten times as much silver as tarnish.—J. C. C.

The Manufacture of Tin in Sweden. Albert af Forselles (*Industritidningen Norden*, 1921, **35**, 287-290).—Describes the general methods used and a new shaft furnace method suitable for Swedish conditions.—Y. G.

Metallic Uranium. J. F. Goggin, J. J. Cronin, H. C. Fogg, and C. James (*Indust. and Eng. Chem.*, 1926, **18**, 114-116).—Preliminary attempts to reduce uranium oxide to metallic uranium by means of metallic calcium in a steel bomb placed in an evacuated steel tube, and heated, are described. The uranium obtained was in the form of powder, owing to the infusible calcium oxide preventing coalescence of the reduced globules of metal. Subsequent experiments were carried out on uranium chloride, the preparation of which is described. A fused button of uranium was obtained, contaminated with iron (uranium 99.31%, iron 0.57%, carbon 0.09%). The calcium used was the source of the impurities, and by subliming it was sufficiently purified to yield, when used to reduce a further quantity of uranium chloride, a clean silvery, fused mass of uranium containing < 0.01% of iron.—F. J.

Proceedings of the Eighth Annual Meeting of the American Zinc Institute.

— (*Bull. Amer. Zinc. Inst.*, 1926, **8**, (5-6), 1-175).—Full particulars of the meeting with verbatim reports of the discussions, &c.—W. H. R.

Zinc Metallurgy in Tonkin [China]. M. Raby (*Bull. Amer. Zinc Inst.*, 1926, **8**, (4), 13-21).—From the *Far Eastern Review* (Shanghai). Details are given of methods of zinc metallurgy adopted by the Ore and Metallurgic Company of Indo-China.—W. H. R.

Metallurgical Recovery of Zinc. C. E. Siebenthal (*Met. Ind. (Lond.)*, 1926, **29**, 173-175, 194-195).—Reprinted from the *Bulletin of the American Zinc Institute*.—E. C.

Studies in the Control and Treatment of "Nickel Rash." Frederick M. R. Bulmer and E. A. Mackenzie (*J. Indust. Hyg.*, 1926, **8**, 517-527).—"Nickel rash" occurs among employees in nickel-plating and nickel-refining works. In the works of the International Nickel Co. of Canada, at Port Colborne, there were 43 cases in 1923, 22 in 1924, and 23 in 1925. The affection is not due to the ingestion of nickel, but mainly to an overheated environment. Fair-skinned people are more susceptible than dark-skinned. The treatment advised is oral administration of concentrated calcium chloride solution, which counteracts alkalosis of the blood caused by excessive heat.

—E. H. T.

Metal Poisoning in Industrial Life. Georg Wolff (*Chem.-Zeit.*, 1925, **49**, 389-390, 411-412).—A review of the effects of exposure to dust and sprays containing compounds of lead, arsenic, phosphorus, mercury, chromium, copper and iron, together with a brief account of the symptoms of poisoning and of means for avoiding the danger.—A. R. P.

Health Hazard of Brass Foundries. J. A. Turner and L. R. Thompson (*Met. Ind. (Lond.)*, 1926, **29**, 362-364).—Abstracted from *Public Health Bulletin*, No. 157, U.S. Public Health Service.—W. H. D.

Lead Poisoning Among Oxy-Acetylene Welders in the Scrapping of Naval Vessels. E. W. Brown (*J. Indust. Hyg.*, 1926, **8**, 113-140; *C. Abs.*, 1926, **20**, 1780).—In cutting old metal plates covered with lead paint and caulked with red lead, plumbism caused 2105 days lost time in a working force averaging 73 men. Air tests showed 4.9 mg. lead per cu. m. In a total of 221 men employed during 8.3 months, the annual plumbism rate was 72.5 per 100 employees. Lead was found by the Fairhall method in 25 out of 26 urine specimens, in quantities varying from 0.05 to 2.15 mg. lead per 2000 c.c. The size of lead fume particles rising from the oxy-acetylene torch averaged 0.5 microns. Complete medical data are presented. Preventive measures suggested are: Medical examination before and during employment; personal hygiene; efficient respirators. Several masks were carefully tested; the canister type is best, but reduction of incidence of plumbism when using the best mask could not be demonstrated.

Does an Injurious Amount of Lead Vapour Arise in Lead Burning? H. Fischer (*Arch. Hyg.*, 1924, **94**, 342-346; *C. Abs.*, 1925, **19**, 1463-1464).—When lead is burned by the use of detonating gas, lead oxide is found in the air in quantities so small that injurious amounts are seldom inhaled.

Industrial Lead Poisoning. Anon. (*Pharm. Zentr.*, 1926, **67**, 405-406).—Descriptive.

The Mechanism and Incidence of Industrial Lead Poisoning. Anon. (*Lancet*, 1926, **211**, (ii.), 1132-1133).—A review of the subject dealing mainly with the alleged greater susceptibility of women to poisoning from lead-inhalations, and with the admittedly greater severity of the symptoms in women, as compared with men.—E. H. T.

Medico-hygienic Observations on the Prevention of Industrial Diseases, Especially Lead Poisoning. L. Schwartz (*Z. angew. Chem.*, 1926, **39**, 504-507).—A discussion of the causes, symptoms and treatment of various industrial diseases. The chief danger to workers using metallic lead is the inhalation of the vapour of the metal or its volatile oxides. The use of oxy-hydrogen flames by plumbers is associated with greater danger than the use of oxy-coal gas or oxy-acetylene burners, but in all cases a certain element of risk is present. This may be neutralized to a great extent by a periodical change of employment.—A. R. P.

Prophylaxis in Industrial Lead Poisoning. David McKail (*J. Indust. Hyg.*, 1926, **8**, 74-77; *C. Abs.*, 1926, **20**, 1289).—Although inhalation of fumes or dust is the main channel of entrance, absorption of lead takes place mainly through the alimentary tract. Lead dust from the upper respiratory passages is swallowed and dissolved by the HCl of the gastric juice. Prophylaxis lies in removal of dust at point of origin; avoidance of raising or inhaling dust; scrupulous cleanliness of face, hands, teeth, and clothing; mouth-washing; an altuminous meal before starting work; and a soluble sulphate cathartic once or twice a week. The sulphate solution forms physiologically inert $PbSO_4$.

Lead Anaemia. May R. Mayers (*J. Indust. Hyg.*, 1926, **8**, 222-231; *C. Abs.*, 1926, **20**, 2551-2552).—An examination was made of 381 employees actively at work in factories where there is more or less exposure to lead dust and lead products. The blood showed what M. calls lead anaemia. This anaemia is characterized by a relatively slight reduction in the red cell count and hæmoglobin associated with red cells of abnormal morphology out of all proportion to the apparently low-grade anaemia. Of these abnormal red cells, stippling ranked fourth in frequency of occurrence, being found in 39% of the 238 cases showing characteristic blood changes. M. calls attention to the fact that in examining the blood of lead workers the whole blood picture must be considered, and not merely the presence or absence of stippled cells. A control series of 250 normal individuals revealed the presence of stippling in 1 case (0.4%).

Danger of Mercury Vapour. A. Stock (*Z. angew. Chem.*, 1926, **39**, 461-466).—A warning is given of the danger of prolonged exposure to the vapours evolved at ordinary temperatures by metallic mercury, *e.g.* from mercury pumps, gas analysis apparatus, and the like. A very complete description is given of the slow development of mercury poisoning in workers in a well-ventilated laboratory during a period of several years; the symptoms include nervous trouble, catarrh, and eye trouble, and can be allayed only by abstention from all contact with mercury for months or even years. Tests on the usual dental amalgams showed serious loss of mercury to take place when the hardened amalgam was heated at 35° C. for some hours in a vacuum; the average loss in this way was 5-6 mg. per week. Although these conditions do not entirely accord with those in the mouth, S. considers that amalgam fillings for teeth are a source of danger to the health of the patient.—A. R. P.

On the Question of the Danger of Mercury Vapour. A Schmidt (*Z. angew. Chem.*, 1926, **39**, 786), Georg Pinkus (*ibid.*, 787-788), H. Reihlen (*ibid.*, 788), F. G. Radenwitz (*ibid.*, 788-789), Ludwig Wolf (*ibid.*, 789-790), Alfred Stock (*ibid.*, 790-791).—A general discussion of Stock's paper (*cf. supra*) S., R., and W. support Stock's contention that contact with mercury at the ordinary temperature results in the slow development of symptoms associated with mercury poisoning, and that, in view of this, the use of amalgam fillings in

dentistry should be abandoned. P. and G., on the other hand, consider that Stock greatly exaggerates the danger, the former having spent over 30 years distilling mercury and preparing dental amalgams without experiencing any unpleasant effects. G. considers that Stock's experiments, showing the possibility of serious loss of mercury from dental amalgams, are quite unrepresentative of the conditions existing in the mouth.

Stock, replying to the above discussion, said that experiments on old amalgams from teeth showed losses varying between 5.2 and 150 mg. per 300 sq. mm. of surface after heating for 3 days at 30° C. *in vacuo*.

—A. R. P.

On the Question of the Danger of Amalgam Fillings. Gustav Heber (*Z. angew. Chem.*, 1926, **39**, 905-907).—Polemical against Stock (*supra*). Many years' experience of amalgam fillings has led to the conclusion that their use does not produce any of the symptoms of mercurial poisoning described by Stock. The most modern type of filling, consisting of platinum-gold-nickel amalgam, shows very little deterioration after several years in the mouth.—A. R. P.

On the Question of the Danger of Amalgam Fillings. L. Sterner-Rainer (*Z. angew. Chem.*, 1926, **39**, 907-908).—S.-R. supports Heber's view, and quotes the researches of Tamman and Dahl on mercury-tin-silver alloys to show that in a properly prepared filling of tin-silver amalgam no free mercury should be present after hardening, the constituents of the hardened amalgam being Ag_3Sn , Ag_3Hg_4 , and a solid solution of mercury in tin.—A. R. P.

On the Danger of Mercury Vapour. Karl Hofer (*Z. angew. Chem.*, 1926, **39**, 1123-1124).—(Cf. *supra*.) H. has experienced similar symptoms to those described by Stock, as a result of working with electrical apparatus, including a mercury commutator over a period of many months. To avoid temperature changes the apparatus was operated in a basement room with very little ventilation, the mean temperature being 30° C. The symptoms disappeared only after a prolonged interval of abstention from contact with mercury.

—A. R. P.

Contradiction of Professor Alfred Stock's Statements on the Danger of Mercury Vapour and Amalgams. Georg Pinkus (*Z. angew. Chem.*, 1926, **39**, 1534).—(Cf. *supra*.) Over a period of 40 years no ill-effects have been experienced from the preparation and use of amalgams for dental purposes.

—A. R. P.

On the Danger of Poisoning by Mercury in Laboratories. Fritz G. Hoffmann (*Chem.-Zeit.*, 1926, **50**, 927).—The suggestion of Stock (cf. *supra*) that constant exposure to mercury vapour at the ordinary temperature leads to slow poisoning is not confirmed by the experience of H.—A. R. P.

Poisoning by Mercury Vapour. L. M. Dennis (*Indust. and Eng. Chem.*, 1926, **18**, 1205).—Summary of a recent article by Alfred Stock (*Z. angew. Chem.* 1926, **39**, 461; this volume, p. 752).—F. J.

Little Danger in Zinc. W. A. Evans (*Bull. Amer. Zinc. Inst.*, 1926, **9**, (9-10), 33).—A discussion of the work of C. K. Drinker on the question of zinc poisoning. Zinc in itself is not a direct poison. The harmful effect of zinc fumes is due to the choking of the air cells by the small particles, and would result from any metallic dust. Zinc sulphate and chloride are, however, corrosive and directly poisonous.—W. H.-R.

Occupational Syndrome among Workers in Zinc. C. P. McCord and Alfred Friedlander (*Amer. J. Pub. Health*, 1926, **16**, 274-280; *C. Abs.*, 1926, **20**, 1779).—In a galvanizing plant 12 out of 15 workers employed 6 years or more had gastric and duodenal ulcers, but it is uncertain whether it was the zinc or

the other hazards. Zinc was found in the urine in excess of normal. Zinc was excreted long after removal from exposure. In another plant, where all employees had been exposed less than 6 years and where general plant conditions were better, no gastro-intestinal disease was found. A period of 5 to 20 years appears to be necessary for the production of the lesions described.

Zinc. Analysis of Factory Inspection Reports, 1920-1922.—III. Anon. (*Internat. Lab. Rev.*, 1926, **13**, 546-549; *J. Indust. Hyg.*, 1926, **8**, 215A.).—From Germany are reported cases of zinc ague from soldering galvanized utensils, from using a blow-torch on ship-plates of galvanized steel, and in reducing zinc oxide electrolytically. Similar symptoms are recorded from a copper-rolling mill (due to fine copper dust), and the conclusion is drawn that all heavy metals under certain conditions can cause "brass-founders'" ague. In Great Britain cases occurred due to cutting galvanized plates with the oxyacetylene flame; and in the Netherlands there was one case due to oxyacetylene-soldering of copper; attacks in brass-smelting varied in severity with the zinc content of the material.—E. H. T.

A Clinical and Laboratory Investigation of the Effect of Metallic Zinc, of Zinc Oxide, and of Zinc Sulphide upon the Health of Workmen. Roger P. Batchelor, J. William Fehnel, Robert M. Thomson, and Katherine R. Drinker (*J. Indust. Hyg.*, 1926, **8**, 322-363).—A detailed report of clinical and laboratory studies on 24 workmen who were exposed to varying concentrations of zinc, as zinc oxide, zinc sulphide, and fine zinc-dust, for periods varying from 2 to 35½ years. The zinc compounds were mainly derived from ores, e.g. Franklinite, containing only very minute amounts of lead, cadmium, and arsenic. In no case was any acute or chronic illness, which could be ascribed to zinc-poisoning, observed; and it is concluded that symptoms commonly attributed to zinc are mostly probably due to the lead, cadmium, arsenic, or antimony that accompany zinc in its ores.—E. H. T.

The Toxicity of Zinc. Anon. (*Lancet*, 1926, **111**, 191).—Attention is drawn to two recent publications containing opposed views on the toxicity of zinc. The one (*Archiv. Internat. Med.*, 1926, May 15) reports widespread gastro-intestinal symptoms, ranging from gastro-enteritis in the young to gastric and duodenal ulcers in the elderly, among workers in galvanizing plants. Zinc is held to be the causative agent.—E. H. T.

Some Modern Aspects of Physical Research. [Sir] J. Alfred Ewing (*Proc. Roy. Soc. Edinburgh*, 1925-6, **46**, (1), 1-8).—Reviews the main developments in physical science of the last fifty years.—W. H.-R.

The Vital Need for Greater Financial Support of Pure Science Research. Herbert Hoover (*Reprint and Circ. Series, Nat. Res. Council [U.S.A.]*, No. **65**, 1925, 1-6).—An address presented upon the Henry Robinson Towney Lectureship before the American Society of Mechanical Engineers, 1925.

The Vital Need for Greater Financial Support to Pure Science Research. Herbert Hoover (*Michigan Technic*, 1926, **39**, (2), 5-6, 21-22).

Research—The Mother of Industry. Arthur D. Little (*Michigan Technic*, 1924, **37**, (4), 18, 26-28).

Research—A Mental Attitude. Charles F. Kettering (*Michigan Technic*, 1924, **37**, (4), 22, 25).

Motive and Obligation. Engineering, Industrial Research, Research without Utilitarian Objective, and the Interdependence of the Fields to which they Pertain. F. B. Jewett (*Reprint and Circ. Series, Nat. Res. Council [U.S.A.]*, No. **68**, 1925, 1-10).—An address delivered before the Section of Engineering of the American Association for the Advancement of Science, 1925.

Report of Committee E-9 on Correlation of Research. H. F. Moore (*Proc. Amer. Soc. Test. Mat.*, 1926, **26**, (I.), 611-618).—A general statement with regard to problems under investigation. Such topics as corrosion-resistant alloys, the effect of arsenic and tin on high-speed tool steels and light high-strength alloys are considered.—J. F. S.

Research and Progress. Charles F. Kettering (*Amer. Found. Assoc.* (Advance Copy), 1926, Sept., 13 pp.).—An address emphasizing the dependence of progress on untiring and continual research.—A. R. P.

Science and Engineering. William F. Durand (*Reprint and Circ. Series Nat. Res. Council [U.S.A.]*, No. **71**, 1926, 1-13).—Reprinted from *Mech. Eng.*, 1926, **48**, 337-340).

Honours Courses in American Colleges and Universities. Frank Aydelotte (*Bull. Nat. Research Council [U.S.A.]*, 1925, No. **52**, 1-96).—Second edition, revised.

Second Census of Graduate Research Students in Chemistry. James F. Norris (*Reprint and Circ. Series, Nat. Res. Council [U.S.A.]*, No. **63**, 1925, 1-3).—Reprinted from *Indust. and Eng. Chem.*, 1925, **17**, 755-756. The census shows that in 1924 the number of graduate research students in metallurgy in the U.S.A. was 38; in 1925 the number was 23. In 1925 there were, in addition, 5 graduate research students in metallography. The total number of graduate research students in all fields of chemistry was 1700 and 1763 respectively.

Research—The Bond Between the University and Industry. A. E. White (*Michigan Technic*, 1921, **33**, 61-67).

A List of Research Problems in Chemistry. J. E. Zanetti (*Reprint and Circ. Series, Nat. Res. Council [U.S.A.]*, No. **53**, 1924, 1-9).—Reprinted from *Indust. and Eng. Chem.*, 1924, **16**, 304-307.

The First Tool in Research—A Comprehensive Bibliography. Donal Hamilton Haines (*Michigan Technic*, 1926, **39**, (3), 10-11, 21-22).

The Quotation of Scientific References. Henry Leffmann (*Science*, 1926, **63**, 231).—Discusses the best way of giving scientific references. The best order is (1) the name of the publication; (2) the series number (if any) in brackets; (3) the year; (4) the volume; and (5) the page. Roman numerals should not be used. [*Note.*—This is the system used in the *J. Inst. Metals*, except that (2) and (3) are reversed.] L. emphasizes the importance of giving both year and volume, and discusses the question of international agreement on abbreviations for titles.—W. H. R.

The Application of Results. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1926, **2**, 65-66).—It is suggested that two types of research reports should be provided when publishing the results of an investigation, one report to include details of all work done and results obtained, and the other to be of a more practical type, omitting all the technical and scientific detail, but emphasizing the suggested practical applications of the results obtained. In this way the interest and appreciation of the practical man might be aroused.—R. G.

A Modern Theory of Alchemy. A. J. Hopkins (*Isis*, 1925, **7**, (21) (reprint); *C. Abs.*, 1916, **20**, 849).—The ancient philosopher believed that (1) matter is one; (2) nothing exists except as it is good; (3) all nature is striving towards improvement; and (4) all nature is living. Artisans at first made artificial products to simulate the natural, such as pearls and Tyrian purple; later they prepared alloys and learned how to bronze metals. "Artistically such alloys were transmuted into more noble ones." The new theory of alchemy assumes that the alchemist inherited the above ideas and emphasized the importance of colour changes. "The alchemist, like the artist, stressed the changeable

Aristotelian qualities where we stress weight and fixed qualities. He changed colour; therefore (according to his definition of gold) transmutation was effected."

List of Publications of the [U.S.] National Research Council and its Fellows and Partial List of Papers Having their Origin in the Activities of its Committees to January 1, 1926. Anon. (*Reprint and Circ. Series, Nat. Res. Council [U.S.A.]*, No. 73, 1926, 1-70).

The New Laboratories of the École Centrale des Arts et Manufactures [Paris]. R. Villers (*La Nature*, 1925, 53, (ii.), 14-16).—A short descriptive article, with 6 illustrations, of the new laboratories of the École Centrale des Arts et Manufactures, of which L. Guillet is director. There are laboratories for general physics, for testing constructional materials, and for applied physics, including heat-treatment of metallurgical products; workshops, a foundry, and a laboratory for applied electricity are situated in the basement. The apparatus includes a horizontal Thomasset machine for tensile testing up to a maximum load of 50 tons, a Charpy pendulum machine (50 kg.-m.), and a Guillery rotary machine for shock tests (60 kg.-m. energy in fly-wheel).

—E. H. T.

Progress in the Art of Electrical Precipitation Since 1900. P. E. Landolt (*Amer. Electrochem. Soc.*, 1927, April, 155-158).—Starting with the early researches of Lodge, Walker, and Cottrell, the rapid development of electrical precipitation up to the present day is briefly recounted. Among the important steps in advance were the introduction of the mechanical rectifier; the large-scale industrial installation at 50,000 to 75,000 v.; the introduction of gas humidification in 1916; and the new "graded resistance" collecting electrode in 1923. At the close of 1925 there were over 300 Cottrell installations in operation throughout the world. The applications are wide and varied.

Possibilities of Industrial Heating. C. L. Ipsen (*Iron Steel Canada*, 1925, 8, 206-207).—A lengthy abstract of a paper read before the American Institute of Electrical Engineers. See *J.*, 1925, 34, 634.—W. H.-R.

Magnetic Reluctivity Relationship. Raymond L. Sanford (*U.S. Bur. Standards Sci. Paper No. 546*, 1927, 743-755).—An experimental and theoretical study of the magnetic properties of pure iron near saturation has led to the conclusion that the so-called reluctivity relationship of Kennelly does not truly represent the properties of pure and homogeneous materials, and that the constants in the reluctivity equation are without physical significance. The Kennelly formula and one recently proposed by Gokhale have practical value, each within its own range, for interpolation and extrapolation. The conclusion that the constants in the reluctivity formula are without physical significance makes the problem of correlating the magnetic properties of materials with their other physical properties more difficult. A new basis for correlation must be sought.

Tentative Definition of the Term Screen (Sieve) [E13-26T]. Anon. (*Proc. Amer. Soc. Test. Mat.*, 1926, 26, (I.), 1091; also *Amer. Soc. Test. Mat. Tentative Standards*, 1926, 992).—A screen (sieve) is defined as a plate or sheet or a woven cloth, with regularly spaced apertures of uniform size, mounted on a suitable frame or holder, for use in separating materials according to size.

The American Electrochemical Society: A Retrospect and a Look into the Future. Louis Kahlenberg (*Amer. Electrochem. Soc.* (Advance Copy), 1927, April, 265-271).

BIBLIOGRAPHY.

[Books marked * may be consulted in the Library of the Institute.]

- ***American Chemical Society.** *A Half-Century of Chemistry in America, 1876-1926. An Historical Review Commemorating the Fiftieth Anniversary of the American Chemical Society.* Edited by Charles A. Browne. Med. 8vo. Pp. iv + 254, with numerous portraits. 1926. Philadelphia, Pa.: The Society.
- ***American Electrochemical Society.** *Transactions of the American Electrochemical Society. General Index. Volumes XXI.-XL., 1912-1921.* Demy 8vo. Pp. 168. 1927. New York: The Society. (\$5.00.)
- ***American Society for Testing Materials.** *Proceedings of the Twenty-Ninth Annual Meeting held at Atlantic City, New Jersey, June 21-25, 1926.* Med. 8vo. Volume 26. Part I.—*Committee Reports. New and Revised Tentative Standards. List of Standards and Tentative Standards.* Pp. 1204, illustrated. Part II.—*Technical Papers.* Pp. 691, illustrated. 1926. Philadelphia, Pa.: The Society (1315 Spruce Street). (\$6.00 paper; \$6.50 cloth; \$8.00 half-leather per part.)
- Andrade, E. N. da C.** *The Structure of the Atom.* Third edition, revised and enlarged. Med. 8vo. Pp. xviii + 750. 1927. London: G. Bell & Sons, Ltd. (30s. net.)
- Arnold, Conrad.** Edited by. *The Practical Engineer. Electrical Pocket Book and Diary, 1927.* 1927. London: Oxford University Press. (Cloth, 2s. 6d. net; leather-cloth, 3s. net.)
- Association of British Chemical Manufacturers.** *British Chemicals: their Manufactures and Uses. Being the Official Directory of the Association of British Chemical Manufacturers (Incorporated); containing a Full List of Members with a Classified List of British Chemicals and a Note of their Applications.* Cr. 4to. Pp. 286. 1927. London: Ernest Benn, Ltd. (10s. 6d. net.)
- ***Austin, Leonard S.** *The Metallurgy of the Common Metals. Gold, Silver, Iron (and Steel), Copper, Lead, and Zinc.* Sixth edition, thoroughly revised. Med. 8vo. Pp. xviii + 658, with 347 illustrations. 1926. New York: John Wiley & Sons, Inc.; London: Chapman and Hall, Ltd. (35s. net.)
- Baly, E. C. C.** *Spectroscopy.* (Text-books of Physical Chemistry.) Third edition. In four volumes. Demy 8vo. Vol. 2. Pp. viii + 398 + 3 plates. 1927. London: Longmans, Green & Co., Ltd. (18s. net.)
- ***Bamford, T. G., and Harold Harris.** *The Metallurgist's Manual.* With a Foreword by Thomas Turner. Demy 8vo. Pp. x + 246, with 55 illustrations. 1927. London: Chapman and Hall, Ltd. (15s. net.)

- Department of Scientific and Industrial Research. *The Cleaning and Restoration of Museum Exhibits*. Third Report upon Investigations conducted at the British Museum. Roy. 8vo. Pp. v + 70 + 58 plates. 1926. London: H.M. Stationery Office. (5s. net.)
- *Descroix, L. Rédigées par. *Art de l'Ingénieur et Métallurgie. Résistance des Matériaux et Données numériques diverses*. Préface de Sir Robert Hadfield. (Extrait du Volume V., Années 1917-1922, Tables Annuelles de Constantes et Données numériques.) 4to. Pp. 1660-1909. 1926. Paris: Gauthier-Villars et Cie; Chicago: University of Chicago Press; Cambridge: Cambridge University Press.
- Deutschen Gesellschaft für Metallkunde. Herausgegeben von der. *Kupfer. Gewinnung, Gefügeaufbau, chemische und physikalische Eigenschaften, Technologie und Krankheitserscheinungen*. Mit einem Anhang: "Erläuterung der physikalischen Begriffe, Amerikan. Lieferungsvorschriften für Kupfer. Quellennachweis." Genehmigte Übersetzung des Circular No. 73: "Copper" des Bureau of Standards, Washington, U.S.A., von Dr. Paul Siebe. DIN A5, 120 Seiten mit 25 Abbildungen und 24 Zahlentafeln. Berlin: VDI-Buchhandlung. (R.M. 5.60; members of VDI, R.M. 5.)
- Evans, Ulick R. *Die Korrosion der Metalle*. Deutsche Bearbeitung von Emil Honegger. 1926. Berlin: VDI-Buchhandlung. (R.M. 16.80.)
- *Evans, Ulick R. *The Corrosion of Metals*. Second edition. Demy 8vo. Pp. xvi + 259, with 28 illustrations. 1926. London: Edward Arnold & Co. (15s. net.)
- Fischer, A. *Elektroanalytische Schnellmethoden: Elektroanalyse unter Bewegung von Elektrolyt oder Elektrode*. Zweite neubearbeitete und vermehrte Auflage von A. Schleicher. (*Die chemische Analyse*, Band 4-5.) Pp. 430. 1926. Stuttgart: Ferdinand Enke. (G.M. 24.)
- *Fischer, Joseph. *Die Zerstäubungserscheinungen bei Metallen unter besonderer Berücksichtigung der mechanisch-thermischen Zerstäubung und der elektrischen Stossverdampfung*. (Fortschritte der Chemie, Physik und physikalischen Chemie, herausgegeben von A. Eucken, Band 19, Heft 1.) Roy 8vo. Pp. 70, with 14 figures in the text. 1927. Berlin: Gebüder Borntraeger. (M. 4.80.)
- *Fourment, M., and Léon Guillet. *Métallurgies du Plomb, du Nickel et du Cobalt et Alliages de ces Métaux*. Med. 8vo. (Grandes Encyclopédies Industrielles, publié sous la direction de L. Guillet.) Pp. 492, with 288 illustrations. 1926. Paris: J.-B. Baillièrre et Fils. (70 francs + 40 per cent. majoration.)
- Fowler, W. H. Edited by. *Fowler's Electrical Engineer's Pocket Book, 1927*. 18mo. Pp. 500. 1927. Manchester: Scientific Publishing Co. (3s. net.)
- Fowler, W. H., Edited by. *Fowler's Mechanical Engineer's Pocket Book, 1927*. 18mo. Pp. 568. 1927. Manchester: Scientific Publishing Co. (3s. net.)
- Fowler, W. H. Edited by. *Fowler's Mechanic's and Machinist's Pocket Book, 1927*. 18mo. Pp. 449. 1927. Manchester: Scientific Publishing Co. (2s. net.)

- ***Fox, Cyril S.** *Bauxite. A Treatise Discussing in Detail the Origin, Constitution, Known Occurrences, and Commercial Uses of Bauxite; and Including Particulars Regarding the Present Condition of the Aluminium Industry and the Peculiar Importance of Cayolite in the Extraction of Aluminium from Bauxite.* Roy. 8vo. Pp. xii + 312, with 29 illustrations and 6 maps. 1927. London: Crosby Lockwood & Son. (30s. net.)
- ***Friend, J. Newton.** Edited by. *A Text-Book of Inorganic Chemistry.* Volume VII. Part III.—*Chromium and its Congeners.* By Reece H. Vallance and Arthur A. Eldridge. Demy 8vo. Pp. xxvi + 380, with 6 figures in the text. 1926. London: Charles Griffin & Co., Ltd. (18s.)
- ***Gardner, William.** *Chemical Synonyms and Trade Names. A Dictionary and Commercial Handbook.* Third edition, revised and much enlarged. Roy. 8vo. Pp. 355. 1926. London: Crosby Lockwood & Son. (30s. net.)
- ***Garland, H., and C. O. Bannister.** *Ancient Egyptian Metallurgy.* Cr. 8vo. Pp. xi + 214, with frontispiece and 113 illustrations. 1927. London: Charles Griffin & Co., Ltd. (12s. 6d.)
- Geiger, H., and Karl Scheel.** Herausgegeben von. *Handbuch der Physik,* Band 17: *Elektrotechnik.* Redigiert von W. Westphal. Sup. Roy. 8vo. Pp. vii + 392. 1926. Berlin: Julius Springer. (G.M. 31.50.)
- ***Gibson, Arnold Hartley, and Schofield Labrow.** *The Efficiency of Regain in Straight and Bent Draught Tubes.* Demy 8vo. (Institution of Civil Engineers. Selected Engineering Papers, No. 34.) Pp. 23, with 9 figures. 1926. London: Institution of Civil Engineers.
- ***Gmelin.** *Handbuch der anorganischen Chemie.* Achte Auflage. Roy. 8vo. Bearbeitet von R. J. Meyer. System-Nummer 2: *Wasserstoff.* Pp. xvi + v + 273, with 3 figures. System-Nummer 19: *Wismut.* Pp. xxii + 229, with 11 figures. System-Nummer 20: *Lithium.* Pp. xxiv + 254, with 13 figures. 1927. Leipzig und Berlin: Verlag Chemie G.m.b.H.
- Goetz, Alexander.** *Physik und Technik des Hochvakuums.* Zweite umgearbeitete und vermehrte Auflage. Roy. 8vo. Pp. x + 260 + 3. Tafeln. 1926. Braunschweig: Friedr. Vieweg und Sohn A.-G. (G.M. 16.)
- ***Guertler, W.** *Metallographie. Ein ausführliches Lehr- und Handbuch der Konstitution und der physikalischen, chemischen und technischen Eigenschaften der Metalle und metallischen Legierungen.* Sup. Roy. 8vo. Zweiter Band: *Die Eigenschaften der Metalle und ihrer Legierungen.* Zweiter Teil: *Physikalische Metallkunde.* Fünfter Abschnitt: *Das Volumen.* Zweite Lieferung: *Die Thermische Ausdehnung* von A. Schulze. Pp. xv + 82-336, with 108 illustrations. 1926. Berlin: Gebr. Borntraeger. (M. 18.80.)
- Haas, Arthur.** *Atomic Theory: An Elementary Exposition.* Translated by T. Verschoyle. Demy 8vo. Pp. xiv + 222. 1927. London: Constable & Co., Ltd. (10s. 6d. net.)
- Hale, William J.,** Edited by, in co-operation with **West, Clarence J.** *A Survey of American Chemistry.* Vol. 1, July 1, 1925, to July 1, 1926: including Reports from Scientific Committees, Division of Chemistry and Chemical Technology, National Research Council. (Published for National Research

- ***Barton, F. R.** *Nickel Coinage*. Cr. 8vo. Pp. iv + 50. [1927.] London: Mond Nickel Co., Ltd.
- Baud, Paul.** *Chimie industrielle: la grande industrie chimique, les métalloïdes et leurs composés, les métaux et leurs sels, industries organiques*. Deuxième édition entièrement rééditée. Roy. 8vo. Pp. xii + 1022. 1927. Paris: Masson et Cie. (100 francs.)
- Bauer, K. H.** Herausgegeben von. *Chemie-Büchlein: ein Jahrbuch der Chemie*. Jahrgang 6. 8vo. Pp. 79. 1927. Stuttgart: Franckhsche Verlagsbuchhandlung. (G.M. 1.50.)
- Beck, Ernest G.** Edited by. *The Practical Engineer. Mechanical Pocket Book, 1927*. 1927. London: Oxford University Press. (Cloth, 2s. 6d. net; leather-cloth, 3s. 6d. net.)
- ***Benedicks, Carl.** *Metallographic Researches. Based on a Course of Lectures delivered in the United States in 1925*. Med. 8vo. Pp. xi + 307, with 153 illustrations. 1926. New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd. (20s.)
- Beresovski-Chestov, Tatiana.** *Statistique intellectuelle de la France: tableaux relatifs à l'enseignement public, aux bibliothèques, aux spectacles, aux publications, préparés sous les auspices de l'Institut International de Coopération intellectuelle et de l'Institut de Statistique de l'Université de Paris. Année 1923-24*. Gl. 4to. Pp. vii + 124. 1926. Paris: Les Presses universitaires de France. (35 francs.)
- Board of Education.** *Catalogue of the Collections in the Science Museum, South Kensington; with Descriptive Notes and Illustrations. Chemistry*. Compiled by A. Barclay. Roy. 8vo. Pp. 76 + 10 plates. 1927. London: H.M. Stationery Office. (1s. net.)
- Born, Max.** *The Mechanics of the Atom*. Translated by J. W. Fisher and revised by D. R. Hartree. (International Text-Books of Exact Science.) Demy 8vo. Pp. xvi + 317. 1927. London: G. Bell & Sons, Ltd. (18s. net.)
- Boutaric, A.** *La Physique moderne et l'électron: les sources de l'électron, le rôle de l'électron dans la science physique contemporaine, les applications de l'électron*. (Nouvelle collection scientifique.) Gl. 8vo. Pp. iii + 266. 1927. Paris: Félix Alcan. (15 francs.)
- Briggs, Dennis Brook.** *Quantitative Analysis*. Cr. 8vo. Pp. vii + 135. 1927. London: Sidgwick and Jackson, Ltd. (3s. 6d.)
- ***British Engineering Standards Association.** *British Standard Specification for Fine Zinc (or Spelter) (Grades A and B)*. No. 220-1926. Demy 8vo. Pp. 5. 1926. London: The Association, 28 Victoria Street, S.W. 1. (2s. 2d. post free.)
- ***British Engineering Standards Association.** *British Standard Specification for Special Zinc (or Spelter)*. No. 221-1926. Demy 8vo. Pp. 5. 1926. London: The Association, 28 Victoria Street, S.W. 1. (2s. 2d. post free.)
- ***British Engineering Standards Association.** *British Standard Specification for Foundry Zinc (or Spelter)*. No. 222-1926. Demy 8vo. Pp. 5. 1926. London: The Association, 28 Victoria Street, S.W. 1. (2s. 2d. post free.)

- Buckley, H.** *A Short History of Physics.* Cr. 8vo. Pp. xi + 263. 1927. London: Methuen & Co., Ltd. (7s. 6d. net.)
- Caven, R. M.** *Atoms and Molecules.* Being Part I. and Chapter XII. of *The Foundations of Chemical Theory.* Demy 8vo. Pp. viii + 141. 1927. London, Glasgow, and Bombay: Blackie & Son, Ltd. (7s. net.)
- ***Chemical Age, The Year Book, Diary, and Directory, 1927.** Roy. 4to. Pp. 155 + Diary. 1927. London: Benn Bros., Ltd. (10s. 6d. net.)
- Chwolson, Orest Danilovič.** *Die Physik, 1914-1926.* 17 ausgew. Kapitel. Übersetzt von Georg Kluge. Roy. 8vo. Pp. ix + 696. 1927. Braunschweig: Friedr. Vieweg und Sohn A.-G. (G.M. 35.)
- Chwolson, O. D.** *Traité de Physique.* Édition revue et considérablement augmentée par l'auteur. Tome supplémentaire: *La physique de 1914 à 1926.* Première partie. Traduite du russe par A. Corvisy. Roy. 8vo. Pp. ii + 340. 1927. Paris: J. Hermann. (63 francs.)
- ***Clark, George L.** *Applied X-Rays.* Med. 8vo. Pp. viii + 255, with 99 illustrations. 1927. London: McGraw-Hill Publishing Co., Ltd. (20s. net.)
- Compton, Arthur H.** *X-Rays and Electrons: An Outline of Recent X-Ray Theory.* Roy. 8vo. Pp. xv + 403. 1927. London: Macmillan & Co., Ltd. (25s. net.)
- ***Corson, M. G.** *Aluminium. The Metal and its Alloys.* (A Critical Descriptive Treatise.) Including a chapter on "Structurography," prepared in co-operation with J. R. Vilella. Med. 8vo. Pp. xx + 291, with 92 figures in the text and 122 plates. 1926. London: Chapman and Hall, Ltd. (36s.)
- Darwin, C. G.** *Recent Developments in Atomic Theory: being the Twenty-eighth Robert Boyle Lecture delivered before the Junior Scientific Club of the University of Oxford on June 4, 1926.* Demy 8vo. Pp. 15 + 1 plate. 1927. London: Oxford University Press. (1s. net.)
- Dawson, Walter H.** Edited by. *The Yearbook of the Universities of the Empire, 1927.* Published for the Universities Bureau of the British Empire. Cr. 8vo. Pp. xii + 858. 1927. London: G. Bell & Sons, Ltd. (7s. 6d. net.)
- DeBlois, Lewis A.** *Industrial Safety Organization: for Executive and Engineer.* Med. 8vo. Pp. xiii + 328 + 16 plates. 1926. New York: McGraw-Hill Book Co., Inc.; London: Mc-Graw-Hill Publishing Co., Ltd. (20s. net.)
- ***Department of Scientific and Industrial Research.** *Co-Operative Industrial Research: An Account of the Work of Research Associations under the Government Scheme.* With a Preface by the Rt. Hon. The Earl of Balfour. Roy. 8vo. Pp. vii + 46 + 8 plates. 1927. London: H.M. Stationery Office. (9d. net.)
- ***Department of Scientific and Industrial Research.** *The Anodic Oxidation of Aluminium and its Alloys as a Protection against Corrosion.* Roy. 8vo. Pp. iv + 40. 1926. London: H.M. Stationery Office. (1s. 3d. net.)

- Council.) Ex. Cr. 8vo. Pp. 257. 1927. New York: The Chemical Catalog Co., Inc. (\$2.00.)
- Harrow, Benjamin.** *The Romance of the Atom.* Cr. 8vo. Pp. 162 + 8 plates. 1927. New York: Boni and Liveright. (\$1.50.)
- Herz, Richard.** *Röntgenstrahlen.* (Physik, Technik und Anwendungen.) (Sammlung Göschen, Band 950.) Pott 8vo. Pp. 136 + 16 Tafeln. 1927. Berlin und Leipzig: Walter de Gruyter und Co. (G.M. 1.50.)
- Hevesy, George v.** *Das element Hafnium.* Demy 8vo. Pp. iv + 49. 1927. Berlin: Julius Springer. (G.M. 3.60.)
- Hind, H. Lloyd, and W. Brough Randles.** *Handbook of Photomicrography.* Second edition (revised). Demy 8vo. Pp. xii + 295 + 44 plates. 1927. London: George Routledge & Sons, Ltd.; New York: E. P. Dutton & Co. (16s. net.)
- Hückel, Walter.** *Katalyse mit kolloiden Metallen.* (Kolloidforschung in Einzeldarstellungen, Herausgegeben von Richard Zsigmondy, Band 6.) Med. 8vo. Pp. viii + 86. 1927. Leipzig: Akademische Verlagsgesellschaft m.b.H. (G.M. 6.)
- *Kautny, Theo.** *Handbuch der autogenen Metallbearbeitung unter Berücksichtigung der elektrischen Schweissung.* Dritte, völlig neubearbeitete und wesentlich erweiterte Auflage. Demy 8vo. Pp. xii + 825, with 838 figures in the text. 1927. Halle-a.-S.: Carl Marhold. (Paper, R.M. 19; bound, R.M. 22.)
- *Kaye, G. W. C.** *High Vacua.* Demy 8vo. Pp. xii + 175, with 91 illustrations. 1927. London: Longmans, Green & Co., Ltd. (10s. 6d. net.)
- *Kaye, G. W. C., and T. H. Laby.** *Tables of Physical and Chemical Constants and Some Mathematical Functions.* Fifth edition. Med. 8vo. Pp. 161. 1926. London: Longmans, Green & Co., Ltd. (14s. net.)
- Knoblauch, Osc., and K. Hencky.** *Anleitung zu genauen technischen Temperaturmessungen.* Zweite völlig neubearbeitete und erweiterte Auflage. Pp. 174. 1926. München und Berlin: R. Oldenbourg. (G.M. 9.)
- Kolthoff, J. M.** *Die Massanalyse.* Unter Mitwirkung von H. Menzel. Erster Teil: *Die theoretischen Grundlagen der Massanalyse.* Demy 8vo. Pp. xii + 254. 1927. Berlin: Julius Springer. (G.M. 10.50.)
- *Kolthoff, I. M., and N. Howell Furman.** *Potentiometric Titrations: A Theoretical and Practical Treatise.* Med. 8vo. Pp. xii + 345, with 45 figures. 1926. New York: John Wiley & Sons, Inc.; London: Chapman and Hall, Ltd. (22s. 6d. net.)
- Koppel, Ivan.** *Der Bau der Atome und das periodische System.* Med. 8vo. Pp. vi + 174 + 4 Tafeln. 1927. Leipzig: Leopold Voss. (G.M. 9.)
- Lefèvre, Albert.** *Pour le soudeur-braseur: formules, recettes, tours de mains, "trucs," méthodes et procédés du praticien amateur ou professionnel.* Gl. 8vo. Pp. viii + 164. 1926. Paris: Libra. Dunod. (12 francs.)
- Lenard, Philipp, and August Becker.** *Kathodenstrahlen.* (Handbuch der Experimentalphysik, Band 14.) 4to. Pp. xiv + 788. 1927. Leipzig: Akademische Verlagsgesellschaft m.b.H. (G.M. 70.)

*Library Association, Issued by the. *The Subject Index to Periodicals*, 1922. K: Science and Technology. Roy. 4to. Pp. 136. 1926. London: Grafton & Co. (21s. net.)

Liesegang, Raph. Ed. Herausgegeben von. *Kolloid-chemische Technologie: ein Handbuch kolloidchemischer Betrachtungsweise in der chemischen Industrie und Technik*. Lieferung 1. Pp. 80. (G.M. 5.) Lieferung 2. Pp. 81-160. (G.M. 5.) 1926. Dresden und Leipzig: Theodor Steinkopff.

Lorentz, H. A. *Lectures on Theoretical Physics, delivered at the University of Leiden*. Authorised translation by L. Silberstein and A. P. H. Trivelli. Vol. 1: *Aether Theories and Aether Models*, edited by H. Bremekamp; *Kinetical Problems*, edited by E. D. Bruins and J. Reudler. Med. 8vo. Pp. xi + 195. 1927. London: Macmillan & Co., Ltd. (12s. 6d. net.)

Love, A. E. H. *A Treatise on the Mathematical Theory of Elasticity*. Fourth edition. Roy. 8vo. Pp. xviii + 643. 1927. Cambridge: At the University Press. (40s. net.)

Mark, Hermann. *Röntgenstrahlen in Chemie und Technik: ein Hilfsbuch für Chemiker und Ingenieure*. (Handbuch der angewandten physikalischen Chemie in Einzeldarstellungen, Herausgegeben von Georg Bredig, Band 14.) Sup. Roy. 8vo. Pp. xv + 528. 1926. Leipzig: Johann Ambrosius Barth. (G.M. 48.)

Medicus, Ludwig. *Kurze Anleitung zur qualitativen Analyse*. (Einleitung in die chemische Analyse, Band 1.) Zum Gebrauche beim Unterricht in chemischen Laboratorien. 20 und 21 verbesserte Auflage. Bearbeitet von K. Richter. Pp. 147. 1926. Dresden und Leipzig: Theodor Steinkopff. (G.M. 5.)

*Mellor, J. W. *A Comprehensive Treatise on Inorganic and Theoretical Chemistry*. Volume VII.—Ti, Zr, Hf, Th, Ge, Sn, Pb, Inert Gases. Med. 8vo. Pp. x + 977, with 255 illustrations. 1927. London: Longmans, Green & Co., Ltd. (£3 3s. 0d.)

*Michel, F. *Metallniederschläge und Metallfärlungen. Praktische Anleitung für Galvaniseure und Metallfärber der Schmuckwaren und sonstiger Metall verarbeitenden Industrien*. Post 8vo. Pp. viii + 179, with 13 figures. 1927. Berlin: Julius Springer. (R.M. 6.90.)

*Midland Institute of Mining Engineers. Compiled from records of borings and sinkings by a Committee of the. *Sections of Strata of the Coal Measures of Yorkshire, together with a Few Sections in the Neighbouring Counties*. Demy 8vo. Pp. 399, with map. 1927. Sheffield: Midland Institute of Mining Engineers. (30s. net.)

*Millis, O. T. *Technical Education: its Development and Aims*. Post 8vo. Pp. vii + 183. 1925. New York: Longmans, Green & Co.; London: Edward Arnold. (6s. net.)

*Mills, Adelbert P. *Materials of Construction: Their Manufacture and Properties*. Third edition, edited by Harrison W. Hayward. Med. 8vo. Pp. xxiii + 419, with 165 illustrations. 1926. New York: John Wiley & Sons, Inc.; London: Chapman and Hall, Ltd. (20s. net.)

- Mondié, Adrien.** *Cours de Physique industrielle, professé à l'école centrale Lyonnaise.* Roy. 8vo. Pp. viii + 431. 1927. Paris: Gauthier-Villars et Cie. (55 francs.)
- Müller-Pouillet's Lehrbuch der Physik.** Elfte Auflage. Herausgegeben von A. Eucken, O. Lummer und E. Waetzmänn. In fünf Bänden. Band 2: *Lehre von der strahlenden Energie (Optik).* Erste Hälfte. Bearbeitet v. O. Lummer. Roy. 8vo. Pp. xviii + 928 + 7 Tafeln. (G.M. 50.) Band 3: *Wärmelehre.* Erste Hälfte: *Physikalische, chemische und technische Thermodynamik (einschl. Wärmeleitung).* Bearbeitet von Arnold Eucken. Roy. 8vo. Pp. xviii + 1185. (G.M. 63.) 1926. Braunschweig: Friedr. Vieweg und Sohn A.-G.
- *National Physical Laboratory. The. Collected Researches.** Vol. 19, 1926. Roy. 4to. Pp. v + 443. 1926. London: H.M. Stationery Office. (18s. 6d. net.)
- *National Research Council of the United States of America. International Critical Tables of Numerical Data, Physics, Chemistry and Technology.** Editor in Chief Edward W. Washburn. Prepared under the Auspices of the International Research Council and the National Academy of Sciences. Volume II. Pp. xvii + 616. New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Inc.
- Olsen, John C., and T. R. Le Compte.** Edited by. *Van Nostrand's Chemical Annual: a Handbook of Useful Data for Analytical, Manufacturing and Investigating Chemists, Chemical Engineers and Students.* Sixth issue, 1926. Thoroughly revised and enlarged. Cr. 8vo. Pp. xv + 882. 1927. London: Chapman and Hall, Ltd. (21s. net.)
- Orlich, Ernst.** *Anleitungen zum Arbeiten im elektrotechnischen Laboratorium.* Teil 1. Zweite durchgesehene Auflage. Roy. 8vo. Pp. iv + 94. 1927. Berlin: Julius Springer. (G.M. 3.15.)
- *Painton, Edgar T.** *The Working of Aluminium.* Demy 8vo. Pp. ix + 214, with 64 figures. 1927. London: Chapman and Hall, Ltd. (13s. 6d. net.)
- *Pokorny, Ernst.** *Molybdän. Eine Monographie mit einem Anhang, enthaltend die Hauptansprüche der wichtigsten in- und ausländischen Patente zur Gewinnung des Molybdäns.* Med 8vo. (Monographien über chemisch-technische Fabrikations-Methoden, Band XL.) Pp. viii + 299, with 52 figures in the text. 1927. Halle (Saale): Wilhelm Knapp. (Geh., R.M. 23.80; geb., R.M. 25.70.)
- Pownall, J. F.** *Organised Publication: A Connected Series of Proposals relating to the Publication and Record of Scientific and Technical Information.* Roy. 8vo. Pp. 91. 1926. London: Elliot Stock. (5s. net.)
- Pullin, V. E., and W. J. Wiltshire.** *X-Rays Past and Present.* Demy 8vo. Pp. 229 + 24 plates. 1927. London: Ernest Benn, Ltd. (12s. 6d. net.)
- *Quin, L. H.** Compiled by. *Quin's Metal Handbook and Statistics.* Fourteenth Year of Publication. Pott 8vo. 1927. London: The Metal Information Bureau, Ltd., 79 Mark Lane, E.C. 3. (5s. net post free.)
[Contains statistics regarding: Aluminium; Antimony; Arsenic; Bauxite; Bismuth; Black Plates; Black Sheets; Cadmium; Chrome ore; Cobalt; Copper;

Ferro Alloys; Galvanized Sheets; Iron and Steel; Lead; Magnesium; Molybdenite; Nickel; Ores; Palladium; Platinum; Pyrites; Quicksilver; Rare Metals; Secondary Metals; Silver; Spelter; Tin; Tinplates, &c.; Tungsten; Zinc Dust; Zinc Sheets. Information is also given regarding Australian Metal Statistics; Average Prices of Metals; Extreme Price Records; French Prices; German Prices; and Metal Exchange Dealings. Parity Tables are also included.]

- *Rang, Edmund Jule.** *Some Properties of Mild Steel, with Special Reference to its Behaviour at High Temperatures.* Demy. 8vo. (Institution of Civil Engineers. Selected Engineering Papers, No. 42.) Pp. 14, with 8 figures. 1926. London: Institution of Civil Engineers.
- Rebière, G.** *Données numériques sur les colloïdes.* (Tables annuelles de constantes et données numériques, Extrait du Volume 5, années 1917 à 1922.) Demy 4to. Pp. vi + 1261-1288. 1926. Paris: Gauthier-Villars et Cie; Cambridge: At the University Press; Chicago, Ill.: University of Chicago Press. (28 francs.)
- *Research Department, Woolwich.** *R.D. Report, No. 64: The Behaviour under Compression of Service Copper Crushers.* Roy. 8vo. Pp. 45. 1927. London: H.M. Stationery Office. (4s. 6d. net.)
- Rideal, Eric K., and Hugh S. Taylor.** *Catalysis in Theory and Practice.* Second edition. Demy 8vo. Pp. xv + 516. 1926. London: Macmillan & Co. Ltd. (20s. net.)
- *Rose, H.** *Das Hafnium.* (Tagesfragen aus den gebieten der Naturwissenschaften und der Technik. Heft 86.) Demy 8vo. Pp. 60, with 17 illustrations. 1926. Braunschweig: Friedr. Vieweg und Sohn A.-G. (Paper, R.M. 3.75.)
- Royal Society.** *Year-Book of the Royal Society of London, 1927.* (No. 31.) Demy 8vo. Pp. v + 218. 1927. London: Harrison & Sons, Ltd. (7s. 6d.)
- *Scientific and Learned Societies.** *The Year-Book of the Scientific and Learned Societies of Great Britain and Ireland: a Record of the Work done in Science, Literature and Art during the Session 1925-1926 by Numerous Societies and Government Institutions.* Compiled from Official Sources. Forty-third Annual Issue. Demy 8vo. Pp. vii + 399. 1926. London: Charles Griffin & Co., Ltd. (18s. net.)
- Segerblom, Wilhelm.** *Properties of Inorganic Substances: a Second Revision and Enlargement of Tables of Properties of over Fifteen Hundred Common Inorganic Substances.* Med. 8vo. Pp. 226. 1927. New York: The Chemical Catalog Co., Inc. (\$6.00.)
- *Society of Chemical Industry.** *Reports of the Progress of Applied Chemistry.* Vol. XI. 1926. 8vo. Pp. 724. 1927. London: Society of Chemical Industry. (Members of the Society, 7s. 6d.; 12s. 6d.)
- Stahl, Erhard.** *Metallgiesserei: Hilfsmittel, Arbeitsverfahren, Erzeugnisse und Kalkulationsregeln.* Zweite neubearbeitete Auflage. 8vo. Pp. 167. 1926. Freiberg i. S.: Craz und Gerlach. (G.M. 9.50.)
- *Stoner, Edmund C.** *Magnetism and Atomic Structure.* Demy 8vo. Pp. viii + 371, with 56 figures. 1926. London: Methuen & Co., Ltd. (18s. net.)
- *Stoughton, Bradley, and Allison Butts.** *Engineering Metallurgy. A Text-Book for Users of Metals.* Med. 8vo. Pp. xi + 441, with 152 illustrations.

1926. New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd. (20s.)
- Sullivan, J. W. N.** *Gallio: or The Tyranny of Science.* (To-day and To-morrow Series.) Pott 8vo. Pp. 96. 1927. London: Kegan Paul & Co., Ltd; New York: E. P. Dutton & Co. (2s. 6d. net.)
- ***Tapsell, H. J., and W. J. Clenshaw.** *Properties of Materials at High Temperatures.* —I. *Mechanical Properties of Armco Iron, 0.17 per Cent. Carbon Steel, and 0.24 per Cent. Carbon Steel, with Special Reference to Creep.* (Department of Scientific and Industrial Research. Engineering Research Special Report No. 1.) Roy. 8vo. Pp. viii + 60, with 31 figures. 1927. London: H.M. Stationery Office. (1s. 9d. net.)
- Thierbach, Bruno.** *Elektrowärmewirtschaft in der Industrie.* (Aus der Serie *Elektrizität in industriellen Betrieben.*) Roy. 8vo. Pp. viii + 154. 1926. Leipzig: S. Hirzel. (G.M. 12.)
- Twyman, F.** *Two Lectures on the Development and Present Position of Chemical Analysis by Emission Spectra.* Lecture 1: "The Discovery and Development of Spectrum Analysis"; 2: "(a) Producing, Observing and Photographing Spectra, (b) Measuring Wave-Lengths, Identifying Metals by their Emission Spectra, and Applications." Roy. 8vo. Pp. 43. 1927. London: Adam Hilger, Ltd. (2s. 6d. net.)
- Tyler, Chaplin.** *Chemical Engineering Economics.* (Chemical Engineering Series. Med. 8vo. Pp. ix + 271. 1926. New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd. (17s. 6d. net.)
- *[U.S.] **Department of Commerce.** *Standards Year-Book, 1927.* Compiled by the National Bureau of Standards. (Bureau of Standards Miscellaneous Publication No. 77.) Demy 8vo. Pp. vi + 392, with 39 figures. 1927. Washington, D.C.: Government Printing Office. (Cloth, \$1.)
- *[U.S.] **Department of Commerce. Bureau of Standards.** *Directory of Commercial Testing and College Research Laboratories.* (Miscellaneous Publication No. 90.) Imp. 8vo. Pp. 39. 1927. Washington, D.C.: Government Printing Office. (15 cents.)
- *[U.S.] **Department of Commerce. Bureau of Standards.** *United States Government Master Specification for Brick, Fireclay.* Roy. 8vo. (Federal Specifications Board Specification, No. 268A. Circular of the Bureau of Standards, No. 299.) Second edition. Pp. 7, with 1 fig. 1926. Washington, D.C.: Government Printing Office. (5 cents.)
- *[U.S.] **Department of Commerce. Bureau of Standards.** *United States Government Master Specification for Clay, Fire.* Roy. 8vo. (Federal Specifications Board Specification, No. 334A. Circular of the Bureau of Standards, No. 298.) Pp. 6, with 1 fig. 1926. Washington, D.C.: Government Printing Office. (5 cents.)
- *[U.S.] **Department of Commerce. Bureau of Standards.** *United States Government Master Specification for Refractories, Fireclay, Plastic.* Roy. 8vo. (Federal Specifications Board Specification, No. 335A. Circular of the Bureau of Standards, No. 297.) Pp. 5, with 1 fig. 1926. Washington, D.C.: Government Printing Office. (5 cents.)

- *[U.S.] Department of Commerce. Bureau of Standards. *United States Government Master Specification for Plumbing Fixtures (for Lard Use)*. Roy. 8vo. (Federal Specifications Board Specification, No. 448. Circular of the Bureau of Standards, No. 310.) Pp. 66; illustrated. 1926. Washington, D.C.: Government Printing Office. (15 cents.)
- Universities of the Empire. *Third Congress of the Universities of the Empire, 1926: Report of Proceedings*. Edited by Alex Hill. Roy. 8vo. Pp. xxviii + 270. 1926. London: G. Bell & Sons, Ltd. (21s. net.)
- University of Chicago. *Abstracts of Theses*. Science Series. Volume 2. Submitted to the Faculties of the Graduate Schools of the University of Chicago for the Degree of Doctor of Philosophy, August 1923-June 1924, with Abstracts of some Theses of an Earlier Date. Med. 8vo. Pp. xi + 398. 1926. Chicago, Ill.: University of Chicago Press; London: Cambridge University Press. (15s. net.)
- University of Chicago. *Abstracts of Theses*. Science Series, Volume 3, Ogden Graduate School of Science. Submitted to the Faculties of the Graduate Schools of the University of Chicago for the Degree of Doctor of Philosophy, August 1924-June 1925. Med. 8vo. Pp. ix + 353. 1927. Chicago, Ill.: University of Chicago Press; London: Cambridge University Press. (15s. net.)
- Venn, John, and J. A. Venn, Compiled by. *Alumni Cantabrigienses: a Biographical List of all known Students, Graduates and Holders of Office at the University of Cambridge, from the Earliest Times to 1900*. Part 1: *From the Earliest Times to 1751*. Vol. 4: *Saal-Zuinglius*. With an Appendix containing additional Information relative to previous Volumes. Cr. 4to. Pp. v + 538. 1927. Cambridge: At the University Press. (150s. net.)
- *Weber, Gustavus A. *The Bureau of Standards: its History, Activities, and Organization*. (Institute for Government Research. Service Monographs of the United States Government, No. 35.) Demy 8vo. Pp. xv + 299. 1925. Baltimore, Md.: The Johns Hopkins Press. (\$2.00.)
- Wulf, Theodor. *Lehrbuch der Physik*. Roy. 8vo. Pp. xiv + 512. 1926. Freiburg im Breisgau: Herder und Co., G.m.b.H. (G.M. 17.50.)

BOOK REVIEWS.

[All books reviewed below may be consulted in the Library of the Institute.]

A Comprehensive Treatise on Inorganic and Theoretical Chemistry. By J. W. Mellor. Volume VII.: **Ti, Zr, Hf, Th, Ge, Sn, Pb, Inert Gases.** Med. 8vo. Pp. x + 977, with 255 illustrations. 1927. London: Longmans, Green & Co., Ltd. (63s. net.)

The present volume deals with the elements of Group IV. of Mendeléeff's classification, which have not been considered in the earlier volume, namely, titanium, zirconium, hafnium, thorium, germanium, tin, and lead, and also with the inert gases. The method of treatment adopted throughout the work has been maintained in the present volume with the same satisfactory result. Special attention is paid to the alloys and intermetallic compounds formed by the metals named with other metals, numerical data of the properties of these alloys are given, and in many cases diagrams of the alloy systems are included. The treatment of thorium and germanium is particularly good, and it includes most of the recent work on these metals as well as a full account of the radio-chemistry of thorium and the elements of the thorium radio active family. A satisfactory account of the metal hafnium is given, and here the author is to be congratulated on the line he has taken with regard to the hafnium-celtium controversy. The present volume, like its predecessors, contains an overwhelming amount of data, and justifies the title of the work to the fullest extent. So thoroughly has Dr. Mellor done his work, and so complete are the references included, that workers seeking information on these elements are almost certain to find it in this book, or at least a reference to it.

One can with difficulty find anything to criticize adversely; the material of the book is accurate and well set out, and the printing, paper, and general appearance are good. The author is to be congratulated on the production of so admirable a volume, and above all things, the thanks of all chemists are his due, not only for the production of so useful a book, but also for the speed with which he is placing it in their hands.—J. F. SPENCER.

Aluminium. The Metal and its Alloys. (A Critical Descriptive Treatise.) By M. G. Corson. Including a chapter on "Structurography," prepared in co-operation with J. R. Vilella. Med. 8vo. Pp. xx + 291, with 92 figures in the text and 122 plates. 1926. London: Chapman and Hall, Ltd. (36s.)

This book is written so carelessly and in such slovenly style that the reader is at once prejudiced against it. The author frequently says what he obviously does not mean. Sometimes the intention is fairly obvious, as in the sentence (p. 28): "This phase may not be entirely stable and liable to dissociate in a eutectoidal way, leaving liquid aluminium (saturated with boron) and crystals of boron saturated with aluminium." Sometimes the meaning is thoroughly obscure, as in the sentence (p. 73): "In fact, aluminium-silicon alloys, if treated in the manner described, are practically the only true eutectical binary alloys of aluminium." Examples of such careless writing may be found on almost every page.

There is also throughout the book a lamentable lack of references. Often where authorities are quoted no references are given to any particular published work, and at times the names are inaccurately quoted. For example, Hanson and Gayler become, on p. 81, Hansen Gayler; Haughton, p. 96, becomes Houghton; and Haenni, p. 279, Henri. Throughout the book the National Physical Laboratory is called the British National Physical Institute. Such unnecessary blemishes tend to hide the merits of the book and to create in the reader a severely critical spirit.

After a short section on the properties of aluminium, the binary and some ternary alloy systems are described and discussed. The value of this section is much reduced by the lack of references. An amusing feature is the inclusion of the number of U.S. patents covering each system.

The section on the technology of aluminium alloys contains much useful information, though some of it cannot be accepted without reservations.

In the section on corrosion an interesting attempt is made to connect the corrosion properties of alloys with the potential differences of the alloying elements. It is doubtful whether this method can prove successful, for there may be said of all the alloys what the author says of one: "The potentials . . . in aqueous solution are so heavily burdened with electromotive forces from side reactions that no safe conclusions can be drawn. . . ."

In the section on aluminium alloys in engineering work the author points out the need of choosing the alloy to suit the job, and rightly advises the avoidance of the more complicated alloys, except in places where their superior properties are needed.

The author uses the uncomfortable word "structurography" to cover macrography and micrography. He treats rather severely all but the most recently published photomicrographs of aluminium and its alloys. "There is no exaggeration in stating, that practically all photomicrographs of aluminium alloys published before 1922 represented mainly the structure of the dirt on their surfaces." After all, there were poets before Homer. An etching reagent consisting of a solution of hydrofluoric and nitric acids in glycerine is claimed to be "by far the best"—a claim not quite confirmed by the photomicrographs included in the book.

The plates of macro- and micro-photographs are very good. The photography is good, and the reproduction excellent. A representative series is shown which should prove very useful for reference. A book for the critical expert rather than for the student.—J. D. Grogan.

Ancient Egyptian Metallurgy. By H. Garland and C. O. Bannister. Cr. 8vo. Pp. xi + 214, with frontispiece and 113 illustrations. 1927. London: Charles Griffin & Co., Ltd. (12s. 6d.)

A note attached to the Frontispiece and the Preface to this little volume tell the tragic death of Major Garland a few days after his return to England after many years' labour in Egypt. The author had exceptional opportunities for the collection and thorough examination of ancient metal specimens not easily obtainable by other metallurgists. The examination and editing of the author's notes have been ably carried out by Professor Bannister, who has given us a book intensely interesting to all students of Egyptian art as well as to metallurgists.

Among other details, a brief survey of Egyptian history is given, together with the sources of metals known to ancient Egyptians. Two chapters are devoted to the Bronze and Iron Age respectively, and it is to be regretted that the original notes on gold and silver were found to be too scrappy to be of any value and were therefore excluded from the book.

By means of the micro-examination of the articles found, the author shows that cored copper castings were being made as early as 3000 B.C. by the *cire perdue* process, a method which was not introduced into Greece—the country to which we owe the most perfect antique examples of it—until about 600 B.C. Also, in the author's experience, almost every sample of antique copper and many bronzes indicate the presence of "coring" which, besides showing that systematic annealing had not been applied, also demonstrates the permanence of the cast "cored" type of microstructure.

After reading the chapter on "Ancient Egyptian Tools," the student will be impressed by the antiquated origin of many tools and implements in everyday use.

The author emphasizes the probability of a much earlier iron age in Egypt than that generally accepted, and amongst other evidence points out that it is highly improbable that the magnificent sculptures and other works in the hardest of stones, such as diorite, basalt, and granite, could have been carved by copper and bronze tools, for the latter were not available until after 2475 B.C., and the processes for hardening these two metals were then unknown.

The book contains numerous illustrations and photomicrographs.—M. L. V. GAYLER.

Applied X-Rays. By George L. Clark. Med. 8vo. Pp. viii + 255, with 99 illustrations. 1927. London: McGraw-Hill Publishing Co., Ltd. (20s.)

The author aims at presenting the achievements and possibilities of the use of X-rays in industry. Actually, apart from the use of X-rays in the detection of flaws in castings, very little headway has been made in the industrial application of X-rays. Still the potentialities of such application are there, and we know of no better work than the present to recommend to metallurgists anxious to know something of the development and technique of X-ray analysis. The book comprises three sections, devoted respectively to the fundamentals of X-ray science, the direct effects and applications of X-radiations, and the analysis of the ultimate structure of materials. In the first section the equipment of an X-ray laboratory, the fundamental characteristics of X-rays, and X-ray spectra and atomic structure are discussed. The second section contains chapters devoted to the ionization, electrical, chemical, and biological effects of X-rays, the measurement of X-ray intensity and radiography, including the examination of metal castings and coal analysis. Reference is made to the possible inhibition of corrosion of metals by X-ray. Metallurgists will probably be most interested in the third section. Here such subjects as the qualitative and quantitative X-ray analysis of crystalline, amorphous, and colloidal substances, and X-ray diffraction methods used in metallurgy, are well treated. Hitherto the industrial technique has been developed principally in connection with the X-ray analysis of steel. There are signs, however, that enlightened manufacturers of other metals and alloys are finding, and will find, still more applications of the rays. X-rays have been employed to detect intercrystalline corrosion in Duralumin (a defect to which the disaster to the airship *Shenandoah* was attributable), season-cracking in brass, the structure of tinned plate, galvanized iron, copper, &c. The author is an enthusiast, and submits that "before long an X-ray apparatus will be an essential part of the research and testing equipment of progressive manufacturers of raw materials and finished metal products." We hope it may be so. This is the book for these progressive manufacturers and their staffs. It is well got up, is well printed on good paper, and is supplied with adequate references and name and subject indexes. The price is reasonable.—J. S. G. THOMAS.

Art de l'Ingénieur et Métallurgie. Résistance des Matériaux et Données numériques diverses. Rédigées par L. Descroix. Préface de Sir Robert Hadfield. (Extrait du Volume V., Années 1917–1922, Tables Annuelles de Constantes et Données numériques.) 4to. Pp. 1660–1909. 1926. Paris: Gauthier-Villars et Cie; Chicago: University of Chicago Press; Cambridge: Cambridge University Press.

These Tables of Annual Constants are now well known and their value recognized. The section under review contains those portions of Volume V. dealing with engineering and metallurgy. In the engineering section are given the mechanical constants of building materials, including timber, cement, and refractory materials; of textiles and rubber; of lubricants; and constants required in hydraulics and aerodynamics. Under thermal constants are found the physical and chemical properties of fuels, data on pyrometry, and the properties of refractory materials. In the metallurgical section the equilibrium diagrams for a number of the commoner technical alloys will be found, the aluminium alloys being particularly well covered. It is only natural that in some cases later work has shown that modification in the diagram is necessary. Thus the nickel-chromium diagram given on p. 1803 can no longer be considered correct. A large proportion of the metallurgical section is devoted to iron and steel, including hardening and methods of analysis. The following properties are considered in the case of a comparatively small number of alloys, mainly special steels: solubility, dilatation, specific gravity, viscosity, thermal and electrical conductivities, transition heat, melting point, and corrosion. A further section gives results of the usual mechanical tests for iron and steel, aluminium alloys, and copper alloys, with a discussion of methods of analysis and testing. The index, which is arranged to follow the order of the pages, is given in French, German, English, and Italian. The mistakes in English are rather numerous, but do not obscure the meaning. The aim of this compilation—namely, to collect together all fundamental data

referring to engineering materials and alloys—has been achieved in a most efficient manner, and should be of the greatest use to practical engineering. From a more purely scientific point of view much of the data must be regarded as out of date, but this is of course inevitable and in no way detracts from the main object of the compilers.—C. J. SMITHIELLS.

Chemical Synonyms and Trade Names. A Dictionary and Commercial Handbook.

By William Gardner. Third edition, revised and much enlarged. Roy. 8vo. Pp. 355. 1926. London: Crosby Lockwood & Son. (Price 30s. net.)

The first edition of this work was published in 1924 and reviewed in this Journal, **31**, 599. The fact that a third edition is already called for is sufficient evidence of its value to scientific and commercial men. The present volume contains over 20,000 definitions, or about 6000 more than the first edition, occupying a further 84 pages and bringing the work completely up to date by the inclusion of many words recently introduced to distinguish new articles of manufacture. The metallurgical side is strongly represented by definitions of practically all the alloys sold or used under trade names, including the latest aluminium alloys developed in Germany. One or two of these definitions might be somewhat amended in future editions; thus osmiridium is a far commoner term commercially than iridosmine, and the definition might with advantage be placed under the former heading with the cross-reference under the latter, also mention might be made of the ruthenium content of this substance. Again the definitions of matte and speiss should be amplified, the former to include nickel and nickel-copper matte, and the latter to include artificial arsenides and antimonides of nickel and cobalt produced as intermediate or by-products in smelting operations. Another minor fault may perhaps be found with the definitions of minerals which are rather unbalanced, undue prominence being given to some of the very rare minerals to which very complex formulae of doubtful value are ascribed, whereas no formulae are given to some of the commoner minerals such as zircon. A brief mention of the use or value of the more important minerals would probably be welcomed by merchants and others to whom parcels of ore are frequently offered.

The book is admirably arranged for ready reference, adequately cross-indexed, and printed in a large clear type on good paper. Altogether it is a considerable advance on the earlier editions, and should be in the library of all those concerned with the buying and selling of chemical and metallurgical products.—A. R. POWELL.

Chromium and its Congeners. By Reece H. Vallance and Arthur A. Eldridge.

(A Text-Book of Inorganic Chemistry. Edited by J. Newton Friend. Volume VII. Part III.) Demy 8vo. Pp. xxvi + 380, with 6 figures in the text. 1926. London: Charles Griffin & Co., Ltd. (18s.)

In these days of intensive research anyone who undertakes the publication of a book "dealing comprehensively" with almost any scientific question is faced with two difficulties. In the first place, new data are appearing at such a rate that even in the time which elapses between the collection of matter for the book and its actual appearance in print new facts may be published, which in certain directions make the information contained in the book out of date and to that extent inaccurate. In the second place, the mass of data existing is so great that, if an attempt is made to include it all in a volume of reasonable size, it is a task of some magnitude to make the text moderately readable. The latest addition to the well-known series edited by Dr. Newton Friend, which deals with the metals chromium, molybdenum, tungsten, and uranium, suffers to some extent in both these respects. Especially in regard to the metallurgy of the first three elements, which are playing a prominent part in steel metallurgy and which promise to become even more important in the non-ferrous metal industry, the information contained is so scanty and "unfresh" that it might well have been omitted. On the other hand, the attempt to "describe all the more important inorganic salts" has resulted in the reference to several consisting of a bare mention of the fact that they have been prepared, and one is inclined to wonder whether some tabular arrangement of the less important salts of those included, with a reference to the location of fuller information, would not have been more satisfactory, leaving space for a more complete discussion of the other data dealt with.

Despite the above, perhaps unavoidable, defects, this volume forms a very useful addition

to any technical library. It contains a mass of information which is, on the whole, very well set out. A very large number of references is included which adds considerably to the value of the publication, though one is rather struck with the number of these which have dates prior to 1900 and the fewness of those which have appeared since, say, 1917. As in the case of its predecessors, the book is well printed and typographical errors are remarkably few. It is most certainly a volume to which every metallurgist should have ready access.—W. T. GRIFFITHS.

Das Hafnium. By H. Rose. (Tagesfragen aus den gebieten der Naturwissenschaften und der Technik. Heft 86.) Demy 8vo. Pp. 60, with 17 illustrations. 1926. Braunschweig: Friedr. Vieweg und Sohn A.-G. (Paper, R.M. 3.75.)

Just as the introduction of ordinary spectroscopy by Kirchhoff and Bunsen was soon followed by the discovery of a number of new elements, so the recently developed technique of the production of X-ray spectra has already resulted in the discovery of at least four new elements—hafnium (celtium), masurium, rhenium, and illinium. Of these, hafnium or celtium is the best known. Its discovery by Coster and Hevesy was announced in *Nature* in January 1923. Literature referring to the metal is scattered through current scientific research literature. The appearance of the present booklet dealing with the subject is welcomed.

Sections of the work are devoted to the discovery of hafnium, its geological distribution, chemistry and physics of the metal and its compounds, and technical applications of the element. We note (p. 5) that the discovery of the element is definitely attributed to Coster and Hevesy. Urbain and Dauvillier's claim to the discovery is dismissed in a paragraph. Those familiar with the subject will know that the question of priority of discovery is still *sub judice*. Hafnium is not a rare metal; in the earth's crust it occurs to about the same extent as nickel. A valuable table on p. 12 of the booklet gives the percentage of hafnium oxide in various ores, principally zirconium ores. The extraction of the metal is described. Several pounds of hafnium have been produced, and its use for electric lamp filaments and as the cathode in hot-cathode X-ray tubes is being developed.

The book is earnestly recommended to all desirous of becoming familiar in a general way with the subject. Literature referring to the metal is scheduled for those desirous of more detailed information. An adequate index is provided. The book is of convenient size for the pocket and is well printed.—J. S. G. THOMAS.

Die Zerstäubungserscheinungen bei Metallen unter besonderer Berücksichtigung der mechanisch-thermischen Zerstäubung und der elektrischen Stossverdampfung. Von Joseph Fischer. (Fortschritte der Chemie, Physik und physikalischen Chemie, herausgegeben von A. Eucken, Band 19, Heft 1.) Roy. 8vo. Pp. 70, with 14 figures in the text. 1927. Berlin: Gebrüder Borntraeger. (M. 4.80.)

This monograph, which constitutes the first part of the nineteenth volume of Professor Eucken's excellent series of works on the progress of chemistry, physics, and physical chemistry, deals with the atomization and volatilization of metals from electrically heated filaments and the phenomena accompanying this process. The opening section of the book, consisting of 8 pp., deals with the general phenomena of atomization in high vacua, in gases, such as nitrogen, chlorine, helium, hydrogen, under low pressure, and in gases, such as the indifferent gases, under high pressure, as in the case of gas-filled lamps. The second section, consisting of 54 pp., deals with special points in connection with the atomization of metals. The investigations of Berliner and Goetz are described and their significance is pointed out. The practical methods by which electrical atomization or vaporization has been examined are given, including the experimental procedure of Kohlschütter, Guntherschultz, Kingdon and Langmuir, the General Electric Company, London, and many others. The empirically found regularities depending on (a) the size of the particles, (b) the current conditions, (c) potential, (d) temperature, and (e) the nature of the metal, are described and discussed.

The book is well and clearly written, and gives a complete account of the position of our knowledge of this subject. It should be invaluable to those interested in the problems of lighting by means of metallic filament lamps.—J. F. SPENCER.

Engineering Metallurgy. A Text-Book for Users of Metals. By Bradley Stoughton and Allison Butts. Med. 8vo. Pp. xi + 441, with 152 illustrations. 1926. London: McGraw-Hill Publishing Co., Ltd. (20s.)

As pointed out in the Preface, the subject of metallurgy has been approached from the standpoint of utility, with the purpose of giving the reader or student an understanding of the relations of structures and properties. The book is also to serve as a text-book where only a short course in metallurgy is given, and is to supplement and not altogether replace lectures on engineering metallurgy.

There is much to be said for a concise introduction to a science which is so closely allied with others, such as engineering and chemistry, and the authors have given students in engineering and workers in metallurgy a valuable book which will supply all their needs. For the student in engineering, the authors, along with other information, have dealt as fully as possible with metals and alloys, including their preparation, their physical and chemical properties and adaptation to engineering purposes; while workers in metallurgy will find much information which will form a valuable basis for more advanced work.

The authors have dealt also with the subjects of electro-metallurgy; corrosion and its prevention; fuels and combustion; slags, fluxes, and refractories; and pyrometry. At the end of each chapter references are given to periodicals and text-books, but except for one or two cases no references are given to original papers, which, in the case of students who wish to follow a more extended study, is perhaps to be regretted.

This book, however, amply fulfils the purpose for which the authors intend it, and will be of great value to all students needing an introduction to the study of metallurgy.

—M. L. V. GAYLER.

Gmelins Handbuch der anorganischen Chemie. Bearbeitet von R. J. Meyer. Achte Auflage. System-Nummer 19: **Wismut.** Roy. 8vo. Pp. xxii + 229, with 11 figures. System-Nummer 20: **Lithium.** Pp. xxiv + 254, with 13 figures. 1927. Leipzig und Berlin: Verlag Chemie G.m.b.H. (Subscription prices, M. 26 and M. 28.50; single prices, M. 33 and M. 37.50 respectively.)

The present volumes constitute two further parts of the eighth edition of Gmelin's hand-book of inorganic chemistry. The metals lithium and bismuth are dealt with, in their respective volumes, in a most thorough and systematic manner, all the literature up to July 1926 having been taken into account. The elements and their compounds are dealt with from many points of view which are of interest to the chemist, and in consequence both volumes contain an exceedingly large amount of useful data, both chemical and physico-chemical. A full account of the detection and quantitative determination of the elements is given. In the volume dealing with bismuth a number of pages is devoted to an account of the preparation and properties of the bismuth-antimony alloys. The radioactive isotopes of bismuth are considered in considerable detail. A useful feature, not often found in works on inorganic chemistry, is the description of the salts of the metals with the commoner organic acids, and compounds of the salts with organic substances. Both volumes are replete with references to the original literature.

The work of compilation has been carried out in a most thorough, accurate, and painstaking manner, so that the volumes furnish a very complete and valuable account of the chemistry of the elements bismuth and lithium. The arrangement of the subject-matter is pleasing, and it presents the data in a most accessible form. The paper and printing of the volume are good and misprints are rare.—J. F. SPENCER.

Handbuch der autogenen Metallbearbeitung unter Berücksichtigung der elektrischen Schweissung. Von Theo Kautny. Dritte völlig neubearbeitete und wesentlich erweiterte Auflage. Demy 8vo. Pp. xii + 825, with 838 figures in the text. 1927. Hall-a.-S.: Carl Marhold. (Paper, R.M. 19; bound, R.M. 22.)

To all who have studied continental methods of welding, particularly autogenous welding, the author is known as a prolific writer on the subject and the inspiring force behind at least

two journals devoted to the art. He is thus qualified, not only because of his own work, but also as a result of his intimate knowledge of the work of others, to summarize his conclusions in a work of this kind. In the first main section the principal metals are considered in succession. The discussion embraces physical and chemical properties, influence of heat-treatment, effects of impurities, and the general relationship of these factors to the welding of the commoner metals and their alloys. In the second chapter the different processes for joining metallic parts are considered, while in the third the manufacture and storage of the gases used are dealt with. Autogenous welding, including the use of benzol and coal-gas as well as acetylene, is fully discussed in all its aspects in the next section. The various types of burners for both welding and cutting, and the proper adaptation of each to a particular class of work, occupy over one hundred pages of the text, while the last two hundred pages are devoted to the technique of welding. The whole subject is thus covered very completely, and though the author's ideas may not entirely coincide with those of some of his readers, he must be given the credit for writing an extremely useful and informative book. Perhaps the only serious defect is the lack of clarity in some of the photomicrographs and illustrations which, after all, is probably due to bad printing rather than bad authorship.

—W. A. C. NEWMAN.

High Vacua. By G. W. C. Kaye. Demy 8vo. Pp. xii + 175, with 91 illustrations. 1927. London: Longmans, Green & Co., Ltd. (10s. 6d. net.)

This book is based upon three Cantor lectures delivered by the writer at the Royal Society of Arts in 1926. The author's status as superintendent of the Physics Department of the National Physical Laboratory ensures that the subject-matter of the lectures is authoritative, up to date, and correct. The technique of the production of high vacua has made tremendous strides in recent years, and has played a leading part in the recent development of atomic theory and certain industrial processes. To anyone desirous of knowing what degree of vacuum is now obtainable and how it may be attained this book is recommended. Chapters are devoted to the historical development of vacuum pumps, electric discharges in vacuum tubes, high vacuum technique, joints, backing and high-speed pumps, absorption methods of exhaustion, high vacuum gauges, and pump speeds. All are well treated. Probably the section that will appeal most generally to metallurgists is Chapter V. devoted to methods of joining materials. Here are described the latest developments in the art of joining glass to platinum and platinized metal, copper, tungsten, nickel, and chrome iron, likewise joining silica to metals and glass. Wrung, metal to metal joints, cement and rubber joints, are likewise discussed. Mercury is the liquid most commonly used in high vacuum pumps of the diffusion or condensation types. Experiments are being made with other metals—*e.g.* cadmium—as the pumping fluid.

The book is well got up, is well printed on good paper; the illustrations are clear and well drawn; an adequate index is provided, and the price of the book is very reasonable.

—J. S. G. THOMAS.

L'Organisation Scientifique du Travail ("Scientific Organization of Work"). Par Georges Bricard. Pp. 210, with 34 figures in the text. 1927. Paris: Libraire Armand Colin. (Relié, fr. 10.25; broché, fr. 9.)

This is primarily a book for large employers of labour and their departmental chiefs, but the heads of small concerns and most intelligent employees with any ambition at all will find in it much food for thought, and will probably derive considerable benefit from its perusal as well as many hints and ideas which, adapted to their own particular case, will result in improved efficiency and greater economy in the cost of manufacture. Taylor's system of works organization has been adopted for many years by some of the largest engineering firms in the United States, and has also formed the basis of several other methods of organization; the author has studied the system and its modifications, as well as rival systems in America and in France, and the book under review is the result. It contains an admirable *exposé* of the principles of the Taylor method, an example in detail of its application to a large American works, with

reproductions of the various works-sheets, requisition forms, &c. The various methods of payment for labour are discussed very fully and compared with one another. Finally, an historical survey of the growth of the system in America and France is given, together with a review of its advantages and disadvantages.

The book is well printed in a clear type, and the subject-matter is arranged systematically in a series of numbered sections in every chapter. It appears to be free from any serious misprints, but like a great number of French books it suffers from the lack of an index. It can be thoroughly recommended to all students of works organization.—A. R. POWELL.

Le Voile d'Isis. Numéro spécial consacré à l'Alchimie (1926, 31, 669-779). Paris : Librairie Générale des Sciences Occultes.

Some considerable discussion has taken place during recent years, principally in German scientific periodicals, as to the possibility of obtaining gold by the electrical treatment of mercury. On the one hand we have Miethe and Stammreich asserting that they have obtained minute traces of gold by subjecting mercury to high-voltage discharges over a lengthy period, and on the other hand there is Professor Haber maintaining that the gold was in the apparatus in the form of an impurity in the constituent parts. Nagaoka, in Japan, claims to have confirmed the results of Miethe and Stammreich, but Duhme and Lotz uphold Haber's explanation; there the matter rests for the present. In the volume under review we have a number of French chemists supporting one or other of these views, and generally discussing the question as to the feasibility or otherwise of making gold by transmutation. Naturally this discussion revives interest in the work of the alchemists, and this special number of a Journal, which appears normally to be devoted to the occult sciences, attempts to show the relation and the differences between modern theories of transmutation based on radioactive phenomena and the beliefs of those who spent their lives searching for the philosopher's stone. The editorial article admirably illustrates these relations and differences in a truly witty French manner. In France, apparently, alchemy is not yet dead, for there still exists a French Alchemical Society in Douai, the President of which, one M. Jollivet Castelot, gives us full details of an easy method of making gold from silver; one simply melts the silver with natural sulphides of arsenic or antimony and parts the product in nitric acid to obtain a residue of gold! We have not yet heard of a large-scale plant working on this process! In an article on the conquest of ancient sciences we have another optimistic discourse on the possibilities, in the near future (!), of a general transmutation of one metal into another or several others. A much more rational view of the problem is taken by A. Lélève in an article on transmutation from the scientific point of view. Here we have a succinct description of the modern conception of the atom and of the interrelations of the atoms, and a brief discussion of the relation between radioactive changes and transmutation as commonly interpreted. The five articles following deal solely with various aspects of the old "science" of alchemy. The illustrations are weird, and the explanations of their significance (given as an appendix) are, to say the least, quaint!

—A. R. POWELL.

Magnetism and Atomic Structure. By Edmund C. Stoner. Demy 8vo. Pp. viii + 371, with 56 figures. 1926. London: Methuen & Co., Ltd. (18s. net.)

In this book an account is given of magnetic phenomena and of the attempts made to interpret them in terms of the quantum theory—work which is thought to be of most importance and lasting value being given prominence. Such a book has long been called for, and the author is as qualified as anyone to attempt the difficult task of presenting as intelligible a picture as possible of the present position of magnetic theory. The quantum theory and other modern developments have landed atomic physics in a bog. The way out is by no means clear. Thus, in illustration of the position, it may be remarked that up till quite recently it was considered that most of the difficulties inherent in Bohr's periodic classification of the elements were removed by Dr. Stoner's amendment of that classification. Now some contend that this amendment does nothing to clarify the situation. We are back in the bog. To attempt to

write a book on magnetism and atomic structure under these conditions requires courage, to say the least. Dr. Stoner has done more than one could reasonably expect, and author and publisher are to be congratulated on the result. Chapters of the work are devoted *inter alia* to the earlier theories of magnetism and its interpretation as an atomic phenomenon, the quantum theory, the gyromagnetic effect, the magnetic deviation of atomic rays, the Zeeman and other magneto-optical effects, diamagnetism, and magnetism and chemistry. The presentation is almost entirely mathematical, and very considerable demands are made upon the mathematical knowledge of the reader. The traditional "first four books of Euclid and algebra to quadratics" won't help one at all in digesting the work. The standard of attainment necessary is that of a good honours degree in applied mathematics or physics. Most readers thus equipped will profit much from reading the work. Each chapter concludes with a critical summary of the most important books and papers dealing with the subjects treated. An Appendix brings the work up to date (1926), so far as references are concerned. Adequate name and subject indexes are provided; the book is well got up, is well printed, and is published at a reasonable price.—J. S. G. THOMAS.

Materials of Construction : Their Manufacture and Properties. By Adelbert P. Mills. Third edition, edited by Harrison W. Hayward. Med. 8vo. Pp. xxiii + 419, with 165 illustrations. 1926. New York : John Wiley & Sons, Inc.; London : Chapman and Hall, Ltd. (20s. net.)

That a third edition of this book has been called for in eleven years proves that its utility has been established; but it suffers from the general defect, one supposes, of all so-called elementary works, that the dividing line between simple and advanced material is quite arbitrary. Thus there is a tendency for the book to appear stressed in particular portions according to the viewpoint of the reader. The information given in any particular section is in reality limited, but a genuine endeavour seems to have been made to cover the principal features of the more commonly used materials of construction. The author has gathered his discussions into six sections, but they may be conveniently, and more simply, classified in four: (1) Cementing materials, concrete, stone, bricks and clay products; (2) timber; (3) metals, non-ferrous and ferrous; (4) mechanical fabrics, including wire-ropes. In this edition the portion devoted to alloy steels has been revised and considerably extended. A special point has been made throughout of avoiding the inclusion of data tabulations whenever the latter could be presented graphically by curves and diagrams. It is to be deplored that this same general principle has not been observed in giving a larger number of illustrations appropriate to the text, which would have focussed on the students' minds the processes there described. The space devoted to non-ferrous metals and alloys is extremely meagre—some fifty pages—in which the ores and extraction of the principal metals, their alloys, and some of the fundamentals of physical metallurgy, are described. Every constructional engineer must consider this but the bare minimum. The references to books and periodicals from which data and information have been drawn for this work include only one item which is not American. It is to be regretted that such references, to which the ambitious student and practitioner will naturally turn for more extensive information, contain no hint of the vast amount of work done elsewhere in the world.—W. A. C. NEWMAN.

Metallniederschläge und Metallfärlungen. Praktische Anleitung für Galvaniseure und Metallfärber der Schmuckwaren und sonstiger Metall verarbeitenden Industrien ("Deposition and Colouring of Metals. Practical Introduction to Electroplating and Colouring Metals for the Jewellery and Other Industries Engaged in Working Metals"). Von F. Michel. Post 8vo. Pp. viii + 179, with 13 figures in the text. 1927. Berlin : Julius Springer. (R.M. 6.90.)

Pfanhauser's classical work on electroplating and colouring metals covers such an immense amount of ground and goes so thoroughly into the theory of the subject that it is

much too advanced for study by the beginner or owner of a small electroplating plant. Such people will therefore welcome the book under review which, although published at a reasonably low price, provides an admirable introduction to a complex subject. Only sufficient of the elementary theoretical principles underlying the subject as will enable the reader to operate in an intelligent manner the processes subsequently described are discussed in the simplest language, and every technical term is clearly explained. The preliminary treatment to which the metal must be subjected before immersion in the plating bath and the set-up of the apparatus are discussed in detail, then follow instructions for plating with copper, brass, silver, gold, nickel, cobalt, platinum, palladium, zinc, tin, iron, lead, and several of the less important metals. Considering the great advances that have been made in recent years in chromium plating, especially in Germany, it is rather remarkable that no reference is made to it in the book. However, the articles on the other metals are very well written, and the procedures applicable to each particular case are minutely described, so that even the veriest amateur could hardly go wrong. The care of the bath is an important point for successful results in electroplating and is dealt with very thoroughly, as also are possible causes of failure to obtain good coatings.

The book is printed in a clear type on excellent paper, and the subject-matter is well arranged under suitable headings, which are tabulated in a table of contents at the beginning of the book in the order in which they occur in the text; this arrangement, however, hardly compensates for the lack of an index. An English edition of this handy little volume would no doubt have a ready sale.—A. R. POWELL.

Metallographic Researches. Based on a Course of Lectures Delivered in the United States in 1925. By Carl Benedicks. Med. 8vo. Pp. xi + 307, with 153 illustrations. 1926. London: McGraw-Hill Publishing Co., Ltd. (20s. net.)

"Having been invited by the American Institute of Mining and Metallurgical Engineers in New York to deliver the last bi-annual lecture of the Division of Metals, the author also prepared other lectures on related subjects which had recently been investigated at the Metallografiska Institutet at Stockholm" (Preface). The subjects treated are: (I.) the kinetic constitution of solid matter, (II.) homogeneous thermoelectric and electrothermal effects, (III.) hardness and hardening, (IV.) meteoric iron and Invar, (V.) high-power microscopy, (VI.) microchemical etching, (VII.) on the first discoverer of the critical point A_c in steel, (VIII.) thermal curves, (IX.) specific gravity of molten iron, (X.) a rational ingot section for hard-rolled material, (XI.) and the action of hot wall. As the author points out in his Preface, Chapters I., III., IV., V., VII., and X. contain considerable matter which has not been previously published, or published only in part in Swedish, and should consequently be regarded as original papers.

The treatment of every single problem is very lucid and suggestive, thus opening a wide field for further research. Perhaps the most interesting section to the members of the Institute will be the one on the action of hot-wall, described by the author as "a factor of fundamental influence on the rapid corrosion of water tubes and related to the segregation in hot metals." As a considerable number of papers have been read lately before this Institute both on the subject of corrosion and of inverse segregation, a "synthetic" treatment of these questions by Dr. Benedicks may prove of considerable interest both to the manufacturer and to the engineer. Those interested in rolling will appreciate the author's treatment of the problem of a rational ingot section for hard-rolled material based on his experiments on iron-chromium steels.

Section IV. deals with the author's synthesis of meteoric iron and the constitution of Invar. In both cases a duplex structure has been established, and in the case of Invar most beautiful experiments on its thermal expansibility performed. These latter give a basis for an explanation of the influence of heat-treatment on the expansion of Invar.

Every metallographer will enjoy reading the section on high-power microscopy (V.), on thermal curves (VIII.), and on hardening (III.), as well as the introductory chapter on the kinetic constitution of solid matter. Those interested in the history of science will be rather

surprised to learn that the critical point A_c in steels (the point "a" of Tschernoff) had been observed and described as early as 1777 by J. F. Angerstein, a Swedish ironmaster and a descendant of a distinguished line of metallurgists. As far back as 1637 a Regium Laboratorium Chemicum was instituted in Stockholm alongside a Board of Mines (*Bergkollegium*), and the laboratory's instruction was: "To investigate into the nature of the metals in order to know how far it is possible to improve them." Dr. Benedicks is of opinion that the flourishing state of Swedish metallurgy in the eighteenth century marked by the discovery of silicon, manganese, nickel, cobalt, and other metals, might be connected with the foundation of a State Chemical Laboratory in the seventeenth century; it is very likely that the same high level of scientific research was responsible also for the intelligent interest in the problem of hardening, which eventually led Angerstein to the discovery of the decalescence point.

Every section of the book is supplied with a summary and a bibliography, and it has been so arranged as to present a coherent whole. The volume is admirably illustrated and handsomely produced. It is to be hoped that, like Dr. Benedicks' other works, it will eventually find its way to every metallographer's shelf.—N. T. BELAIEV.

Metallographie. Herausgegeben von W. Guertler. Zweiter Band: **Die Eigenschaften der Metalle und ihrer Legierungen.** Zweiter Teil: **Physikalische Metallkunde.** Fünfter Abschnitt: **Das Volumen.** Zweite Lieferung: **Die thermische Ausdehnung.** Von A. Schulze. Sup. Roy. 8vo. Pp. xv + 82-336, with 108 illustrations. 1926. Berlin: Verlag von Gebrüder Borntraeger. (M. 18.80.)

The thermal expansibility of metals and their alloys has received much less consideration than most of the other methods of metallographic analysis and, up to quite recently, has been little used as a method of investigating the constitution of alloys; it has, however, a great practical importance, as, for instance, in aeroplane technics, where it is often required to know the coefficient of expansion of light alloys; another application of this method is the study of duplex alloys as brasses, cast irons, and hyper-eutectoid steels.

Dr. Schulze's work now published deals with these and many other aspects of the question. An account of general research is given in an introductory chapter and, further, under the name of every metal is given a summary of investigations made. An interesting reference is given to the work of Wiebe (1878) on the thermal expansion in relation to the periodic system, and in Chapter III. the thermal expansion of crystals is considered, with special reference to the work of Grüneisen and Goens. Part II. deals with various alloys, and a special chapter is devoted to Invar, where the latest researches of Benedicks and Sederholm are considered alongside earlier experiments of Charpy and Grenet. Much interesting material will be found in Chapters XIII. and XIV. on the thermal expansion of amalgams and molten metals.

The book is written in a clear and concise manner, is up to date and, like the other parts of Dr. Guertler's "Metallographic," of which it forms a section, is very well produced; the diagrams are clear, and it is provided with a good index; by consulting the latter any desired metallic system can be easily found. In this respect the only criticism to be offered is the absence of a bibliography or of a list of references on the lines of such text-books as Mellor's treatise.

Dr. Schulze's work forms the only full treatise on the subject available now. It brings home to the metallographer and to the practical engineer the great possibilities of the method of thermal expansibility, and will be welcomed by both.—N. T. BELAIEV.

Métallurgies du Plomb, du Nickel et du Cobalt et des Alliages de ces Métaux. Par M. Fourment et Léon Guillet. Med. 8vo. (Grandes Encyclopédies Industrielles, publié sous la direction de L. Guillet.) Pp. 492, with 288 illustrations. 1926. Paris: J.-B. Baillière et Fils. (70 francs + 40% majoration.)

This book forms one of a series of mining and metallurgical textbooks which in turn is part of a larger series dealing with industrial processes. Over two-thirds of the volume is taken up

with the metallurgy of lead and, apart from two short chapters on the properties of the metal, its compounds and its alloys, the 330 pages which form this portion are devoted to descriptions of the extraction of lead from its ores and the desilverization of the product. A comparatively detailed description of the processes is given, but it is doubtful whether this will be of much interest to English readers, owing to the existence of admittedly more exhaustive treatises on the subject in English, notably that of Hofman.

In the section on nickel and cobalt some of the details of the extraction of nickel from the New Caledonian ores are an addition to the literature on this subject. The descriptions of the two principal processes for the extraction of the metal from the Canadian ores, however, show that the authors are hardly *au fait* with the more recent developments which have taken place in this sphere. The Report of the Ontario Nickel Commission (published in 1917) has been drawn upon to a considerable extent for information, and the facts and the statistics, of which a large number are given, relate principally to the position as it stood before about 1919 or 1920.

The chapters dealing with the alloys of the metals consist mostly of the equilibrium diagrams of the various alloy systems. Several of the diagrams given are not up to date—for example, there is no mention of δ -iron in the nickel-iron diagram. It is also confusing that when diagrams are repeated (in one case the same one appears three times) the relative scales of the ordinates are not the same in each case, while the diagram is often reversed end to end. In some instances, too, the temperatures given for lines in the diagram are not exactly the same on repetition, while in one or two cases lines appearing in a figure are missing entirely on its reinsertion.—W. T. GRIFFITHS.

Molybdän. Eine Monographie mit einem Anhang, enthaltend die Hauptansprüche der wichtigsten in- und ausländischen Patente zur Gewinnung des Molybdäns.

Von Ernst Pokorný (Monographien über chemisch-technische Fabrikations-Methoden, Band XL.). Med. 8vo. Pp. viii + 299, with 52 figures in the text. 1927. Halle (Salle): Wilhelm Knapp. (Geh. R.M. 23.80; geb. R.M. 25.70.)

This very comprehensive monograph has been compiled by the author after many years of practical experience in the manufacture of molybdenum. Rather more than one-third of the book is devoted to details of the various methods of production which may be used. Thirty pages only are devoted to molybdenum alloys, which permits only of a brief statement in regard to the method of preparation of each of the known alloys. This condensation is deliberate, as the author states in his preface, since the ground has already been covered by other authors. We think it is an unfortunate arrangement, and that either the section should have been omitted or, better still, treated more fully. The next 50 pages cover the uses of molybdenum and its compounds in the arts, the chief of which are the use of the metal in the steel industry, or unalloyed in the electric lamp industry; and the use of its compounds in chemical technology. The last 75 pages of the book are of very doubtful value. They are occupied by statistical tables of the prices of molybdenum and its compounds, details of production over a number of years, and finally the chief claims of all patents dealing with molybdenum. Whilst the last may have some value, it is not sufficiently complete to be of real use where patent questions are involved, and the statistics will be of little interest in the course of a few years. It is disappointing to find so large a portion of the book occupied with this data.

The first part of the book is really good, and covers the various methods of production accurately and in great detail. References to the literature are numerous throughout, although occasionally a reference only is given without quoting results obtained. Thus on p. 23 the reader is referred to original papers for certain properties of the metal, when the actual data could have been given in almost the same space. The book is clearly printed, and illustrated with line diagrams. No photomicrographs appear, which is to be regretted in a metallurgical treatise. Printers' errors are rather numerous, and some thirty errata have been corrected

on the last page. The reader is not likely to discover this list, however, until he has read most of the book.—C. J. SMITHELLS.

1914-1924. Dix Ans d'Efforts scientifiques, Industriels et Coloniaux. Sous la direction du Jean Gerard. 4to. In two volumes. (Volume II.) Paris: Chimie et Industrie, 49 rue des Mathurins.

To the metallurgist this second volume is not quite so specially interesting as its predecessor; but in a more general sense it must appeal to everyone as a very comprehensive digest of varying fields of French industrial life. In the two volumes together practically every feature upon which the prosperity of France depends has been dealt with in more or less extended form, with illustrations and diagrams where appropriate. Thus among many other subjects of very varied interest in the present volume are the following, which are typical of the wide range covered—hydraulic and electrical power stations, the Rhine industries, automobile industry, banks and banking, medicinal and aromatic plant cultivation, rubber, gums and lacquers, &c. For the sake of grouping the various sections together the matter is arranged under two main heads—(1) the economic industries of France, and (2) French colonial effort. To the engineer and metallurgist the most instructive part will probably be that in which works are described. This is a considerable section and is rich in illustrations.

Such a survey as is contained in this work, while having no direct appeal to any particular industry and dealing only with the salient features of the various branches of French commercial enterprise, has yet a very definite value. The perspective of the whole is without doubt truer than that which can be derived from an internal view of a single phase of that whole. To this end the summary of achievement during the last ten years is impressive, and is a matter for sincere congratulation.—W. A. C. NEWMAN.

Popular Fallacies Explained and Corrected. By A. S. E. Ackermann. Third Edition, with an Introduction by Sir Richard Gregory. Pp. xvi + 984. 1923. (12s. 6d. net.)

Scientific Paradoxes and Problems and Their Solutions. By A. S. E. Ackermann, with an Introduction by C. V. Boys. Pp. viii + 131. 1925. London: The Old Westminster Press. (5s. net.)

Mr. Ackermann has in these two books set out to destroy many of the most cherished beliefs, traditions, and superstitions that are still current, in spite of the advance of science, in some circles, and which have been and still are, in many cases, the subject of a great deal of argument wherever two or more people are gathered together in a spirit of friendly controversy. He has made the collecting of fallacies the hobby of his lifetime, and here he gives us the benefit of his researches. There are very few people so well informed that they will not find something in both these books to interest them, something they have always believed to be true, but which is here shown to be a fallacy, and something the true explanation of which will really come as a great surprise. The books cover all the aspects of human knowledge—history, geography, literature, music, medicine, law, and all branches of science. The portions dealing with natural phenomena, science, and engineering are particularly interesting and well written, and the author has gone to some considerable trouble in obtaining explanations of many phenomena from experts in that particular subject. The smaller book contains explanations of scientific paradoxes and problems, discussed by the author in a series of broadcast talks, and covers a very wide range, varying from purely scientific subjects to drawing-room "catches."

We can thoroughly recommend both books to everyone who desires a little relaxation from purely scientific reading, for their perusal affords an insight into the mental attitude towards science of the "man in the street"; they will also provide material for amusement at social gatherings, and suggest means for entrapping the dogmatic person who knows all there is to know about a certain subject.—A. R. POWELL.

Potentiometric Titrations. A Theoretical and Practical Treatise. By I. M. Kolthoff and N. Howell Furman. Med. 8vo. Pp. xii + 345, with 45 figures. 1926. New York: John Wiley & Sons, Inc.; London: Chapman and Hall, Ltd (22s. 6d. net.)

So-called "electrometric" titrations may be divided into two classes: conductometric titrations and potentiometric titrations. Dr. Kolthoff has already written a book dealing with the former class (see this *J.*, 1925, **33**, 610) which, unfortunately, has not yet been translated into English. In the book under review he has, in collaboration with a prominent American investigator in the same field, dealt entirely with the potentiometric type of titration in which the end-point is ascertained by measuring the change in potential of a standard electrode during the titration. The first 130 pages of the book contain an admirable and lucid exposition of the theoretical principles of precipitation, neutralization, oxidation, and reduction reactions, which are explained in great detail, together with considerations of the possible sources of error and of the general conditions for carrying out potentiometric titrations. The second part of the work deals with practical applications, and is prefaced by chapters in which the arrangement of the necessary apparatus and the means of detecting the end-point are discussed. Potentiometric titrations are more generally applicable to the determination of metals than are conductometric titrations, so that this book should prove to be of considerable interest to metallurgical chemists who wish to keep in touch with the latest advances in analytical procedure as applied to their branch of the science. Unfortunately, the cost of the apparatus required is somewhat high and, in the case of some metals, no sufficiently accurate method has yet been discovered. Again, some titrations occupy too long a time compared with the usual titrations using indicators, or the addition of relatively expensive reagents, such as alcohol, may be necessary to secure a well-marked end-point. No doubt these drawbacks to the more extended use of potentiometric titrations in commercial work will some day be removed, but their removal will require a great deal of careful and painstaking research. To those desiring an even more intimate acquaintance with the subject than can be obtained by a perusal of this book, the numerous references given as footnotes and the complete bibliography at the end of the book will prove invaluable. Another useful feature is the series of tables showing the normal potentials of some electrode reactions, the dissociation constants of some acids and bases, and the solubility products of some salts.

The book is well written, and the printing and binding are of a high standard of excellence, whilst the few misprints noticed are of a minor character and in no way detract from the value of the work.—A. R. POWELL.

Tables of Physical and Chemical Constants and Some Mathematical Functions. By G. W. C. Kaye and T. H. Laby. Med. 8vo. Fifth edition. Pp. 161. 1926. London: Longmans, Green & Co., Ltd. (14s. net.)

The first edition of Kaye and Laby's well-known Tables was published in 1911, and the appearance of successive editions has merely served to confirm its pre-eminence amongst books of constants, of a convenient size for easy reference. There are numerous comprehensive and cumbersome volumes available—Landolt-Bornstein, *Recueil des Constantes Physiques*, *International Critical Tables*—to name but three. These works look impressive on the shelf. "Kaye and Laby" is the sort of book one likes to have at one's elbow. Looking up the value of a physical constant in it is an easy matter. Very rarely have we failed in our quest. The general contents of the volume are well known. In the present edition new matter on isotopes has been included, and the table relating to the mechanical equivalent of heat revised. The book can be heartily recommended to any who have occasion to use data of a general character. The size of the book precludes it from containing data on very special subjects. Thus the metallurgists seeking the values of the density of brass or phosphor-bronze will find his needs supplied. Not so the metallurgists inquiring about "Lautal" or any of the more recent alloys. Only the old familiar brass, bronze, steel, Duralumin, "German silver," Manganin, &c., are tabulated. We note the omission of all reference to the fact that some British silver

coins contain nickel, in the table on page 22. But it would be too much to expect the book to be brought up to date in all respects. That would be a whole-time job for the authors. We would ask them to extend the sections devoted to alloys in a future edition, which will appear in due course, and metallurgists then will want nothing better than Kaye and Laby.

—J. S. G. THOMAS.

Technical Education : Its Development and Aims. By C. T. Millis. Post 8vo. Pp. vii + 183. 1925. New York : Longmans, Green & Co. (\$2.25); London : Edward Arnold & Co. (Price 6s. net.)

The author, who for 30 years was Principal of the Borough Polytechnic Institute, endeavours in this little book to give an historical outline of the development of technical education in this country from the formation of the Mechanics' Institutes in the early part of the last century, and of the Science and Art Department in 1859 to the foundation of the modern Technical Institutes and Schools, and to discuss their aims and methods of teaching with the idea of pointing out possible openings for improvement in their syllabuses. The result is an extremely interesting book, which should provide material for study and food for thought for all who have the welfare of the younger generation at heart as well as those who have undertaken the somewhat thankless task of preparing them for entry into trades in which a sound technical education is the first stepping-stone towards success in these days of strenuous competition. In the last four chapters the author has ably defined the aim and scope of the various types of day and evening Technical Institutes and Continuation Schools, the history of most of which has been discussed in the earlier part of the book. Some stress is laid on the necessity on the part of any institute not to deviate too far from the programme mapped out for it on its foundation; to this error of judgment is ascribed the loss to technical education of the Finsbury Technical College, which was the first Technical Institute to be opened in England.

As an example of the field to be covered by a day continuation school preparing students for entry into the engineering and metal trades, the excellent syllabus of the 3-year course at the Junior Technical School of the Borough Polytechnic is quoted in full in an appendix.

The book can be thoroughly recommended to all interested in technical education, as well as to employers in technical trades, who might thereby be persuaded to emulate the example of various City of London Companies and Guilds in founding new schools or endowing existing ones! The employer might also be encouraged to appreciate more fully the value of a technically trained staff in improving his business and the trade of the country as a whole.

—A. R. POWELL.

The Bureau of Standards : its History, Activities, and Organization. By Gustavus A. Weber. (Institute for Government Research. Service Monographs of the United States Government, No. 35.) Demy 8vo. Pp. xv + 299. 1925. Baltimore, Md. : The Johns Hopkins Press. (\$2.00.)

This is one of a series of monographs prepared by the Institute for Government Research, U.S.A., to afford a detailed description of each of the fifty or more distinct services of the Government. Briefly, all the monographs, including the present one, are prepared according to a uniform plan : sections are devoted to the history of the establishment and development of the service; its specific activities and organizations; its plant, laws, and regulations governing its operations; its finance, and a bibliography bearing on its service and operation. The statutory existence of the Bureau of Standards, Washington, dates from March 3, 1901. Here its birth and development are interestingly told. The metallurgist will probably be most interested in the account of its numerous scientific activities. These cover all branches of physical, chemical, and engineering science. Thus from the subsection of the book devoted to metallurgy we learn that the metallurgical work undertaken by the Bureau is extremely comprehensive, embracing all means for the control of physical properties of metallic materials. Routine testing is confined to work for other Government departments. Tests for individual

firms are rarely undertaken. The Bureau co-operates with and does not compete with commercial laboratories. Its metallurgical activities are described under five headings—viz. optical, thermal, mechanical and chemical metallurgy, and experimental foundry work. This is all interesting reading, as indeed is the whole book. The results obtained at the Bureau are made available in the form of scientific and technologic papers published at very frequent intervals and issued annually in bound volumes. These annual volumes of scientific papers are marvels of cheapness, being issued at \$2 per volume, bound in cloth (\$2.15 for foreign subscriptions). The Bureau also issues simplification practice recommendations, building code recommendations, and other publications. All these activities are scheduled and detailed in the book under review. We heartily recommend it to industrialists throughout the world. From it they will learn how the United States Government seeks to aid in the development of pure science and its applications. It is a fine tale, well told. There is only one thing more we would wish, and that is that the publications of the Bureau were made more readily accessible to the scientific and industrial public in England.—J. S. G. THOMAS.

The Corrosion of Metals. By Ulick R. Evans. Second edition. Demy 8vo. Pp. xvi + 259, with 28 illustrations. 1926. London: Edward Arnold & Co. (15s. net.)

It is a deserved tribute to Mr. Evans that he should have been called upon to prepare a second edition of his book within two years of its first publication. Both the science and practice of metallurgy continue to make such rapid strides that current books soon become out of date, and it is especially desirable that comprehensive works of this type, which appeal to a wide circle of readers, should be frequently revised. While in the second edition the general arrangement of the first is retained, numerous additions have been made to the text, and references to recent papers have been included. Information added to the German translation of the first edition by Dr. E. Honegger has in some cases also been incorporated. The volume has increased in size to the extent of forty-seven pages and six illustrations, the price being raised by one shilling.

The book is written with the refreshing clarity of expression generally associated with Mr. Evans' publications, and is admirably printed. None of the classes of readers for whom it is intended should have any difficulty in extracting from it a large amount of useful information. It is to be hoped that the second edition will repeat the success of the first.

—R. GENDERS.

The Metallurgist's Manual. By T. G. Bamford and Harold Harris. With a Foreword by Thomas Turner. Demy 8vo. Pp. x + 246, with 55 illustrations. 1927. London: Chapman and Hall, Ltd. (15s. net.)

As the title conveys, this is intended as a handy book for metallurgists in all parts. Approximately one-half deals with assays and analyses of bullion, of ores, and of ferrous and non-ferrous metals. Sound methods are described shortly, but with convincing insistence upon essential details. Short chapters on fuels, gas analysis, fireclays, and smelting follow with a good collection of the main facts and figures of these subjects; then there are fuller chapters upon pyrometry and metallography, and finally some tabulated information of wide usefulness. The iron-carbon equilibrium diagram "with various useful working temperatures" in itself is an education and a boon. It is not clear why the subjects pyrometry and metallography should have been treated much more in the style of the elementary textbooks than the remainder. Probably these chapters could have been condensed to admit more useful information in the space given. Electroplating is touched upon, but electrolysis and electrothermics are otherwise ignored. A chapter on the nature and use of various refractories would have been welcome.

The authors appear to have aimed at providing the traveller with a small manual for most of his metallurgical information, and have certainly succeeded in presenting a very useful work.—A. C. VIVIAN.

The Metallurgy of the Common Metals. Gold, Silver, Iron (and Steel), Copper, Lead, and Zinc. By Leonard S. Austin. Sixth edition, thoroughly revised. Med. 8vo. Pp. xviii + 658, with 347 illustrations. 1926. New York: John Wiley & Sons, Inc. London: Chapman and Hall, Ltd. (35s. net.)

The fact that this is the sixth edition of this volume proves that it fills a want. It commences by dealing at considerable length with the general problems of process metallurgy, such as the treatment of ores (it is a little difficult to see why casting of metals should be included under this head), fuels, sampling, furnaces, &c., and then discusses the metallurgy of gold, silver, iron and steel, copper, lead, and zinc, and finishes with six chapters on the subject of plant and equipment and on the business of metallurgy—a truly ambitious problem—indeed, the reviewer cannot help thinking that the author would have produced a better book had he been less ambitious.

Dealing with lead-silver and copper ores the author speaks with authority, having had a quarter of a century's experience with these materials, but in other places there are very curious statements. Perhaps the weakest part of the book is that on the subject of steel. Indeed, it may be questioned whether it is possible to deal at all satisfactorily with wrought iron and steel in 33 pages. In a section headed "Peculiarities of Steel" (p. 346) it is stated that "If heated beyond a yellow heat (800°C.) steel may be burned and permanently injured. It must therefore be worked at a lower heat than wrought iron. Wrought iron will accordingly weld better than steel." Lower down on the same page occurs the following:—"High Grade Steel.—This is steel made in the electric furnace." What have non-electric-furnace steel-makers to say to this? On the next page it is stated that the maximum phosphorus content for open-hearth structural steel is 0.66%. Is this a typographical error for 0.06%? Again, exception must be taken to the statement that "alloy steels are divided into two groups, those alloyed with one metal and quaternary steels alloyed with three metals" (p. 347).

Another curious definition is that which states that spelter is an alloy of zinc with lead, iron, and cadmium, and then proceeds to state that electrolytic spelter may contain 99.95% of zinc (p. 571). This is an example of the deplorable results which may arise from the use of the unfortunate term "spelter," which originally seems to have been more or less reserved for the commercial brands of zinc containing 0.5% or more of impurities, but which is now used absolutely interchangeably with zinc.

One minor criticism—the book is spoiled in many places by a curious system of punctuation. What, for instance, is meant by the statement "In the course of half an hour, the hot air, leaving, the stove falls at least 100°C. in temperature"? (p. 297).

Apart from weaknesses such as those criticised above, the book contains a vast amount of very valuable matter and is well and very fully illustrated.—J. L. HAUGHTON.

SUBJECT INDEX.

[The letter "A." following a page number denotes a reference to the section of the Journal dealing with abstracts, bibliography, &c.]

- "A" aluminium alloys. See *Aluminium alloys*.
- Abbreviations used in Journal, 356A., 370A.
- Absorption spectra. See *Spectra*.
- Abstractors, names, 355A.
- Accounts, 10.
- Accumulator, lead, theory, 633A.
- Acetic acid.
action on metals and alloys, 498A.
resistance of metals and alloys, 500A.
resistant alloys, 499A.
- Acetylene. See also *Welding*.
action on copper and its alloys, 683A.
- Acid-resisting materials, 498A., 499A., 500A.
- Acids (see also *Pickling*, &c.),
action on metals, 495A.
pump, self-priming, 673A.
- Admiralty bronze. See *Bronzes*.
- Admiralty gun-metal. See *Gun-metal*.
- Aeron, mechanical properties, 454A.
- Agglomeration of unmelted powders, 435A.
- Aggregates, thermoelectric power, 481A.
- Airplanes, metal, construction, 651A., 652A.
- Ajax-Northrup electric furnace, 292, 310.
- Ajax-Wyatt electric furnace, 288, 300, 313, 315, 316, 319; performances, 291, 306.
- Alchemy, book review, 775A.
- Alchemy, modern theory, 755A.
- Alcumite, properties, 449A.
- Alitaton, 499A.
- Alkali metal alloys, reactions with alkaline earth metals and their chlorides, 479A.
- Alkali metals (see also *Cæsium*, *Lithium*, *Potassium*, *Rubidium*, and *Sodium*),
analysis, 567A.
atoms, magnetic moments, 531A.
photoelectric cell, 673A.
- Alkali metals—
separation, 567A.
spectrum, doublets, 547A.; intensity relations in doublets of principal series, 547A., 548A.
vapour pressures, 416A.
- Alkali-resisting alloys, 499A.
- Alkaline earth metals (see also under names of *Alkaline earth metals*),
reactions with alkali metals and their chlorides, 479A.
spectrum, intensity relations of triplet components, 535A.
- Allotropy of—
Cobalt, 377A., 396A.
Copper, 380A.
Zinc, 415A.
- Alloys (see also *Eutectics*, *Solid solutions*, *Bearing alloys*, *Brass*, *Bronze*, *Gun-metal*, *Solders*, &c., under trade names, and under names of individual metals),
binary, eutectic lowering of freezing point, 483A.
colour, relation to structure, 482A.
composition, effect of remelting, 711A.
crystal structure, 516A.
diffusion, 434A.
electrical conductivity, relation to thermal conductivity, 480A.
electrical contact, 672A.
equilibrium relations in liquid and solid state, 466A.
- Hall effect, relation to temp., 480A.
- Industrial, properties, 671A.
- Interdendritic flow, 249.
- Inverse segregation, 241 (*Paper*).
- Limiting states, 483A.
- Liquation, theories, 243.
- Ludwig-Soret effect, 243, 484A.
- Molten, elect. resistance, 480A.; electrolytic conduction, 479A.; internal friction, 455A.; surface tension, 392A.
- Power to fill a moulded piece, influence of chem. compn., 482A.

Alloys—

quaternary, graphic representation, 485*A*.

quinary, graphic representation, 485*A*.

reaction limits, 417*A*.

solidification, 250.

ternary, constitution, 485*A*.

thermal conductivity, 430*A*.; relation to constitution, 480*A*.; relation to elect. conductivity, 480*A*.

thermal expansion, 481*A*.

thermoelectric power, 481*A*.

transformations which take place in homogeneous phases without crystallization changes, 483*A*.

undercooling, 244.

Almelec, properties, 452*A*.

Alpax. (See *Aluminium-silicon alloys*, *Silumin*.)

Alpha particles. See *Rays*.

Alpha rays. See *Rays*.

Aluminium—

action of cement, 497*A*.; nitric acid, 373*A*.; organic acids, 488*A*.; oxygen-nitrogen mixtures, 434*A*.

analysis, A.S.T.M. methods, 565*A*.; spectroscopic, 568*A*.

anode film dielectric, 632*A*.

anode films, electrostatic capacity, 632*A*.

anodic oxidation, 507*A*.; as protection against corrosion, 486*A*.; book, 759*A*.

atomic weight, 425*A*.

bath tubs, 648*A*.

boiling point, 433*A*.

book review, 768*A*.

brazing, 680*A*.

casting, 713*A*.

cementation by copper, 506*A*.

coatings, on metals, production, 505*A*.

cold-rolled, crystal structure, 517*A*.

commercial, effect of calcium, 77.

containing silicon, effect of calcium, 77 (*Paper*).

corrosion by acids, 487*A*.; by conc. sodium chloride solns., 487*A*.; by hydrochloric acid, effect of thermal treatment, 487*A*.; by neutral salt solutions, 487*A*.

crystals, regular growth during recrystallization, 521*A*.

deposition on, electrolytic, 641*A*.

detection, 568*A*.; improvement in cobalt aluminate test, 568*A*.

die-casting, 716*A*.

discovery, 371*A*.

Aluminium—

electrical conductivity, 372*A*.; effects of torsion, 371*A*.

electrode potential, in aqueous solns., 373*A*.; theoretical, 373*A*.

electromotive behaviour, 373*A*.

estimation in bronze bearing metal, 566*A*.; in ferro-chrome, 577*A*.; in light metals, progress, 565*A*.

fifty years' progress, 646*A*.

finishes, black, 509*A*.

finishing industry of Germany, 648*A*.

foundry, gas-heating, 710*A*.; temp. control, 615*A*.

German production, 749*A*.

history, 371*A*., 647*A*.

industry, prospects, 646*A*.

ingots for remelting, A.S.T.M. specifications, 647*A*.

latent heat of fusion, 431*A*., 432*A*.

mechanical properties, 372*A*.

melting, electric, 304, 722*A*.

melting point, effect of cold-work, 422*A*.

metallography, 649*A*.

microstructure, 513*A*.

molten, elect. resistance, 426*A*.

moulding sand for, 708*A*.

occlusion of gases, 436*A*.

paint, heat saver, 648*A*.; spraying of transformer tank, 648*A*.; uses, 506*A*.; value, 648*A*.

passivity, 374*A*.; periodic, 631*A*.

photoelectric emission, 428*A*.

pistons, compared with Silumin and magnesium pistons, 453*A*.; see also under *Aluminium alloys*.

production, 634*A*., 671*A*.

properties, 671*A*.

protection against corrosion, 486*A*., 487*A*., 507*A*.

recrystallization, 372*A*., 517*A*.

reflection of X-rays, 374*A*.

secondary, prodn. from scrap, 704*A*.

sheet, action of magnesium sulphate soln., potassium chloride soln., and sodium chloride soln., 488*A*.; A.S.T.M. specifications, 647*A*.; Brinell hardness, 605*A*.

single crystals, behaviour under tension, 371*A*., 372*A*.; effects of torsion on thermal and elect. conductivities, 371*A*.

soldering, 680*A*.

solders, 680*A*.

soils, preparation, 436*A*.

solubility in hydrochloric acid, 487*A*.

solubility rate in acids, 374*A*.; in alkalis, 374*A*.

Aluminium—

- specific heat, 432*A*.
- spectrum, extreme ultra-violet, wave-length standards, 533*A*.
- spraying on grate bars, 505*A*.
- sublimation pressure, 433*A*.
- technical importance, 649*A*.
- tensile properties of single crystals, 371*A*., 372*A*.
- thermal conductivity, effects of torsion, 371*A*.
- thermal hydrochloric acid test, 488*A*.
- uses, 671*A*.; in apparatus industry, 648*A*.; in electrothermics, 648*A*.
- very pure, mech. properties, 372*A*.; structure, 372*A*.
- welding, 680*A*., 681*A*., 682*A*.; auto-genous, 680*A*., 681*A*.
- working, book, 764*A*.
- works of Aluminium Co. of America, 648*A*.
- world's production since discovery, 749*A*.
- X-ray refraction, 443*A*.**
- Aluminium alloys (see also *Aluminium-bronze*, *Duralumin*, *Lautal*, *Silumin*, &c.),**
 - ageing, 446*A*.
 - analysis, 565*A*.; A.S.T.M. methods, 565*A*.; progress, 565*A*.
 - anodic oxidation as protection against corrosion, 486*A*., 759*A*.
 - book review, 768*A*.
 - casting, 712*A*., 713*A*.
 - casting temperature, relation to properties, 713*A*.
 - corrosion products, effect of atmospheric exposure, 486*A*.
 - creep, 445*A*.
 - deposits on, electrolytic, 641*A*.
 - effect of boron, 448*A*.
 - electrical conductivity, effect of atmospheric exposure, 486*A*.
 - estimation of cadmium, 89.
 - etching characteristics in commercial, 512*A*.
 - for casting, A.S.T.M. specifications, 649*A*.; B.E.S.A. specifications reviewed, 649*A*.; properties, 445*A*., 446*A*.
 - future developments, 671*A*.
 - heat-treatment, 678*A*.
 - mechanical properties, effect of inclusions, 447*A*.; influence of shrinkage, 459*A*.
 - modified, improvement, 446*A*., 447*A*.
 - moulding sand for, 708*A*.
 - new, 445*A*.
 - oxidizing salt test, 488*A*.

Aluminium alloys—

- permanent mould castings, 715*A*.
- pistons, properties, 651*A*.
- protection against anodic corrosion, 507*A*.
- relative advantages of steel and, 649*A*.
- sand-castings, A.S.T.M. specifications, 650*A*.
- sea-water resisting, 487*A*.
- secondary, prodn. from scrap, 704*A*.
- tensile properties, effect of atmospheric exposure, 486*A*.
- use in ammonia stills, 489*A*.; in automobiles, 652*A*.; in marine engineering, 652*A*.; in shipbuilding, 648*A*.
- welding, autogenous, 681*A*.
- wrought, 446*A*.
- "Y," heat-treatment, 677*A*.
- Aluminium-beryllium alloys,**
 - ageing phenomena, 447*A*.
 - mechanical properties, 447*A*.
- Aluminium-bronzes "** (see also *Aluminium-copper alloys*),
 - acid-resistance, 657*A*.
 - castings, A.S.T.M. specifications, 657*A*.
 - heat-treatment, 678*A*.
 - transformations, 458*A*.
 - viscosity, 380*A*.
- Aluminium-cadmium alloys, 448*A*.**
- Aluminium - cadmium - zinc alloys,**
 - mechanical properties, 448*A*.
- Aluminium-calcium-alloys,**
 - electrical resistance, 448*A*., 449*A*.
- Aluminium-calcium-silicon alloys,**
 - constitution, 448*A*.
 - electrical conductivity, 84.
 - hardness, 81.
 - tensile properties, 81.
- Aluminium-cobalt alloys,** sand-cast, 449*A*.
- Aluminium Company of America,** Quebec works, 648*A*.
- Aluminium-copper alloys (see also "*Aluminium-bronzes*," &c.),**
 - acid-resisting, 657*A*.
 - action of magnesium sulphate solns., 488*A*.; of potassium chloride solns., 488*A*.; of sodium chloride solns., 488*A*.
 - equilibrium relations, 449*A*.
 - segregation, 483*A*.
 - solid solutions, thermoelect. properties, 481*A*.
 - viscosity at high temps., 481*A*.
- Aluminium - copper - iron - magnesium alloys,** effect of reheating, 449*A*.

- Aluminium-copper-manganese alloys**, crystal structure, 522*A*.
- Aluminium-copper-nickel alloys**, Hall effect, relation to temp., 480*A*.
- Aluminium - copper - nickel-magnesium alloys**,
effect of reheating, 449*A*.
heat-treatment, 677*A*.
- Aluminium-copper-silicon alloys**, mechanical properties as sand-cast and heat-treated, 449*A*.
- Aluminium-germanium alloys**, ageing phenomena, 451*A*.
constitution, 451*A*.
- Aluminium-iron alloys**, solidification, 451*A*.
temper colours, 473*A*.
- Aluminium-magnesium alloys**, constitution, 452*A*.
- Aluminium-magnesium-silicon alloys**, sand-cast, metallography, 452*A*.; properties, 451*A*., 452*A*.
- Aluminium - magnesium - zinc alloys**, mechanical properties, 663*A*.
- Aluminium-manganese alloys**, equilibrium relations, 452*A*.
properties, 469*A*.
uses, 469*A*.
- Aluminium-manganese-copper alloys**, properties, 469*A*.
uses, 469*A*.
- Aluminium oxide**, spectrum, band, 534*A*.
- Aluminium-silicon alloys** (see also *Silumin*, &c.),
electrical conductivity, 84.
hardness, 82.
papers published in 1926, critical discussion, 453*A*.
sand-cast, modification and properties, 453*A*.
solubility of silicon, 453*A*.
tensile properties, 82.
- Aluminium - silver alloys**, ageing phenomena, 454*A*.
- Aluminium-titanium alloys**, compounds, 454*A*.
- Aluminium-zinc alloys**, transformation in solid state, 478*A*.
- Aluminium-zinc-tin alloys**, corrosion, 454*A*.
physical properties, 454*A*.
- Amalgams**,
Cadmium, behaviour in relation to Weston normal element, 633*A*.
contact switches, 664*A*.
Copper, constitution, 469*A*.
dental, 664*A*.
fillings, danger, 753*A*.
- Amalgams**,
Gold, constitution, 469*A*.
liquid, use in analysis, 563*A*., 564*A*.
microstructure, 513*A*.
Potassium, effect of light on interaction of water and, 470*A*.
removal of manganese, chromium, iron, cobalt, and nickel, 632*A*.
Silver, constitution, 469*A*.; crystal structure of Ag_2Hg_4 , 523*A*.
Sodium, effect of light on interaction of water and, 470*A*.
Thallium, metallography, 513*A*.
Tin, metallography, 513*A*.
- Ambrac**, properties, 497*A*.
- America**. See *United States of America*.
- American Chemical Society**, history, 757*A*.
- American Electrochemical Society**, 756*A*.
- American Zinc Institute**, eighth annual meeting, 751*A*.
- Ammonium chloride vapour**, action on metals, 435*A*.
- Amorphous cement**, 522*A*.
- ANALYSIS, METHODS OF.**
Analysis,
colorimetric, 557*A*.
electrolytic, rapid, 557*A*.; use of mercury as cathode, 557*A*.
filtering crucibles, porcelain, quartz, and glass, 561*A*.
gravimetric, use of organo-metallic complexes, 557*A*.
iodometric, use of hydrazine sulphate, 562*A*.
laboratory apparatus. See *Laboratory apparatus*.
mass, book, 762*A*.
metallurgical, advances in year 1925, 557*A*.
micro-, use of pyrophosphates, 582*A*.
potassium permanganate solutions, standardization, 563*A*.
precipitates, apparatus for automatic washing, 561*A*.
precipitations, electrolytic, gauze cathode of V2A steel as substitute for platinum, 561*A*.
qualitative, book, 763*A*.
quantitative, book, 758*A*.
reagent chemicals, recommended specifications, 562*A*.
solutions, apparatus for continuous percolation and for filtration in neutral atmospheres, 561*A*.

Analysis, methods of.

Analysis,

spectroscopic, book, 766*A.*; quantitative, 553*A.*, 560*A.*

thiosulphate solutions, keeping quality, 562*A.*; variability of titre, 562*A.*

vacuum filtration, use of filter pump, 561*A.*

volumetric, logarithmic tables for, 558*A.*; precision, 558*A.*; use of liquid amalgams, 563*A.*, 564*A.*

Analysis of—

Alkali metals, 567*A.*

Aluminium, A.S.T.M. methods, 565*A.*; spectroscopic, 568*A.*

Aluminium alloys, 565*A.*; A.S.T.M. methods, 565*A.*; progress, 565*A.*

Boron alloys, 565*A.*

Brass, complete, 566*A.*; ingots and castings, A.S.T.M. methods, 566*A.*; rapid, 566*A.*

Bronze bearing metal, A.S.T.M. methods, 565*A.*

Cæsium, quantitative, 566*A.*

Columbium, 566*A.*

Ferro alloys, A.S.T.M. methods, 566*A.*

Fuels (solid), 731*A.*

Non-ferrous metals and alloys, report of A.S.T.M. committee, 564*A.*

Rubidium, quantitative, 566*A.*

Tantalum, 566*A.*

Titanium chloride, 410*A.*

Detection of—

Aluminium, 568*A.*; improvement in cobalt aluminate test, 568*A.*

Antimony, 568*A.*

Arsenic, mercuric bromide paper for Gutzeit method, 569*A.*

Beryllium, 568*A.*

Bismuth, 569*A.*; qualitative, potassium cobalticyanide as reagent, 571*A.*

Cadmium, 570*A.*; in presence of copper, 569*A.*

Calcium, 571*A.*

Cobalt, spectroscopic, 569*A.*

Copper, 569*A.*

Heavy metals, 567*A.*

Iridium, 584*A.*

Mercury, 570*A.*

Metals, spot reactions, 568*A.*

Molybdenum, 570*A.*

Osmium, 584*A.*

Palladium, 584*A.*

Platinum, 584*A.*

Analysis, methods of.

Detection of—

Platinum metals, 584*A.*

Products of atomic disintegration in transmutation of elements, 567*A.*

Rare earths, 568*A.*

Rhodium, 584*A.*

Ruthenium, 570*A.*, 584*A.*

Silver, 570*A.*

Sodium, 570*A.*

Strontium, 571*A.*

Thorium, 568*A.*; drop reactions, 571*A.*; in incandescent filament wires, 571*A.*

Tin, blowpipe method, 571*A.*

Titanium, drop reactions, 571*A.*

Tungsten, 568*A.*

Vanadic acid by means of hydrogen peroxide, 571*A.*

Zinc, qualitative, potassium cobalticyanide as reagent, 571*A.*

Zirconium, 568*A.*; drop reactions, 571*A.*

Estimation of—

Aluminium in bronze bearing metal, 566*A.*; in ferro-chrome, 577*A.*; in light metals, progress, 565*A.*

Antimony, electrolytic, 577*A.*; in hydrochloric acid, electrolytic, 577*A.*

Arsenic, electrolytic, 577*A.*; gravimetric, 572*A.*; new methods, 580*A.*

Barium, 579*A.*

Bismuth in copper, 577*A.*; microchemical, 578*A.*; volumetric, 577*A.*

Cadmium, gravimetric, by means of cyanamide, 588*A.*; in zinc and in alloys, 578*A.*; new method, 578*A.*

Calcium, 579*A.*; by conversion of oxalate to carbonate, 578*A.*; in aluminium alloys, 89; in lead alloys, 578*A.*; volumetric, by pptn. as oxalate, 578*A.*; volumetric, in mineral substances containing phosphoric acid, magnesium, iron, and aluminium, 579*A.*

Chromic acid by a titanous salt, using liquid amalgams, 563*A.*

Chromium, volumetric, 579*A.*

Cobalt, microchemical, use of pyrophosphates, 582*A.*; rapid, spectroscopy and colorimet 569*A.*; volumetric, 582*A.*

Analysis, methods of.**Estimation of—****Columbium, 583A.****Copper** by means of orthohydroxyquinoline, 580A.; by means of permanganate, 580A.; in bronze, electrolytic, 268; new methods, 580A.; oxidimetric, by means of bismuth amalgam, 564A.; quantitative, 580A.; titrimetric, with potassium iodide, 580A.**Ferric iron** by a titanous salt, using liquid amalgams, 563A.; electrometric (small quantities), 581A.**Ferricyanide** by a titanous salt, using liquid amalgams, 563A.**Gold, potentiometric, 580A.****Iridium** in small quantities, 584A.**Lead, 581A.**; by oxidation with persulphates, 581A.; in solder by calculation on the Archimedean principle, 587A.**Lithium** in lead alloys, 578A.**Manganese, bismuthate method, 582A.**; in rich alloys, 581A.; microchemical, use of pyrophosphates, 582A.**Mercury, colorimetric, 582A.**; in minute quantities, 582A.; in minute quantities, colorimetric, 582A.; new methods, 580A.**Molybdenum** in small quantities, 587A.**Nickel, acidimetric, by means of nickel dicyanodiamidine, 583A.**; in minute quantities, colorimetric, 583A.; in presence of iron, electrolytic, two causes of error, 583A.; volumetric, 583A.**Osmium** in small quantities, 584A.**Oxygen** in refined copper, 583A.**Palladium** in small quantities, 584A.**Phosphoric acid** by means of a uranyl salt, using liquid amalgams, 563A.**Platinum** in small quantities, 583A., 584A.**Platinum metals, 584A.**; potentiometric, 584A.**Potassium** in potassium salts as perchlorate, 584A.; polarimetric, 584A.; quantitative, by means of electrometric titration, 584A.**Rhodium** in small quantities, 584A.**Analysis, methods of.****Estimation of—****Ruthenium** in small quantities, 584A.**Selenium** by means of potassium permanganate, 584A.; quantitative, 584A.**Silver, microchemical, 585A.****Sodium, gravimetric, 585A.**; in lead alloys, 578A.**Strontium, 579A.**; microchemical, 585A.**Sulphate, modification of Jellinek's method, 585A.****Sulphur** in refined copper, 583A.**Tantalum, 583A.****Tellurium** by means of potassium permanganate, 584A.; in presence of ferric iron, selenium, and copper, electrometric, 586A.; quantitative, 584A.; rapid electrolytic, by means of reduced potential, 585A.**Thallium** as thallous chromate, 586A.**Thorium** in small quantities, 587A.**Thorium-X, quantitative, 586A.****Tin, electrolytic, 577A.**; in solder by calculation on Archimedean principle, 587A.; oxidimetric, by means of bismuth amalgam, 564A.**Tungsten** by distillation in current of air and carbon tetrachloride vapour, 586A.; in ferro-tungsten by calculation on the Archimedean principle, 587A.; in small quantities, 587A.; oxidimetric, using liquid amalgams, 563A.**Vanadium, action of potassium iodide on vanadophosphoric acid, 588A.****Zinc, gravimetric, by means of cyanamide, 588A.**; microchemical, use of pyrophosphates, 582A.; titrimetric, 588A.**Recipitation of—****Hydroxides, electrometric studies, 558A., 559A.****Zirconium** with picric acid, 588A.**Precipitation reactions of metals, 559A.****Separation of—****Alkali metals, 567A.****Antimony** from acid and alk. solns., electrolytic, 572A.**Arsenic** from selenium, 572A.**Cadmium, new method, 578A.**

Analysis, methods of.**Separation of—**

Calcium (small quantities) from magnesium (large amounts), 573*A*.

Copper by means of orthohydroxyquinoline, 580*A*.; in presence of cadmium, electrolytic, 573*A*.

Gallium from aluminium and iron, 574*A*.

Hafnium from zirconium, 573*A*.

Iridium from platinum and rhodium, 584*A*.

Magnesium from alkali metals, 574*A*.

Manganese and zinc by Na_2S , 574*A*.

Metals by graded potentials, 557*A*.; electrolytic, by graded potentials, 572*A*.; electrolytic, new method, 572*A*.

Nickel and iron from chromium, electrolytic, 574*A*.

Palladium from platinum, 584*A*.

Platinum and ruthenium, 575*A*.; from platinum metals, 584*A*.

Platinum metals, 574*A*.

Radium and mesothorium-I. from barium by ionic migration method, 575*A*.

Rare earths by basic pptn., 575*A*.; from uranium alkali uranyl-salicylates, 576*A*.

Rhodium from platinum, 584*A*.; from platinum and iridium, 584*A*.

Ruthenium from platinum, 584*A*.

Selenium and arsenic, 572*A*.

Tantalum and columbium, 575*A*.

Thallium from other elements, 586*A*.

Zinc and copper, 575*A*.; and nickel with hydrogen sulphide, 575*A*.

Zirconium from iron, 575*A*.; from other metals by fractional distillation, 575*A*.; from titanium, 575*A*.

Titration,

electrometric, application of three-electrode valves, 576*A*.

end-point, new type, 576*A*.

micro-burette with manometer, regulating device for, 576*A*.

potentiometric, 576*A*.

potentiometric, book review, 781*A*.

titaneous chloride solutions, potentiometric standardization, 562*A*.

Titration of—

Barium ions, 578*A*.

Analysis, methods of.**Titration of—**

Mercury, potentiometric, alone and in presence of other metals, 582*A*.; with potassium cyanide, 582*A*.

Platinum metals, potentiometric, 584*A*.

Potassium, electrometric, 584*A*.

Tin in white metals with potassium bromide, 586*A*.; potentiometric, with potassium bromate, 587*A*.; with ferric chloride, using indigo-carmin as indicator, 587*A*.

Zinc, electrometric, 588*A*.; visual conductometric, 588*A*.

Anemometers, hot wire, 594*A*.

Annealing (see also *Heat-treatment*), equipment of Western Electric Co., 677*A*.

Annealing of—

Brass, elect., 678*A*.

Copper wire, 678*A*.

Gun-metal, 678*A*.

Magnetic materials for telephone apparatus, electric, 677*A*.

Annual General Meeting, 1.**Anode effect,**

character of discharge in, 624*A*.

in electrolysis of molten salts, 624*A*.

Anodes (see also *Electrodes*),

insoluble, for electrolysis of brine, 497*A*.

nickel, wear, 625*A*.

Anodic behaviour of metals, electronic theory, 441*A*.

Anodic polarization, oscillograph study, 626*A*.

Antimony,

anodic behaviour in dil. sulphuric acid, 628*A*.

deposition at mercury dropping cathode, 625*A*.; from acid and alk. solns., electrolytic, 566*A*.

detection, 568*A*.

estimation, electrolytic, 577*A*.; hydrochloric acid, electrolytic, 577*A*.

Hall effect with weak fields, 374*A*.

latent heat of fusion, 431*A*.; 432*A*.

molten, elect. resistance, 426*A*.

occlusion of gases, 436*A*.

separation from acid and alk. solns., electrolytic, 572*A*.

specific heat, 432*A*.

spectrum in magnetic field, 545*A*.

- Antimony.**
thermoelectric properties, 481*A*.
Zeeman effect, 545*A*.
- Antimony alloys.** See *Babbitt metal*;
Bearing alloys, &c.
- Antimony-bismuth alloys,**
electrical conductivity, 480*A*.
electrolysis, 478*A*.
magnetic analysis, 38.
thermal conductivity, 480*A*.
- Antimony-cadmium alloys,**
electrical conductivity, 480*A*.
electrolysis, 478*A*.
magnetic analysis, 39.
thermal conductivity, 480*A*.
- Antimony-lead alloys,**
equilibrium relations, 455*A*.
magnetic analysis, 37.
microscopic examination, preparation
of specimens, 514*A*.
solidus line, 467*A*.
- Antimony-lead-arsenic alloys,** constitu-
tion, 467*A*.
- Antimony-lead-zinc alloys,** constitution,
467*A*.
- Antimony-silver alloys,**
thermal expansion, 481*A*.
thermoelectric properties, 481*A*.
- Antimony-tellurium alloys,** magnetic
analysis, 42.
- Antimony-tin alloys,**
magnetic analysis, 44.
thermoelectric properties, 481*A*.
- Antimony-tin-copper alloys** (see also
Bearing metals),
constitution, 477*A*.
- Antimony-zinc alloys,** magnetic analysis,
40.
- Apparatus, laboratory.** See *Laboratory
apparatus*.
- Arc welding.** See *Welding*.
- Argon, spectrum,** *M*-doublet, 534*A*.;
series, 534*A*.
- Arsenic,**
deposition at mercury dropping
cathode, 625*A*.
detection, mercuric bromide paper
for Gutzeit method, 569*A*.
effect on copper, 121 (*Paper*).
estimation, electrolytic, 577*A*.; new
methods, 580*A*.
powdered, action of moist air,
375*A*.
separation, gravimetric, 572*A*.; from
selenium, 572*A*.
- Arsenic-copper alloys,**
casting, 124.
density, 127.
electrical conductivity, 138.
- Arsenic-copper alloys,**
fatigue, 135.
hardness, 134.
impact tests, 135.
macrostructure, 139.
microstructure, 139.
rolling, 125.
solid solubility of arsenic, 140.
tensile tests, 127.
- Arsenic-copper-oxygen alloys,**
casting, 144.
density, 147.
electrical conductivity, 155.
fatigue, 151.
hardness, 151.
impact tests, 154.
macrostructure, 154.
microstructure, 154.
rolling, 145.
tensile properties, 147.
- Arsenic-lead-antimony alloys,** constitu-
tion, 467*A*.
- Arsenical copper.** See *Copper*.
- Aterite,** resistance to corrosive waters,
500*A*.
- Atomic moment,** variation, 429*A*.
- Atomic number,** relation to proper-
ties of ions in crystal lattice,
531*A*.
- Atomic structure,**
book review, 775*A*.
books, 757*A*., 759*A*., 761*A*.,
762*A*.
general articles, 532*A*.
magnetism and, 532*A*.
teaching, 532*A*.
theory, 530*A*.
- Atomic structure of—**
AgMg, 531*A*.
AuZn, 531*A*.
Lead, 531*A*.
- Atomic weight of—**
Aluminium, 425*A*.
Carbon, 406*A*.
Copper, 380*A*., 425*A*.
Elements, 2nd report of International
Cttee. of International Union of
Pure and Applied Chemistry,
424*A*.; 7th report of German
Cttee., 425*A*.; 32nd report of
American Cttee., 425*A*.
Lead, 390*A*., 425*A*.
Selenium, 405*A*., 425*A*.
Silver, 406*A*., 407*A*.
Titanium, 410*A*.
Zirconium, 415*A*.
- Atomization of metals,** book review,
772*A*.

- Atoms** (see also *Electrons, &c.*),
alkali metal, magnetic moments, 531*A.*
complex, dynamical model, 529*A.*
electronic groups, synthesis, 527*A.*
elliptical orbits, modification of Sommerfeld's theory, 529*A.*
forces of attraction and repulsion, 529*A.*
having four magnetic parts, application of Pauli's method of co-ordination, 531*A.*
lithium-like, spectrum, 538*A.*
magnetic properties, 429*A.*
mechanics, book, 758*A.*; undulatory theory, 530*A.*
models, Whittaker's, 529*A.*
orientation in magnetic field, optical evidence, 530*A.*
radii, 530*A.*
sodium-like, spectrum, 538*A.*
structure. See *Atomic structure.*
- Auditor**, election, 17.
- Babbitt metals**. See *Bearing alloys*, and under names of constituent metals.
- Baily electric furnace**, 320.
- Balls**, hollow, from sheet metal and tubes, 699*A.*
- Band spectra**. See *Spectra.*
- Barium**,
estimation, 579*A.*
ions, titration, 578*A.*
- Bars**,
deflection, 596*A.*
effect of combined tension (or compression) and torsion, 607*A.*
eye-shaped end, investigation by photo-elastic method, 602*A.*
failure due to impact, 603*A.*
flexure, statical hysteresis in, 602*A.*
- Bauxite**, book, 761*A.*
- Bearing alloys** (see also *Babbitt metals, Careco, Genelite, &c.*, and under names of constituent metals),
fluidity tests, 477*A.*
footstep, 646*A.*
locomotive, casting with calcium-lead alloys, 713*A.*
oil-rings, limitations, 646*A.*
railway car and tender, A.S.T.M. specifications, 646*A.*
tests, 610*A.*
- Benedick's effect**, 430*A.*
- Beryllium**,
density, 375*A.*
detection, 568*A.*
hardness, 375*A.*
- Beryllium**,
melting point, 375*A.*
preparation, 375*A.*, 652*A.*; electrolytic, 634*A.*
solubility in acids and alkalis, 375*A.*
spectrum, series, 534*A.*
thermochemistry, 375*A.*
uses, 652*A.*
- Beryllium alloys**, future developments, 671*A.*
- Beryllium-aluminium alloys**,
ageing phenomena, 447*A.*
mechanical properties, 447*A.*
- Beryllium-copper alloys**,
constitution, 459*A.*, 460*A.*
corrosion tests, 460*A.*
mechanical properties, 459*A.*
- Binary alloys**. See *Alloys*, and under names of constituent metals.
- Biographies**. See *Obituaries.*
- Bismuth**,
anodic behaviour in dil. sulphuric acid, 628*A.*
colloidal, 376*A.*
crystallization, influence of X-rays, 375*A.*
deposition at mercury-dropping cathode, 625*A.*
detection, 569*A.*; qualitative potassium cobalticyanide as reagent, 571*A.*
effect on copper, 169 (*Paper*).
estimation in copper, 577*A.*; microchemical, 578*A.*; volumetric, 577*A.*
Hall effect in sputtered films, 376*A.*
latent heat of fusion, 431*A.*, 432*A.*
molten, elect. resistance, 426*A.*
occurrence, 653*A.*
refining, 653*A.*
single crystals, thermal conductivity, 418*A.*; thermal e.m.f., 418*A.*
specific heat, 432*A.*
spectrum, fine structure, 534*A.*; fluorescence, 545*A.*; in magnetic field, 545*A.*; *K*-series emission, 547*A.*; *L*-series, precision measurements, 547*A.*; series, 534*A.*
surface tension, 392*A.*
thermoelectric properties, 481*A.*
uses, 653*A.*
Zeeman effect, 545*A.*
- Bismuth-antimony alloys**,
electrical conductivity, 480*A.*
electrolysis, 478*A.*
magnetic analysis, 38.
thermal conductivity, 480*A.*
- Bismuth-cadmium alloys**,
electrolysis, 478*A.*
equilibrium relations, 455*A.*

- Bismuth-copper alloys**,
 casting, 173.
 constitution, 172.
 density, 175.
 electrical conductivity, 176.
 electrical resistivity, 176.
 fatigue tests, 177.
 hardness, 175.
 impact tests, 177.
 macrostructure, 177.
 microstructure, 172.
 rolling, 174.
 tensile properties, 175.
- Bismuth-lead alloys**,
 electrical conductivity, 480*A*.
 magnetic analysis, 36.
 thermal conductivity, 480*A*.
- Bismuth-tellurium alloys**, magnetic analysis, 41, 46.
- Bismuth-thallium alloys**, thermoelectric properties, 481*A*.
- Bismuth-tin alloys**,
 magnetic analysis, 36.
 viscosity, 455*A*.
- Bismuth-zinc alloys**, electrolysis, 478*A*.
- Blacking**, foundry, 706*A*.
- Boiling points of—**
 Aluminium, 433*A*.
 Cadmium, 433*A*.
 Cobalt, 433*A*.
 Copper, 433*A*.
 Gold, 433*A*.
 Iron, 433*A*.
 Magnesium, 433*A*.
 Manganese, 433*A*.
 Nickel, 433*A*.
- Boron**, deoxidizers, 711*A*.
- Boron alloys**, analysis, 565*A*.
- Brass(es)** (see also *Muntz metal*, *Nickel-brass*, &c., and under names of constituent metals),
 acid dips, 640*A*.
 action of sea-water on ancient cannon, 489*A*.
Admiralty condenser tubes and ferrule stock, A.S.T.M. specifications, 661*A*.
 analysis, A.S.T.M. methods, 566*A*.; complete, 566*A*.; rapid, 566*A*.
 annealing, elect., 678*A*.
 attack of molten tin, 194.
 bars for forgings and drop-forgings, British specifications, 660*A*.; (high-speed screwing and turning), British specifications, 660*A*.
 castings, defects, 464*A*.
 cold-rolled, behaviour in tension and compression, 464*A*.
 cold-worked, internal stress, 464*A*.
- Brass(es)**,
 "composition," A.S.T.M. specifications, 661*A*.
 corrosion in calcium salts, 489*A*.; in distilled water, 489*A*.; in magnesium salts, 489*A*.; in sodium salts, 489*A*.; in water meters, 489*A*.
 cracking, 183, 193.
 defects, common, 464*A*.
 deposition, compositions of baths, 641*A*.
 deposits, "diseases," 641*A*.
 die-casting, 716*A*.
 effect of arsenic, 465*A*.
 effect of nickel. See *Nickel-brasses*.
 endurance of annealed and hard-drawn, 464*A*.
 exudations, 464*A*.
 fifteenth-century, examination, 71 (Note).
 finishes, black, 509*A*.
 foundry, health hazards, 751*A*.; temp. controls, 615*A*., 616*A*.
 high-tensile bars and sections, British specifications, 660*A*.
 hot-brittleness, 463*A*.
 liner, shrinking a cylinder on a, 662*A*.
 manufacture, 656*A*.
 mass to weight ratios, 532*A*.
 melting, electric, 291, 314, 720*A*., 722*A*.; in elect. induction furnace, 710*A*.
 Naval rods for structural purposes, A.S.T.M. specifications, 661*A*.
 oxidation, anomalous protection against, 381*A*.
 penetration by tin and solder, 183 (Paper).
 pipe for water services, long service, 662*A*.
 plant, management, 749*A*.
 pressing, 700*A*.
 protective oxide films, formation, 507*A*.
 red, used in railway work, 466*A*.
 rods, drawn, 464*A*.
 sections for forgings and drop-forgings, British specifications, 660*A*.
 sheet, A.S.T.M. specifications, 661*A*.; phys. properties, 600*A*.; testing, 600*A*.
 60 : 40, hardness, 463*A*.; heat-treatment, 463*A*.; microstructure, 463*A*.; transition point, 463*A*.
 special, British specifications for castings, 660*A*.; British specifica-

- Brass(es)**,
 tions for ingots for castings, 660*A*.
 temperature of melt, visual judgment, 710*A*.
 transformations which take place in homogeneous phases without crystallization changes, 483*A*.
 tubes, cracking, 183; for railway rolling stock, British specifications, 654*A*.; reaming, 699*A*.; welding, 683*A*.
 viscosity, 380*A*., 481*A*.
 waste, electrolytic treatment in hydrochloric acid soln., 637*A*.
 weight of stock for screw machine parts, 662*A*.
 wires, tenacity, 418*A*.
- Brazing**,
 book, 762*A*.
 solder, British standard specification, 679*A*.; penetration of mild steel by, 215.
- Brazing of—**
 Aluminium, 680*A*.
 Cast iron, 679*A*.
- Brinell hardness testing**. See *Testing*.
- Brinell hardness testing machines**.
 See *Testing machines*.
- British Non-Ferrous Metals Research Association**, work of, 747*A*.
- Brittleness**,
 cold-, 422*A*.
 hot-, 422*A*.
- Brittleness of—**
 Arsenical copper, 51 (*Paper*).
 Lead, intercrystalline, 389*A*.
 Nickel, 395*A*.
- Bronze(s)** (see also *Gun-metal*, &c., and under names of constituent metals),
 aluminium-. See *Aluminium-“bronzes,”* and *Aluminium-copper alloys*.
 ancient bits and check pieces, 660*A*.; from Transvaal, 462*A*.; restoration, 749*A*.
 bearing, A.S.T.M. methods of analysis, 565*A*.
 casting, 22, 712*A*.
 coinage, ancient Chinese, 461*A*.
 colouring, 660*A*.
 compositions, 660*A*.
 crystallization, 22.
 cylinder liners, prodn., 706*A*.
 deposition, electrolytic, 641*A*.
 die-casting, 716*A*.
 ductility, 461*A*.
 estimation of copper, electrolytic, 268.
- Bronze(s)**,
 exudations, 464*A*.
 forging, change in properties by, 461*A*.
 founding, 21, 713*A*.
 foundry, elect. furnace practice, 710*A*.
 gears, chill-cast, 714*A*.
 inverse segregation, 253.
 manganese-. See *Manganese-brass*.
 occlusion of gases, 436*A*.
 oxidation, anomalous protection against, 381*A*.
 phosphor. See *Phosphor-bronze*.
 physical properties, improvement, 713*A*.
 porosity, prevention, 713*A*.
 pressing, change in properties by, 461*A*.
 sand-castings, A.S.T.M. specifications for steam or valves, 659*A*.
 temperature of melt, visual judgment, 710*A*.
 “tin sweat,” 251.
 trolley wire, A.S.T.M. specifications, 659*A*.
 worm-gear blanks, centrifugal casting, 714*A*., 715*A*.
 zinc-, A.S.T.M. specifications for sand castings, 658*A*.
- Bronzing**, electrolytic, 641*A*.
- Bureau of Standards**,
 book review, 782*A*.
 chemistry in metallurgical division, 747*A*.
- Burettes**,
 micro-, rapid method for calibration, 589*A*.
 new type, 593*A*.
 pinchcocks, Mohr's modification, 589*A*.; regulating device, 589*A*.
 precision, 589*A*.
- Cables**, high-pressure, tests, 673*A*.
- Cadmium**,
 anodes, periodic phenomena, 630*A*.
 boiling point, 433*A*.
 coatings, protection of iron, 505*A*.
 deposition, 641*A*., 645*A*.; action of gelatine, 641*A*.
 detection, 570*A*.; in presence of copper, 569*A*.
 electrical resistance down to 1.3° abs., 387*A*.
 estimation, gravimetric, by means of cyanamide, 588*A*.; in zinc and in alloys, 578*A*.; new method, 578*A*.

Cadmium,

- latent heat of fusion, 432.A.
- molten, elect. resistance, 426.A.
- overvoltage in liquid ammonia and in water, 628.A.
- photoelectric cell, 653.A.
- production, 653.A.
- properties, 653.A.
- separation, new method, 578.A.
- single crystals, thermal conductivity, 418.A.; thermal e.m.f., 418.A.; thermal expansion, 415.A.; thermoelect. properties, 415.A.
- specific heat, 432.A.
- spectrum, effect of elect. field, 546.A.; fine structure, 534.A.; fluorescence, 535.A.; new lines, 546.A.; red line $\lambda 6438.7$, change of wave-length, 534.A.; resonance lines, 535.A.; under heavy current excitations, 553.A.
- sublimation pressure, 433.A.
- vapour pressure, adjusted, 415.A.
- Cadmium-aluminium alloys, 448.A.**
- Cadmium-aluminium-zinc alloys, mechanical properties, 448.A.**
- Cadmium amalgams, behaviour in relation to Weston normalelement, 633.A.**
- Cadmium-antimony alloys,**
 - electrical conductivity, 480.A.
 - electrolysis, 478.A.
 - magnetic analysis, 39.
 - thermal conductivity, 480.A.
- Cadmium-bismuth alloys,**
 - electrolysis, 478.A.
 - equilibrium relations, 455.A.
- Cadmium-lead alloys,**
 - electrolysis, 478.A.
 - eutectic, structure, 108.
- Cadmium-sulphur mixtures, chemical reactions in solid phase, 436.A.**
- Cadmium-tin alloys, eutectic structure, 108.**
- Cadmium-zinc alloys,**
 - constitution, 478.A.
 - electrolysis, 478.A.
 - eutectic, formation of twin deformations, 483.A.; structure, 108.
- Cæsium (see also *Alkali metals*),**
 - analysis, quantitative, 566.A.
 - displacement by iron, 376.A.
 - ions, secondary electron emission produced by, 376.A.
 - preparation of small quantities, 404.A.
 - spectrum, *ls-md* series, 535.A.; luminescence, 535.A.
 - vapour, photo-ionization and relative absorption probabilities, 535.A.
 - vapour pressures, 416.A.

Calcium,

- absorption of hydrogen, 408.A.
- action of oxygen-nitrogen mixtures, 434.A.
- atom, excited, average life, 526.A.
- detection, 571.A.
- estimation, 579.A.; by conversion of oxalate to carbonate, 578.A.; in aluminium alloys, 89; in lead alloys, 578.A.; volumetric, by pptn. as oxalate, 578.A.; volumetric, in mineral substances containing phosphoric acid, magnesium, iron, and aluminium, 579.A.
- lattice energy, 527.A.
- production, 671.A.
- properties, 671.A.
- separation (small quantities) from magnesium (large amounts), 573.A.
- spectrum, *H* and *K* lines in O-type stars, 536.A.; *K* X-ray absorption edge, 536.A.; spark doublets, 535.A.; stationary lines in O- and B-type stars, 536.A.
- uses, 671.A.
- Calcium-aluminium alloys, electrical resistance, 448.A., 449.A.**
- Calcium-silicide, crystal structure, 521.A.**
- Calcium-silicon-aluminium alloys,**
 - constitution, 448.A.
 - electrical conductivity, 84.
 - hardness, 81.
 - tensile properties, 81.
- Calorizing of metals, 506.A.**
- Carbon,**
 - atomic weight, 406.A.
 - spectrum, extreme ultra-violet, wave-length standards, 533.A.
- Carborundum. See *Refractory materials*.**
- Careco bearing alloy, 646.A.**
- Casting (see also *Moulds, &c.*),**
 - centrifugal. See *Centrifugal casting*.
 - die. See *Die-casting*.
 - gravity. See *Die-casting*.
 - permanent mould. See *Moulds, permanent*.
 - pressure. See *Die-casting*.
 - still-, 713.A.
- Casting of—**
 - Aluminium, 713.A.
 - Aluminium alloys, 712.A., 713.A.
 - Arsenical copper, 124.
 - Bronze, 22.
 - Copper - arsenic - oxygen alloys, 144.
 - Copper-bismuth alloys, 173.
 - Magnesium, 711.A.

- Casting of—**
Metals and alloys, 711*A.*
Nickel-brass, 662*A.*, 713*A.*
- Castings,**
contraction stress, 712*A.*
defective, analysis, 712*A.*
influence of wall-thickness of moulds, 707*A.*
testing, 601*A.*
- Catalysis,** theory and practice, book, 765*A.*
- Catalytic action,** 437*A.*, 438*A.*, 439*A.*
- Cathode dispersion problems,** 441*A.*, 442*A.*
- Cathode sputtering,** 407*A.*; explanation of phenomena, 441*A.*
- Cathodes.** See *Electrodes.*
- Celtium.** See *Hafnium.*
- Cement,** action on metals, 497*A.*
- Cementation of aluminium by copper,** 506*A.*
- Centrifugal casting,**
714*A.*, 715*A.*
development in Gt. Britain and Europe, 714*A.*
- Centrifugal casting of bronze worm-gear blanks,** 714*A.*, 715*A.*
- Centrifugals for handling corrosive materials,** 501*A.*
- Cerium,**
magnetic susceptibility, 416*A.*
production, 671*A.*
properties, 671*A.*
uses, 671*A.*
- Cerium-iron alloys,** preparation, 456*A.*
- Cerium metals,** electrolysis, 634*A.*
- Chemical constants,** book review, 781*A.*
- Chemical properties.** See under *Specific properties.*
- Chemical reactions in solid phase,** method of investigation, 436*A.*
- Chemical resisting materials,** 497*A.*, 498*A.*, 499*A.*, 500*A.*
- Chemical synonyms,** book review, 771*A.*
- Chemical trade names,** book review, 771*A.*
- Chemicals,** British, manufacturers, 757*A.*
- Chemistry,**
American, book, 761*A.*
applied, reports on progress, 765*A.*
colloid, book, 763*A.*
industrial, book, 758*A.*
inorganic, book reviews, 768*A.*, 773*A.*
theoretical, book review, 768*A.*
- Chicago University,** abstracts of theses, 767*A.*
- Chlorination of metals,** 435*A.*
- Chromium,**
anodic behaviour, in dil. sulphuric acid, 628*A.*
book review, 771*A.*
crystal structure of electrodeposits, 521*A.*
deposition, Colin Fink's patent, 672*A.*; from aqueous chromic acid solns., theory, 641*A.*, 642*A.*; on automobile parts, 672*A.*; on glass moulds, 643*A.*; patent muddle, 672*A.*; progress in Germany, 642*A.*; removal of dangerous fumes, 643*A.*
deposits, properties, 505*A.*
electrochemical behaviour, 631*A.*
estimation, volumetric, 579*A.*
ferro. See *Ferro-chromium.*
latent heat of fusion, 432*A.*
pure, prepn., 377*A.*
specific heat, 432*A.*
- Chromium alloys,**
chemical resistant, 653*A.*
use in chemical plant, 501*A.*
- Chromium-cobalt-tungsten alloys.** See *Stellite.*
- Chromium-iron alloys** (see also *Ferro-chrome*),
constitution, 471*A.*
manufacture, 653*A.*
uses, 653*A.*
- Chromium-iron-carbon alloys,** constitution, 456*A.*, 457*A.*, 470*A.*
- Chromium-nickel alloys,**
constitution, 471*A.*
manufacture, 653*A.*
solid solutions, lattice structure, 470*A.*
uses, 653*A.*
- Chromium-silicon alloys,**
manufacture, 653*A.*
uses, 653*A.*
- Clays.** See *Refractory materials.*
- Coal(s)** (see also *Fuels*),
analysis, 731*A.*
combustion, rate, 730*A.*
estimation of volatile matter, 731*A.*
pulverized, combustion, 732*A.*; for copper-refining, 732*A.*; in foundry, 732*A.*; test for fineness, 732*A.*
terms relating to, definitions, 731*A.*
X-ray studies, 731*A.*
- Coating of metals.** See *Deposition, Galvanizing, Sherardizing, Spraying of metals, Tinning, &c.*
- Cobalt,**
absorption of hydrogen and carbon dioxide, 396*A.*
allotropy, 377*A.*, 396*A.*

- Cobalt,**
 boiling point, 433*A.*
 book review, 778*A.*
 deposition, advantages, 643*A.*;
 compn. of baths, 643*A.*; at mer-
 cury dropping cathode, 625*A.*
 detection, spectroscopic, 569*A.*
 electrodeposition potentials, 627*A.*
 estimation, microchemical, use of
 pyrophosphates, 582*A.*; rapid, by
 spectroscopy and colorimetry,
 569*A.*; volumetric, 582*A.*
 Hall effect in evaporated films,
 378*A.*
 latent heat of fusion, 432*A.*
 magnetic permeability, effect of
 hydrostatic pressure, 378*A.*
 magnetic transformation, 429*A.*;
 heat, 396*A.*
 non-magnetic films, 378*A.*
 passivity, periodic, 631*A.*
 specific heat, 396*A.*, 432*A.*
 transformation, new, 458*A.*
Cobalt alloys (see also *Stellite*),
 book review, 778*A.*
Cobalt-aluminium alloys, sand-cast,
 449*A.*
Cobalt-chromium-tungsten alloys. See
Stellite.
Cobalt-iron alloys, constitution, 457*A.*,
 458*A.*
Cobalt-iron-nickel alloys, electrodeposi-
 tion potentials, 627*A.*
Cobalt-nickel alloys, constitution, 457*A.*,
 458*A.*
Cobalt-tungsten alloys, constitution,
 458*A.*
Coining, dies, 700*A.*
Coke (see also *Fuels*),
 metallurgical, combustibility and
 strength, 729*A.*; purchasing,
 730*A.*
 terms relating to, definitions, 731*A.*
 testing, 730*A.*
 X-ray studies, 731*A.*
Cold-working,
 effect on evaporation, 422*A.*
 theoretical considerations, 420*A.*,
 421*A.*
Colloidal metals. See under names of
 metals.
Colloidal particles, photophoresis in
 aqueous solns., 436*A.*
Colour of alloys, relation to structure,
 482*A.*
Colouring of—
 Bronze, 660*A.*
 Metals, 639*A.*, 672*A.*; book review,
 776*A.*
Columbium,
 analysis, 567*A.*
 behaviour in presence of carbon
 tetrachloride, 583*A.*
 estimation, 583*A.*
Combustion, surface, 731*A.*
Compounds,
 intermetallic. See *Intermetallic*
compounds.
 metallic, thermal expansion, 481*A.*
Compression testing. See *Testing.*
Compton effect, according to Schrö-
 dinger's theory, 550*A.*; attempt to
 affect magnetically, 500*A.*; bearing
 on diffraction of X-rays by crystals,
 549*A.*; disappearance of unmodified
 line in, 549*A.*; intensity of reflection
 of X-rays by crystals and, 520*A.*
Condenser tubes,
 A.S.T.M. specifications, 661*A.*
 corrosion, 496*A.*
 corrosion prevention, 508*A.*
Conduction, metallic, dual theory,
 425*A.*; kinetic theory, 426*A.*
Conductivity, thermal, new method of
 determination, 430*A.*
Conductivity of—
 Alloys, thermal, 430*A.*; thermal,
 relation to constitution, 480*A.*;
 thermal, relation to elect., 480*A.*
 Aluminium, elect., 372*A.*; elect.,
 effects of torsion, 371*A.*; thermal,
 effects of torsion, 371*A.*
 Aluminium alloys, elect., effect of
 atmospheric exposure, 486*A.*
 Aluminium-calcium-silicon alloys,
 elect., 84.
 Aluminium-silicon alloys, elect., 84.
 Antimony-bismuth alloys, elect.,
 480*A.*; thermal, 480*A.*
 Antimony-cadmium alloys, elect.,
 480*A.*; thermal, 480*A.*
 Arsenical copper, elect., 138.
 Bismuth single crystals, thermal,
 418*A.*
 Cadmium single crystals, thermal,
 418*A.*
 Clouds, elect., 426*A.*
 Copper, elect., effect of lead and tin
 with oxygen, 380*A.*
 Copper-arsenic-oxygen alloys, elect.,
 154.
 Copper-bismuth alloys, elect., 176.
 Copper-palladium alloys, elect., 480*A.*;
 thermal, 480*A.*
 Gold-silver alloys, elect., 480*A.*;
 thermal, 480*A.*
 Lead-bismuth alloys, elect., 480*A.*;
 thermal, 480*A.*

Conductivity of—

- Lithium, elect., 391A.; thermal, 391A.
- Metals, thermal, 430A.
- Molten alloys, elect., 479A.
- Oxide mixtures, elect., 426A.
- Platinum, elect., influence of absorbed gas, 399A.; elect., influence of pressure, 399A.
- Single crystals of non-cubic metals, thermal, 418A.
- Sodium, elect., 391A.; thermal, 391A.
- Tin, single crystals, thermal, 418A.
- Tin-zinc alloys, elect., 480A.; thermal, 480A.
- Tungsten, thermal, 410A.
- Zinc single crystals, thermal, 418A.
- Conductors, electric. See *Cables*.
- Constantan,
 - Hall effect, relation to temp., 480A.
 - ionization potentials of nitrogen and iron on, 437A.
- Constitutional diagrams. See *Equilibrium diagrams*.
- Constructal-2, properties, 445A.
- Constructal-8, properties, 445A.
- Contact, electrical, temperature of a, 615A.
- Contact alloys, 672A.
- Contact resistance, 428A.
- Copper,
 - acid dips, 640A.
 - action of acetylene, 683A.; of milk, 497A.
 - allotropy, 380A.
 - ancient bits and check pieces, 660A.
 - anisotropic, 380A.
 - annealing of wire, 678A.
 - annealing twins, 417A.
 - anodes, periodic phenomena, 630A.
 - arsenical, 121; brittleness, 51(*Paper*); casting, 124; density, 127; effect of oxygen, 144; elect. conductivity, 138; fatigue tests, 135; hardness, 134; impact tests, 135; macrostructure, 139; microstructure, 139; rolling, 125; solid solubility of arsenic, 140; temp. coeff. of elect. resistance, 139; tensile properties, 127.
 - atomic weight, 380A., 425A.
 - "best select," British specifications, 654A.
 - boiling point, 433A.
 - cable, A.S.T.M. specifications, 655A.
 - casting, 712A.
 - castings, exudations, 383A.

Copper,

- catalyst, dehydrogenation and isomeric change of allyl alcohol by, 383A.; heat absorption of carbon monoxide on, 384A.
- catalytic action, 384A., 385A.
- catalytically active, structure, 513A.
- cold-rolled and annealed, crystal structure, 517A.
- containing cuprous oxide, action of zinc, tin, aluminium, and magnesium, 380A.
- crystals (large), production, 379A.; orientation in dependence of degree of rolling, 379A.
- crystal structure, 522A.
- cuprous oxide in, 382A., 383A.
- deposition, 645A.; acidity control of bath, 643A.; heavy and rapid, 643A.; rapid, 643A.
- detection, 569A.
- effect of arsenic, 121 (*Paper*); arsenic + oxygen, 144; (*Paper*); bismuth, 169 (*Paper*).
- effect on condensed milk, 657A.
- electrical conductivity, effect of lead and tin with oxygen, 380A.; relation of annealing temp., 382A.
- electrical resistance at very high frequencies, 383A.; effect of lead and tin with oxygen, 380A.; from 20° to 900° C., 380A.
- electrolytic, influence of cuprous oxide, 382A., 383A.; wire bars, cakes, slabs, billets, ingots and ingot bars, A.S.T.M. specifications, 656A.
- embrittlement by hot reducing gases, 383A.; annealing to prevent, 383A.
- endurance, 464A.
- estimation by means of orthohydroxyquinoline, 580A.; by means of permanganate, 580A.; in bronze, electrolytic, 268; new methods, 580A.; oxidimetric, by means of bismuth amalgams, 564A.; quantitative, 580A.; titrimetric, with potassium iodide, 580A.
- estimation of bismuth, 577A.
- etching reagent, 69 (*Note*).
- expansion, thermal, between + 101° C. and - 253° C., 379A.
- fireboxes, welding, 683A.
- for electrical purposes, 656A.
- grain-size, relation to degree of deformation, 420A.
- Hall effect, relation to temp., 480A.
- hardening, 461A.

Copper,

hardness, 380*A*.
heated, action of reducing gases, 383*A*.
high conductivity, corrosion products, 487*A*.
ingots, inhomogeneity of zones of crystallization, 382*A*.
ionization potentials of nitrogen and iron on, 437*A*.
lake wire bars, cakes, slabs, billets, ingots and ingot bars, A.S.T.M. specifications, 656*A*.
latent heat of fusion, 432*A*.
low-temperature behaviour, 380*A*.
lubrication, 381*A*.
manufacture, 656*A*.; profits, 749*A*.
mattes, removal of iron, 749*A*.
mechanical properties at high temps., 382*A*.
microstructure, 513*A*.; change by rolling and annealing, 382*A*.
occlusion of gases, 436*A*.
optical constants, 429*A*.
overvoltage, hydrogen, 628*A*.; in liquid ammonia and in water, 628*A*.
oxidation, anomalous protection against, 381*A*.
phosphor-, A.S.T.M. specifications, 658*A*.; comparison with tough pitch copper, 382*A*.
pipes for railway rolling stock, British specifications, 654*A*.; for water services, long service, 662*A*.
plates for railway rolling stock, British specifications, 654*A*.
powdered, use in analysis, 562*A*.
protective oxide films, formation, 507*A*.
reaction with selenium tetrachloride, 381*A*.
recrystallization, 517*A*.; in hard-drawn wire, 521*A*.
reduced, catalytic action, 384*A*.; 385*A*.
refined, estimation of oxygen, 583*A*.; estimation of sulphur, 583*A*.; influence of cuprous oxide, 383*A*.
refining, electrolytic, 636*A*.; 637*A*.
rods for railway rolling stock, British specifications, 654*A*.
rolls, engraved, 657*A*.
scrap, recovery, 748*A*.
separation by means of ortho-hydroxyquinoline, 580*A*.; in presence of cadmium, electrolytic, 573*A*.
sheets, electrolytically deposited, properties, 382*A*.

Copper,

silicon-, A.S.T.M. specifications, 658*A*.
softening of cold-rolled strip, effect of arsenic, 159; effect of arsenic + oxygen, 159.
sols, preparation, 436*A*.
solubility in mercury, 470*A*.
solution in aqueous solns. of ferric chloride, 381*A*.
specific heat, 432*A*.
spectrum, arc, 536*A*.; arc, Zeeman effect and, 536*A*.; explosion, 550*A*.; quartet and doublet terms, 536*A*.
sublimation pressure, 433*A*.
sulphur vapour coatings, 381*A*.
surface colours, variation with temp., 710*A*.
temperature of melt, visual judgment, 710*A*.
tough, cakes and billets for rolling, British specifications, 654*A*.
tough pitch, comparison with phosphorized copper, 382*A*.
trolley wire, A.S.T.M. specifications, 655*A*.
tubes (arsenical), brittleness, 51; for railway rolling stock, British specifications, 654*A*.; welding, 683*A*.
vapour pressure, 433*A*.
viscosity, 380*A*.; 481*A*.
welding, 682*A*.; 683*A*.; autogenous, 683*A*.; oxy-acetylene, 682*A*.; 683*A*.
wetting of oils, heat of, 381*A*.
wire, A.S.T.M. specifications, 654*A*.; 655*A*.; effect of process annealing temp. on final annealing temp., 379*A*.; relation of annealing temp. to conductivity, 382*A*.
X-ray absorption, 381*A*.
X-ray refraction, 443*A*.
Copper alloys (see also *Aluminium-bronze*, *Babbitt metal*, *Bearing alloys*, *Brass*, *Bronze*, *Duralumin*, *Gun-metal*, *Muntz metal*, &c.)
action of acetylene, 683*A*.; of milk, 497*A*.
annealing twins, 417*A*.
crystal structure, 522*A*.
mechanical properties, influence of shrinkage, 459*A*.
oxidation, anomalous protection against, 381*A*.
surface colours, variation with temp., 710*A*.
temperature of melt, visual judgment, 710*A*.

- Copper alloys—
viscosity, 380*A.*, 481*A.*
which do not soften at high temperatures, 459*A.*
- Copper-aluminium alloys (see also *Aluminium*-“*bronze*”),
acid-resisting, 657*A.*
action of magnesium sulphate solns., 488*A.*; of potassium chloride solns., 488*A.*; of sodium chloride solns., 488*A.*
equilibrium relations, 449*A.*
segregation, 483*A.*
solid solutions, thermoelect. properties, 481*A.*
viscosity at high temps., 481*A.*
- Copper-aluminium-silicon alloys, mechanical properties as sand-cast and heat-treated, 449*A.*
- Copper amalgams, constitution, 469*A.*
- Copper-arsenic alloys,
casting, 124.
density, 127.
electrical conductivity, 138.
fatigue, 135.
hardness, 134.
impact tests, 135.
macrostructure, 139.
microstructure, 139.
rolling, 125.
solid solubility of arsenic, 140.
tensile tests, 127.
- Copper-arsenic-oxygen alloys,
casting, 144.
density, 147.
electrical conductivity, 155.
fatigue, 151.
hardness, 151.
impact tests, 154.
macrostructure, 154.
microstructure, 154.
rolling, 145.
tensile properties, 147.
- Copper-beryllium alloys,
constitution, 459*A.*, 460*A.*
corrosion tests, 460*A.*
mechanical properties, 459*A.*
- Copper-bismuth alloys,
casting, 173.
constitution, 172.
density, 175.
electrical conductivity, 176.
electrical resistivity, 176.
fatigue tests, 177.
hardness, 175.
impact tests, 177.
macrostructure, 177.
microstructure, 172.
- Copper-bismuth alloys,
rolling, 174.
tensile properties, 175.
- Copper-gold alloys, effect of lead, 466*A.*
- Copper-magnesium alloys,
hardness, 94.
mechanical properties, 93.
microstructure, 96.
tensile properties, 95.
- Copper-manganese alloys,
properties, 469*A.*
segregation, 483*A.*
solid solutions, thermoelect. properties, 481*A.*
uses, 469*A.*
- Copper - manganese - aluminium alloys (see also *Heusler's alloys*),
crystal structure, 522*A.*
properties, 469*A.*
uses, 469*A.*
- Copper-manganese-tin alloys,
properties, 469*A.*
uses, 469*A.*
- Copper-manganese-zinc alloys,
constitution, 465*A.*
properties, 479*A.*
uses, 469*A.*
- Copper-nickel alloys,
colour, 460*A.*
deposition, electrolytic, 643*A.*
electrical resistance, 460*A.*
melting, electric, 293.
properties, 472*A.*
solid solutions, thermoelect. properties, 481*A.*
- Copper-nickel-aluminium alloys, Hall effect, relation to temp., 480*A.*
- Copper-nickel-zinc alloys. See *Nickel-brass*.
- Copper-palladium alloys,
electrical conductivity, 480*A.*
thermal conductivity, 480*A.*
- Copper-silicon alloys, properties, 460*A.*, 461*A.*
- Copper-silver alloys,
eutectic, structure, 103.
solid solutions, disintegration, 483*A.*
- Copper-tin alloys (see also *Bronze*),
equilibrium diagram, 188.
eutectic, 188, 235.
magnetic analysis, 46.
microstructure, 189.
solid solutions, thermoelect. properties, 481*A.*
viscosity, 455*A.*
- Copper-tin-antimony alloys, constitution, 477*A.*

- Copper-tin-zinc alloys**,
 constitution, 465*A*.
 properties, 465*A*.
- Copper-zinc alloys** (see also *Brass*, &c.),
 α solid solution, diffusion of zinc,
 462*A*.
 constitution, 462*A*.
 electrode potential, 463*A*.
 hardness, 463*A*.
 magnetic analysis, 45.
 solid solutions, thermoelect. prop-
 erties, 481*A*.
- Core oils**, specifications, 706*A*.
- Cores**,
 binders, standard sand for use in
 testing, 706*A*.
 dry-sand, effects of moisture absorp-
 tion, 705*A*.
 made with cereal binders, detg. pro-
 perties, 706*A*.
 making with elect. heat, 705*A*.
 supports in large castings, 706*A*.
- Correspondence**, principle of, 555*A*.
- Corrosion** (see also *Deposition*, *Gal-
 vanizing*, *Paints*, *Spraying of
 metals*, *Tinning*, &c.),
 accelerated tests, report of A.S.T.M.
 Cttee., 493*A*.
 book review, 783*A*.
 by sea-water, 498*A*.
 electrolytic studies, 494*A*.
 electrolytic theory, 494*A*.
 ferroxyl indicator, 493*A*.
 fundamental principles, 495*A*.
 intensive, porosity and, 494*A*.
 liquid line, 496*A*.
 prevention, 507*A*., 508*A*., 509*A*.
 (see also *Deposition*, *Galvanizing*,
Paints, *Tinning*, &c.).
 rapid, within capillaries, 493*A*.
 research at Chemisch-Technische
 Reichsanstalt, Berlin, 493*A*.; in
 England, 493*A*.
- Corrosion fatigue**, stress-strain-cycle
 relationship and, 423*A*.
- Corrosion Fund**, accounts, 12.
- Corrosion of—**
 Aluminium, by acids, 487*A*.; by
 conc. sodium chloride solns., 487*A*.;
 by hydrochloric acid, effect of
 thermal treatment, 487*A*.; by
 neutral salt solutions, 487*A*.
 Aluminium alloys, atmospheric, 486*A*.
 Brass in calcium salts, 489*A*.;
 in distilled water, 489*A*.; in mag-
 nesium salts, 489*A*.; in sodium
 salts, 489*A*.; in water-meters,
 489*A*.
 Condenser tubes, 496*A*.
- Corrosion of—**
 Cream separators, 497*A*.
 Galvanized iron plates, 502*A*.
 Gasolene plant, 497*A*.
 Iron, 495*A*.; effect of temp. on
 liberation of hydrogen by, 492*A*.
 Lead cable sheaths, 490*A*.
 Locomotive boilers, 496*A*.
 Nickel alloy singe rolls, 490*A*.
 Non-ferrous metals and alloys, report
 of A.S.T.M. Cttee., 493*A*.
 Oil refinery apparatus, 496*A*.
 Petroleum refining plant, 501*A*.
 Pulp and paper industry machinery,
 496*A*.
 Pumps, 498*A*.
 Tinplate containers, 491*A*., 492*A*.
 Zinc, atmospheric, 493*A*.; effect of
 temp. on liberation of hydrogen by,
 492*A*.; in alkaline solns., 493*A*.
- Corrosion resistant materials**, 497*A*.,
 498*A*., 499*A*., 500*A*., 501*A*.
- Cottrell process**, development, 756*A*.
- Council**,
 Report, 1.
 vote of thanks to, 13.
- Cracking of brass**, 183, 193.
- Creep**,
 failure of metals by, 423*A*.
 pamphlet, 766*A*.
- Crucibles**,
 graphite, clays for, 737*A*.
 tungsten powder, 737*A*.
- Crystal aggregates**, plastic deformation,
 421*A*.
- Crystal growth** (see also *Recrystalliza-
 tion*, &c.), 417*A*.
- Crystal growth in electrolytic deposits**,
 638*A*.
- Crystal habit**, factors influencing, 519*A*.
- Crystal lattice** (see also *Crystal structure*),
 orientation of crystal in, 521*A*.
 reciprocal, and X-ray diffraction
 patterns, 520*A*.
 relation between atomic number and
 properties of ions in, 531*A*.
- Crystallization**, periodic, 347.
- Crystallography**, geometrical, addition
 and subtraction rule in, 520*A*.
- Crystal structure** (see also *Crystal lattice*),
 analysis, Bragg method, 516*A*.; use
 of X-rays, 516*A*.; X-ray, and its
 relation with chem. constitution,
 516*A*.
 connection with chemical valency and
 electron grouping, 520*A*.
- Crystal structure of—**
 Ag₃Hg₄, 523*A*.
 Alloys, 516*A*.

Crystal structure of—

- Aluminium (cold-rolled), 517*A*.
- Calcium silicide, 521*A*.
- Chromium electrodeposits, 521*A*.
- Copper, 522*A*.; (annealed cold-rolled), 517*A*.
- Copper alloys, 522*A*.
- Duralumin, 521*A*.
- Gallium, 522*A*.
- Gold, 522*A*.
- Hard-drawn wires, 517*A*.
- Heusler's alloys, 522*A*.
- Magnesium dizincide, 523*A*.
- Magnesium plumbide, 522*A*.
- Manganese-aluminium-copper alloys, 522*A*.
- Molybdenum-carbon system, 524*A*.
- Osmium, 523*A*.
- Permalloy, 523*A*.
- Ruthenium, 523*A*.
- Silver, 522*A*.
- Thallium, 523*A*.
- Tungsten-carbon system, 524*A*.

Crystals,

- angles, measurement with microscope, 520*A*.
- annealing twins, formation, 417*A*.
- concave forms in, 512*A*.
- deformed, meaning of Laue diagram, 519*A*.
- growth, 512*A*.; in supersaturated liquids, 331 (*May Lecture*); theory of mechanism, 519*A*.
- inner diffusion in, temp. at commencement of, 419*A*.
- metallic, growth, 518*A*.
- optical anomalies, 519*A*.
- orientation, determination by production of slip-bands, 511*A*.; in metal pieces, relation to elastic properties, 419*A*.
- plastic deformation, 421*A*.
- single. See *Single crystals*.
- small inclusions in, detection by production of slip-bands, 511*A*.
- solution, 512*A*.; 518*A*.
- symmetry, mathematical study, 519*A*.

X-ray reflection, intensity, 520*A*.Cupellation, losses, effect of air, 564*A*.Cupolas, air-blast conveyance, 710*A*.

Cutting,

- blowpipes, improvement, 693*A*.; Weber cast-iron, 694*A*.
- equipment at British Industries Fair, 692*A*.
- machines, oxygen, 702*A*.
- oils, manuf., 702*A*.

Cutting,

- pressure in milling, 701*A*.
- temperatures, measurement, 701*A*.
- velocity in milling, 701*A*.

Cyanide sores, treatment, 640*A*.Deformation. See *Plastic deformation*.

Density of—

- Arsenical copper, 127.
- Beryllium, 375*A*.
- Copper-arsenic-oxygen alloys, 147.
- Copper-bismuth alloys, 175.
- Platinum (native), 398*A*.
- Silver, 406*A*.
- Tungsten, effect of working, 410*A*.

Dental alloys, oligodynamic action, 440*A*.Deposition (see also *Galvanizing*, *Sherardizing*, *Spraying*, *Tinning*, &c.),

- acidity of solutions, 639*A*.
- addition agents, effect of various conditions, 639*A*.
- book review, 776*A*.
- cleaning systems, 640*A*.
- conductivity of solutions, 638*A*.
- correcting "unsatisfactory" electrolytes, 639*A*.
- dipping baskets, Monel metal, 641*A*.
- mechanical, 638*A*.
- plating generator, 640*A*.
- recent advances, 637*A*.; 638*A*.
- regulating the solution, 639*A*.
- spotting-out troubles, 640*A*.
- teaching principles, 637*A*.
- treating cyanide sores, 640*A*.
- value of research, 637*A*.

Deposition of—

- Brass, compositions of baths, 641*A*.
- Bronze, electrolytic, 641*A*.
- Cadmium, 641*A*.; 645*A*.; electrolytic, action of gelatine, 641*A*.
- Chromium, Colin Fink's patent, 672*A*.; patent muddle, 642*A*.; progress in Germany, 642*A*.; removal of dangerous fumes, 643*A*.; from aqueous chromic acid solns., theory, 641*A*.; 642*A*.; on automobile parts, 643*A*.; on glass moulds, 643*A*.

Cobalt, advantages, 643*A*.; compn. of baths, 643*A*.Copper, 645*A*.; acidity control of bath, 643*A*.; heavy and rapid, 643*A*.; rapid, 643*A*.Copper-nickel alloys, electrolytic, 643*A*.

Deposition of—

Metals on aluminium and light alloys, elect., 641*A*.

Nickel, acid control of baths, 644*A*.; building plating tank, 644*A*.; commercial, 644*A*.; compn. and properties of solutions, 644*A*.; discussion, 644*A*.; H-ion control of baths with quinhydrone electrode, 644*A*.; on aluminium, 644*A*.

Tin, electrolytic, 645*A*.

Zinc from electrolytes containing gelatine and aluminium sulphate, 645*A*.; from sulphate solns., electrolytic, 645*A*.; on positive pole of simple voltaic cell, 645*A*.

Detinning, 637*A*., 667*A*.

Detroit electric furnaces, 320, 725*A*.

Dezincification. See *Corrosion*.

Didymium, spectrum, ultra-red absorption, 537*A*.

Die-casting,
machines, 716*A*.
processes, 716*A*.

Die-casting of—
Aluminium, 716*A*.
Brass, 716*A*.
Bronze, 716*A*.

Dielectric constant of Selenium (red crystalline), 405*A*.

Diffusion of solids, 434*A*.

Dilatation. See *Expansion*.

Dilatometers, 591*A*., 592*A*.

Dilatometric analysis,
applications, 485*A*.
principles, 485*A*.

Dipping, bright, 640*A*.

Disintegration of elements, artificial, 525*A*.

Drawing properties of metals, measurement, 699*A*.

Drop-forging, 700*A*.

Duralumin (see also under names of constituent metals),

action of magnesium sulphate solns., 488*A*.; of potassium chloride solns., 488*A*.; of sodium chloride solns., 488*A*.

age-hardening, 449*A*.

airship coverings, 652*A*.

aircraft propellers, manuf., 651*A*.

connecting rods, machining, 651*A*.

corrosion, 447*A*.

crystal structure, 521*A*.

deposits on, electrolytic, 641*A*.

endurance, 464*A*.

heat-treatment, 447*A*., 449*A*.

mechanical properties, 450*A*.

production, 447*A*.

Duralumin,

properties, 449*A*.

Sheet, effect of heat-treatment on mechanical properties, 450*A*.; hardness, 605*A*.

uses, 450*A*.

welding, 682*A*.

Dwi-manganese, discovery, 385*A*., 386*A*.

Dyehouse machinery, materials for, 499*A*.

Dynamometers, precision, temp. compensation, 599*A*.

École Centrale des Arts et Manufactures (Paris), new laboratories, 756*A*.

Education, technical, book reviews, 782*A*.

Egypt, ancient metallurgy, book review, 769*A*.

Eka-manganese, discovery, 385*A*., 386*A*.

Elastic limit, dynamic, 604*A*.

Elasticity,

application of diffraction halos to, 601*A*.

book, 763*A*.

Election of—

Auditor, 17.

Members, 14, 329.

Officers, 13.

Student Members, 14, 329.

Electric currents, measurement by electronic emission from heated wires, 599*A*.

Electric furnaces. See *Furnaces*.

Electric welding. See *Welding*.

Electrical conductivity. See *Conductivity*.

Electrical conductors, improving, 673*A*.

Electrical overhead transmission lines, 672*A*.

Electrical resistance (see also *Conductivity, electric*),

measurement, methods, 611*A*.

Electrical resistance materials, 672*A*.

Electrical resistance of—

Aluminium in molten state, 426*A*.

Aluminium-calcium alloys, 448*A*., 449*A*.

Antimony in molten state, 426*A*.

Arsenical copper, temp. coeff., 139.

Bismuth in molten state, 426*A*.

Cadmium down to 1.3° abs., 387*A*.; in molten state, 426*A*.

Copper, effect of lead and tin with oxygen, 380*A*.; from 20° to 900°C., 380*A*.; wires at very high frequencies, 383*A*.

- Electrical resistance of—**
Copper-bismuth alloys, 176.
Copper-nickel alloys, 460A.
Gold down to 1.3° abs., 387A.
Indium at low temps., 427A.
Iron down to 1.3° abs., 387A.
Lead in molten state, 426A.
Mercury, 426A.
Metallic materials for electric heating,
A.S.T.M. method of test, 611A.
Metals, effect of absorbed gas film,
427A.; relation between change
at fusion and crystal lattice,
427A.; theoretical considerations
of valency and, 427A.
Molten metals and alloys, 480A.
Nickel down to 1.3° abs., 387A.
Nickel steels, dependence upon
compn., temp., and heat-treatment,
474A., 475A.
Platinum down to 1.3° abs., 387A.
Pure metals in molten state, 426A.
Silver down to 1.3° abs., 387A.; in
molten state, 426A.
Tin in molten state, 426A.
Tungsten, 410A.; effect of working,
410A.
Zinc down to 1.3° abs., 387A.; in
molten state, 426A.
Electricity, comparison with gas for
indust. heating, 728A.
Electro-capillarity, theory, 624A.
Electrochemistry,
future trends, 621A.
industrial, 25 years' progress, 621A.;
review for year 1926, 621A.
theoretical, 25 years' progress, 621A.
Electro-deposition. See *Deposition*.
Electrode potential, electrokinetic be-
haviour and, 631A.
Electrode potential of—
Aluminium, in aqueous solns., 373A.;
theoretical, 373A.
Copper-zinc alloys, 463A.
Thallium, 409A.
Electrodes (see also *Anodes*),
Miguet, 721A.
Electrolysis, alternating current, ar-
rangement for, 622A.; new method
of measurement in, 622A.
Electrolytic analysis. See *Analysis*.
Electrolytic deposition. See *Deposi-
tion*.
Electrolytic refining. See *Refining*.
Electromotive behaviour of Aluminium,
373A.
Electromotive power, mechanism of de-
velopment, relation of hydration and
adsorption, 624A.
Electron(s) (see also *Atoms*),
book, 758A., 759A.
emission from cold metals, 442A.
heat capacity, 428A.
Lorenz, moving arbitrarily along a
straight line, 528A.
spinning, in hydrogen-like spectra,
528A.
structure, 527A.
sub-, existence, 527A., 528A.
variable mass, 527A.
Electro-plating. See *Deposition*.
Elektron (see also *Magnesium alloys*),
manufacture, 468A.
protective oxide layer, 490A.
Element No. 61, discovery, 416A.,
417A.
Elements,
artificial disintegration, 525A.
periodic classification, 443A., 444A.
Elinvar, hairsprings, manuf. and prop-
erties, 115.
Elkonite copper-tungsten electrodes,
691A.
Embossing dies, 701A.
Enamelling,
furnaces, comparison of gas- and coal-
fired, 507A.
industry in South (U.S.A.), 507A.
Endurance. See *Fatigue of metals*.
Endurance limit, 423A.
Endurance of—
Brass, 464A.
Copper, 464A.
Duralumin, 464A.
Entropy, change on melting, 432A.
**Eppléy standard cells at high tempera-
tures**, 633A.
Equilibrium diagrams, general prop-
erties, 485A.
Estimation. See *Analysis*.
Etching figures, nature, 512A.
Etching of metals, 748A.
Etching reagents, potassium ferri-
cyanide, durability, 514A.
Etching reagents for—
Copper, 69 (*Note*).
Germanium, 386A.
Europium, spectrum, arc, new lines,
537A.
Eutectics,
lowering of freezing point in binary
systems, 483A.
structure, application of strain
methods to investigation, 103
(*Note*).
win deformations, formation,
483A.
Everdur, properties, 497A.

- Expansion,**
coefficient, and free space, 433*A*.
thermal, Röntgenographic determination, 610*A*.
- Expansion of—**
Alloys, thermal, 481*A*.
Aluminium-iron alloys on solidification, 451*A*.
Antimony-silver alloys, 481*A*.
Copper, thermal, between + 101° C. and - 253° C., 379*A*.
Invar, 472*A*.
Metals, thermal, book review, 778*A*.; thermal coeff., influence of working, 433*A*.
Tungsten, thermal, 610*A*.
- Extensometers for threads and wires,** 609*A*.
Martens type, modified, 479*A*.
mechanical autographic, 609*A*.
new type, 609*A*.
- Failure of metals by creep,** 423*A*.
Fallacies, popular, book review, 780*A*.
Fatigue (see also *Endurance*), corrosion-. See *Corrosion fatigue*.
- Fatigue of—**
Arsenical copper, 135.
Copper-arsenic-oxygen alloys, 151.
Copper-bismuth alloys, 177.
Metals, effect of grooves, threads, and corrosion, 424*A*.; general survey, 422*A*.; mechanism, 423*A*.; 424*A*.; present knowledge, 424*A*.
Fatigue testing. See *Testing*.
- Ferro alloys,**
analysis, A.S.T.M. methods, 566*A*.
sampling, 566*A*.
- Ferro-chromium,**
A.S.T.M. specifications, 653*A*.
estimation of aluminium, 577*A*.
industry, history, 635*A*.
- Ferromagnetic metals,** magnetic transformation, 429*A*.
- Ferro-magnetism of nickel and quantum state of its atoms,** 396*A*.
- Ferro-manganese,**
A.S.T.M. specifications, 663*A*.
anodic behaviour, 469*A*.
history, 392*A*.
properties, 392*A*.
- Ferro-molybdenum,**
manufacture, 395*A*.
working, 395*A*.
- Ferro-tungsten,** estimation of tungsten by calculation on the Archimedean principle, 587*A*.
- Ferro-vanadium,** A.S.T.M. specifications, 668*A*.
- Filaments,** manufacture, 699*A*.
- Films,** very thin, electrolytic deposition, 638*A*.
- Fireboxes.** See *Locomotives*.
- Fireclay bricks.** See *Refractory materials*.
- Flame spectra.** See *Spectra*.
- Flaws,** methods of observation in metal surfaces, 611*A*.
- Flowmeters,** new types, 593*A*.; 594*A*.
- Fluxes,** use, 710*A*.
- Foils,** metal, preparation, 676*A*.
- Forming,** dies, 700*A*.
- Foundry,**
American practice, 703*A*.
apprentices, upgrading, 716*A*.
book, 765*A*.
British industry, present state, 703*A*.
education in, 746*A*.
exhibition in Düsseldorf, 703*A*.
handling of materials, 705*A*.
lay-out, 704*A*.
planning for economical production, 703*A*.
practice, non-ferrous, 703*A*.
trestle for supporting moulds, &c., 705*A*.
- Fracture,** continuous, reduction of risk of, 603*A*.
- France,**
Ecole Centrale des Arts et Manufactures (Paris), 756*A*.
industrial effort, book review, 780*A*.
- Friction,** elastic range, 601*A*.
- Fuels** (see also *Coal, Coke, Gas, Oil fuel, &c.*).
economy, 728*A*.
European developments, 717*A*.
selection, factors affecting, 728*A*.; for heat-treatment, 728*A*.
solid, ignition, 730*A*.
- Furnaces,**
Ajax-Northrup, electric, 292, 310.
Ajax-Wyatt, 288, 300, 313, 315, 316, 319; performances, 291, 306.
Baily, 320.
crucible, utilizing waste heat from, 718*A*.
Detroit, 320, 725*A*.
electric, Ajax-Northrup, 292, 310; Ajax-Wyatt, 288, 300, 306, 313, 315, 316, 319; automatic control, 724*A*.; 725*A*.; auxiliary equipment, 725*A*.; Baily, 320; design of transformers, 721*A*.; Detroit, 320, 725*A*.; electrode regulation, 725*A*.; erected or being erected

Furnaces,

in Great Britain, 299; for brass melting, 720*A.*; for melting, working, and power consumption, 721*A.*; for melting metals with high thermal conductivity, 721*A.*; for refining Monel metal, 722*A.*; for silicon-manganese, 722*A.*; H.-F. induction, 725*A.*, 726*A.*, 727*A.*; heat-treating, 296, 301, 302, 305, 722*A.*, 723*A.*, 724*A.*; Kay tilting, 721*A.*; latest designs, 720*A.*; melting in U.S.A., 314; Miguët, 721*A.*; non-ferrous, 287 (*Paper*); 100,000 amp., 721*A.*, 722*A.*; "pinch effect," 308; power factor, 724*A.*; refractories, 736*A.*; resistor tubes, 724*A.*; Russ induction, 306; Tammann, 721*A.*; use at Niagara Falls from 1902 to 1926, 720*A.*; use for alloy melting, 721*A.*; vector diagram for, 724*A.*; Watson, 304; when advisable, 717*A.*

electric annealing, advantages, 678*A.*; of Western Electric Co., 677*A.*

electric arc, theory, 725*A.*

electric resistance, 725*A.*

electric vacuum, improved, 590*A.*

European developments, 717*A.*

flame stream in, isotherms, 730*A.*

forced-draught, conveyance of air-blast, 710*A.*

gas-fired, 710*A.*; burner selection, 719*A.*; for heat-treating, 729*A.*; for melting, 719*A.*

heat-treating, 717*A.*

high-frequency electric, 287.

Kay tilting electric, 721*A.*

Krupp radiant-heat, 717*A.*, 718*A.*

laboratory, 590*A.*

lead-bath, elect. heated, 677*A.*

Miguët electric, 721*A.*

Muffle, heating phenomena in, 718*A.*

oil-fired annealing, 677*A.*; crucible, 719*A.*; improved burners, 720*A.*

radiant-heat, Krupp, 717*A.*, 718*A.*

roofs, interlocking tiles, 719*A.*; suspended, 719*A.*

Russ, 306.

salt-bath, elect. heated, 677*A.*

Tammann electric, 721*A.*

temperatures, pyrometers for measurement, 618*A.*

volume, relation to combustion of fuels, 717*A.*

Watson, 304.

Fusible alloys, transformation phenomena, 455*A.*

Gallium,

crystal structure, 522*A.*

separation from aluminium and iron, 574*A.*

vapour, resonance potentials, 537*A.*

Galvanized coatings, microstructure, 513*A.*

Galvanized iron or steel telephone and telegraph line wire, A.S.T.M. specifications, 670*A.*

Galvanized iron or steel tie wires, A.S.T.M. specifications, 670*A.*

Galvanized iron plates,

fire, corrosion tests, 502*A.*

spray-, corrosion tests, 502*A.*

Galvanized sheets,

blisters, cause of, 502*A.*

branding of quality, 670*A.*

fire tests, 670*A.*

hot-dipped, A.S.T.M. specifications, 669*A.*

Galvanized sheet steel, bend tests, 502*A.*

Galvanizing,

coatings, A.S.T.M. specifications, 502*A.*; Preece test, 503*A.*

modern practice, 502*A.*

workers, occupational syndrome among, 753*A.*, 754*A.*

Galvanizing of iron and steel wire, 502*A.*

Galvanometers,

magnetic screening of, 597*A.*, 598*A.*

moving-magnet, 597*A.*

vibration, 597*A.*

Gamma-rays. See *Rays*.

Gas(es) (see also *Fuels*),

comparison with electricity for industrial heating, 728*A.*

flow, apparatus for measurement, 594*A.*

occlusion, 436*A.*

pocket tester, 732*A.*

temperature, measurement, 619*A.*

Gas-fired furnaces. See *Furnaces*.

Gates, 706*A.*

Genelite, 646*A.*

Germanium,

book review, 768*A.*

contact-voltage sensitivity, 386*A.*

etching reagents, 386*A.*

melting point, 386*A.*

occurrence in Bolivia, 749*A.*

preparation, 386*A.*

purification, modified vacuum apparatus for, 592*A.*

volatility in hydrogen and *in vacuo*, 386*A.*

- Germanium-aluminium alloys,
ageing phenomena, 451*A*.
constitution, 451*A*.
- German silver. See *Nickel-brass*.
- Germany,
aluminium production, 749*A*.
material standards, 671*A*.
- Glass to metal joints, 597*A*.
- Glucinium. See *Beryllium*.
- Gold,
anisotropic, 380*A*.
anodic behaviour in dil. sulphuric acid, 628*A*.
anodic oxidation, 387*A*.
boiling point, 433*A*.
catalytic decomposition of hydrogen iodide, 387*A*.
colloidal, analysis, 388*A*.; constitution, 388*A*.; in silicic acid gel, rhythmic diurnal bands, 389*A*.
crystal structure, 522*A*.
dispersoid synthesis, 388*A*.
effect of lead, 466*A*.
electrical resistance down to 1.3° C., 387*A*.
estimation, potentiometric, 580*A*.
Hall effect, relation to temp., 480*A*.
latent heat of fusion, 432*A*.
native, hardness, 386*A*.; origin, 386*A*.
optical constants, 429*A*.
overvoltage, hydrogen, 628*A*.
photoelectric emission, 428*A*.
precipitation by proteins, 388*A*.
protection by proteins, 388*A*.
separation from silver, Batch process, 635*A*.; from silver, conductivity of electrolytes, 636*A*.
sols, coagulation, effect of temp. on velocity, 388*A*.; differently coloured, 388*A*.; preparation from dilute alk. gold chloride solns., growth of small gold particles, 388*A*.
specific heat, 432*A*.
spectral emissivity as function of gold, 408*A*.
spectrum, coincidence of some lines of thallium, 537*A*.; *K*-series emission, 547*A*.; *L*-series, precision measurements, 547*A*.
transmutation, book review, 774*A*.; of mercury into, 439*A*., 440*A*.
vapour pressure, 433*A*.
- Gold amalgams, constitution, 469*A*.
- Gold-copper alloys, effect of lead, 466*A*.
- Gold-silver alloys,
action of nitric acid, 495*A*.
electrical conductivity, 480*A*.
- Gold-silver alloys,
equilibrium relations in liquid and solid state, 466*A*.
thermal conductivity, 480*A*.
- Gold-zinc alloys, compound AuZn, atomic structure, 531*A*.
- Goniometer, X-ray, Weissenberg, 595*A*.
- Grain-growth (see also *Crystal growth*, *Recrystallization*, &c.),
relation of surface to volume in crystals as determining factor, 519*A*.
- Grain-size, relation to degree of deformation, 420*A*.
- Granulation of slags and metals, 748*A*.
- Graphite. See *Refractory materials*.
- Gravimetric analysis. See *Analysis*.
- Gravity casting. See *Die-casting*.
- Gun-metal (see also under names of constituent metals),
heat-treatment, 678*A*.
physical properties, improvement, 713*A*.
porosity, prevention, 713*A*.
- Hafnium,
book review, 768*A*., 772*A*.
books, 762*A*., 765*A*.
modification changes, 415*A*.
separation from zirconium, 573*A*.
spectrum, arc, 573*A*.
thermionic emission, 413*A*.
- Hairspring strip, testing, 119.
- Hairsprings,
manufacture, 111.
properties, 111.
- Hall effect,
new experiment on, 430*A*.
relation to allied effects, 429*A*.
retardation in magnetic field, 430*A*.
- Hall effect in—
Antimony with weak fields, 374*A*.
Bismuth sputtered films, 376*A*.
Cobalt evaporated films, 378*A*.
Constantan, relation to temp., 480*A*.
Copper, relation to temp., 480*A*.
Copper-nickel-aluminium alloys, relation to temp., 480*A*.
Gold, relation to temp., 480*A*.
Iron evaporated films, 378*A*.
Manganin, relation to temp., 480*A*.
Nickel evaporated films, 378*A*.
Palladium evaporated films, 378*A*.
Phosphor-bronze, relation to temp., 480*A*.
Platinum evaporated films, 378*A*.

- Handling of materials, 705*A*.
 Hardening
 by cold deformation, 420*A*.
 by dispersed constituents precipitated from solid solutions, 479*A*.
 crystal lattice and, 420*A*.
 strain-, 420*A*., 421*A*.
 theory, 420*A*.
 Hardness, Hertzian, apparatus to measure, 606*A*.
 Hardness testing. See *Testing*.
 Hardness testing machines. See *Testing machines*.
 Hardness tests. See *Testing*.
 Hardness of—
 Aluminium sheet, 605*A*.
 Aluminium-calcium-silicon alloys, 81.
 Aluminium-silicon alloys, 82.
 Arsenical copper, 134.
 Beryllium, 375*A*.
 Brass (60 : 40), 463*A*.
 Copper, 380*A*.
 Copper-arsenic-oxygen alloys, 151.
 Copper-bismuth alloys, 175.
 Copper-zinc alloys, 463*A*.
 Duralumin sheet, 605*A*.
 Gold (native), 386*A*.
 Lautal, 450*A*.
 Magnesium-copper alloys, 94.
 Platinum (native), 398*A*.
 Heating,
 comparison of gas and electricity, 728*A*.
 industrial, possibilities, 756*A*.
 theory, 727*A*.
 Heat-treating furnaces. See *Furnaces*.
 Heat-treatment (see also *Annealing*, &c.),
 gas fuel, 729*A*.
 selection of fuel, 728*A*.
 furnaces. See *Furnaces*.
 Heat-treatment of—
 Aluminium alloys, 678*A*.
 "Aluminium-bronzes," 678*A*.
 Aluminium-copper-nickel-magnesium (piston) alloy, 677*A*.
 Brass (60 : 40), 463*A*.
 Gun-metal, 678*A*.
 "Y" alloy, 677*A*.
 Helium, spectrum, time intervals between appearance of certain lines, 541*A*.
 Heusler's alloys, crystal structure, 522*A*.
 Heterogeneous systems, equilibrium, 624*A*.
 High vacua, book review, 774*A*.
 Hon. Treasurer's Report, 9.
 Hot-galvanizing. See *Galvanizing*.
 House Fund, accounts, 11.
 Hydrochloric acid,
 action on metals and alloys, 498*A*.
 transference numbers in glycerol-water mixtures, 633*A*.
 Hydrogen, spectrum, continuous, 537*A*.
 Hydrogen-ion concentration, determination, 622*A*., 623*A*.
 Hypernik, cores for current transformers, 665*A*.
 Illinium, discovery, 389*A*.
 Illumination of specimens. See *Metallography*.
 Impact testing. See *Testing*.
 Incandescent Heat Co., Ltd., heat-treating furnaces, 717*A*.
 Indium,
 electrical resistance at low temps., 427*A*.
 vapour, resonance potentials, 537*A*.
 Inner structure of metals, practical significance, 511*A*.
 Inorganic substances, properties, book, 765*A*.
 Intercrystalline penetration of metals, 183, 193, 218, 224.
 Interfaces, equilibrium at, 624*A*.
 Intermetallic compounds, preparation by wet method, 484*A*.
 Internal stress. See *Season-cracking*, &c.
 Internal stress in Brass, 464*A*.
 Invar (see also *Nickel alloys*),
 abnormal expansion, 472*A*.
 hairsprings, manuf. and properties, 115.
 microstructure, 472*A*.
 use for precision balances, 591*A*.
 Inverse segregation,
 avoidance, 266.
 contraction theory, 248, 284.
 theory, 262.
 Inverse segregation in—
 Alloys, 241 (*Paper*).
 Bronze, 253.
 Iridium,
 detection, 584*A*.
 estimation in small quantities, 584*A*.
 separation from platinum and rhodium, 584*A*.
 spectrum, *K*-series emission, 547*A*.; *L*-series, precision measurements, 547*A*.; *M*-series X-ray, 542*A*.
 Iridosmine, preparation of platinum metals from, 402*A*.

Iron,

- anodic behaviour in dil. sulphuric acid, 628*A*.
 - boiling point, 433*A*.
 - castings, segregation, 483*A*.
 - corrosion, 495*A*.; effect of temp. on liberation of hydrogen by, 492*A*.
 - electrical resistance down to 1.3° abs., 387*A*.
 - electrodeposition potentials, 627*A*.
 - ferric, estimation in small quantities, 583*A*.
 - Hall effect in evaporated films, 378*A*.
 - ionization potentials of nitrogen and hydrogen on, 437*A*.
 - latent heat of fusion, 432*A*.
 - magnetic permeability, effect of hydrostatic pressure, 378*A*.
 - magnetic transformation, 429*A*.
 - mould gases, 748*A*.
 - non-magnetic films, 378*A*.
 - occlusion of gases, 436*A*.
 - overvoltage in liquid ammonia and in water, 628*A*.
 - passivity, periodic, 631*A*.
 - photoelectric emission, 428*A*.
 - pyrophoric, absorption of hydrogen and carbon dioxide, 396*A*.
 - single crystals, longitudinal magneto-resistance, 419*A*.; tenacity, 418*A*.
 - sols, preparation, 436*A*.
 - specific heat, 432*A*.
 - spectrum, explosion, 550*A*.
- Iron-aluminium alloys,**
- solidification, 451*A*.
 - temper colours, 473*A*.
- Iron-carbon alloys,** temper colours, 473*A*.
- Iron-carbon-nickel alloys,** lattice constant, relation to density, 474*A*.
- Iron-cerium alloys,** preparation, 456*A*.
- Iron-chromium alloys** (see also *Ferrochromium*),
- constitution, 471*A*.
 - manufacture, 653*A*.
 - uses, 653*A*.
- Iron-chromium-carbon alloys,** constitution, 456*A*.; 457*A*.
- Iron-chromium-nickel alloys,** constitution, 470*A*.
- Iron-cobalt alloys,** constitution, 457*A*.; 458*A*.
- Iron-cobalt-nickel alloys,** electrodeposition potentials, 627*A*.
- Iron group,** magneton numbers, spectroscopic explanation, 547*A*.
- Iron-manganese alloys,**
- mechanical properties, 469*A*.
 - physical properties, 469*A*.

Iron-molybdenum alloys, constitution, 470*A*.

Iron-nickel alloys (see also *Invar*, *Mumetal*, *Permalloy*, &c.),

constitution, 471*A*.

lattice constant, relation to density, 474*A*.

magnetization, 473*A*.

solid solutions, lattice structure, 470*A*.

specific heat, 473*A*.

temper colours, 473*A*.

Iron-nickel meteorites, structure, 474*A*.

Iron-tin alloys, constitution, 477*A*.

Iron-tungsten alloys, constitution, 477*A*.

Iron-vanadium alloys, temper colours, 473*A*.

Isotopes,

atomic configuration, 524*A*.

mass spectra and, 524*A*.

non-radioactive, 524*A*.

origins, 524*A*.

proportions in different isotopic elements, 524*A*.

radioactive, 524*A*.

relation between atomic wt., life period, and manner of transformation, 524*A*.

separation, 524*A*.

Isotopes of—

Lead, atomic wt., 390*A*.; studies on, 390*A*.

Uranium, 413*A*.

Jolly balance, automatic calculating device, 591*A*.

Joule effect, explained by Bohr's theory, 428*A*.

Kaolin. See *Refractory materials*.

Kay tilting electric furnace, 721*A*.

Knudsen effect, 430*A*.

Krupp radiant-heat furnaces, 717*A*.; 718*A*.

"K.S.-Seewasser," properties, 445*A*.; 487*A*.; 648*A*.

Kunheim metal, preparation, 635*A*.

Laboratory apparatus—

Ammeters, 599*A*.

Anemometers, hot wire, 594*A*.

Balances, British chemical and physical, 591*A*.; precision, use of Invar for, 591*A*.

Laboratory apparatus—

Bomb calorimeters, Krupp V2A steel as platinum substitute, 589A.

Burettes, modification of Mohr's pinchcock, 589A.; new type, 593A.; precision, 589A.; regulating device for pinchcocks, 589A.

Condensers, list, 596A.; variable air, list, 596A.

Contact breaker, adjustable, 599A.

Dilatometers, 591A., 592A.

Dynamometers, precision, temp. compensation, 599A.

Electrometer, Compton, 598A.

Filtering crucibles, porcelain, quartz, and glass, 561A.

Flowmeters, new types, 593A., 594A.

Furnaces, improved electric vacuum, 590A.; laboratory load, 590A.

Galvanometers, magnetic screening of, 597A.; moving-magnet, 597A.; vibration, 597A.

Goniometer, Weissenberg X-ray, 595A.

Heating apparatus, simple, 590A.

Inductance standards, list, 599A.

Jolly balance, automatic calculating device, 591A.

Micro-balance, Kuhlmann, 561A.

Micro-burettes, rapid method for calibration, 589A.

Micrometer, measuring, 596A.

Microscopes. See *Microscopes*.

Optical multiplier, 596A.

Polariscope for determining feeble polarization, 597A.

Potentiometers, British made, 598A.; improvements, 598A.; portable, 598A.; Tinsey-Gall, applications, 598A.

Pyrometers. See *Pyrometers*.

Quartz mercury lamp, experience, 595A.

Record measuring machine, 595A.

Rubber moulded articles, 591A.

Shearer X-ray tube, modification, 595A.

Spectrograph, vacuum, 594A.

Spectrometer, ultra-red, 594A.; X-ray, with which wave-lengths are read directly on an ordinary micrometer screw, 594A.

Sputtering apparatus, new, 595A.

Stop-watch, new, 596A.

Testing machines. See *Testing machines*.

Thermo-converter, reliable, 597A.

Thermometers. See *Thermometers*.

Laboratory apparatus—

Thermo-regulators, mercury, interruptor for use with, 590A.; toluene - mercury, automatic, 590A.

Thermostat, gas-controlled, prevention of flickering in flames of, 590A.

Voltmeters, permanent magnet, 599A.; triode, 598A.

Wash-bottles, non-spattering, continuous-stream, 589A.

Wheatstone bridge, control key, 598A.

X-ray tube, new, 595A.

Lanthanum, magnetic susceptibility, 416A. spectrum, terms, 537A.

Latent heat of fusion, theory, 432A.

Latent heat of fusion of—Aluminium, 431A., 432A.

Antimony, 431A., 432A.

Bismuth, 431A., 432A.

Cadmium, 432A.

Chromium, 432A.

Cobalt, 432A.

Copper, 432A.

Gold, 432A.

Iron, 432A.

Lead, 431A., 432A.

Magnesium, 431A.

Manganese, 432A.

Nickel, 432A.

Palladium, 432A.

Platinum, 432A.

Selenium, 405A.

Silver, 432A.

Thallium, 432A.

Tin, 431A., 432A.

Zinc, 431A., 432A.

Lattice structure. See *Crystal lattice and Crystal structure*.

Lautal,

hardness, 450A.

mechanical properties, 450A.

physical properties, 450A.

Lead,

absorption coeff. for atmospheric penetrating radiation, 390A.

accumulator, theory, 633A.

action of cement, 497A.

annual production in U.S.A., 662A.

anodes, periodic phenomena, 630A.

anodic behaviour in dil. sulphuric acid, 628A.

atomic structure, 531A.

atomic weight, 390A., 425A.

book reviews, 768A., 778A.

Lead,

- brittleness, intercrystalline, 389*A*.
 - cables, intercrystalline brittleness, 389*A*.
 - casting a 35-ton keel, 713*A*.
 - corrosion of cable sheaths, 490*A*.
 - deposits, electrochem. and X-ray studies, 644*A*.
 - estimation, 581*A*.; by oxidation with persulphates, 581*A*.; in solder by calculation on the Archimedean principle, 587*A*.
 - future, 662*A*.
 - isotopes, atomic wt., 390*A*.; band spectra, 538*A*.; studies on, 390*A*.
 - latent heat of fusion, 431*A*, 432*A*.
 - molecular weight, variation with temp., 390*A*.
 - molten, elect. resistance, 426*A*.
 - overvoltage in liquid ammonia and in water, 628*A*.
 - parting plant of U.S.S. Lead Refinery, Inc., 637*A*.
 - pipes, causes of rupture, 663*A*.
 - poisoning, 751*A*, 752*A*.
 - radioactivity, effects of sunlight, 403*A*.
 - removal of antimony by dry method, 750*A*.
 - Roman, from Folkestone and Richboro Castle, silver contents, 73 (*Note*).
 - self-diffusion, 434*A*.
 - sols, preparation, 436*A*.
 - specific heat, 432*A*.
 - spectrum, arc, 538*A*.; explosion, reversal of lines, 538*A*.; in magnetic field, 545*A*.; *K*-series emission, 547*A*.; *L*-series, precision measurements, 547*A*.
 - storage battery, 634*A*.
 - transmutation into mercury, 440*A*.
 - waste from pipes, use for solders, 663*A*.
 - welding, autogenous, 684*A*.
 - world's production, 662*A*.
 - Zeeman effect, 545*A*.
- Lead alloys** (see also *Babbitt metals*, *Bearing metals*, *Solders*, &c.),
- anti-friction, influence of pouring temp., and mould temp., 466*A*.
 - book review, 778*A*.
 - estimation of calcium, 578*A*.; of lithium, 578*A*.; of sodium, 578*A*.
 - hardening, 467*A*.
- "Lead anæmia," 752*A*.
- Lead-antimony alloys,**
- equilibrium relations, 455*A*.
 - magnetic analysis, 37.

Lead-antimony alloys,

- microscopic examination, preparation of specimens, 514*A*.
 - solidus line, 467*A*.
- Lead-antimony-arsenic alloys,** constitution, 467*A*.
- Lead-bismuth alloys,**
- electrical conductivity, 480*A*.
 - magnetic analysis, 36.
 - thermal conductivity, 480*A*.
- Lead-cadmium alloys,**
- electrolysis, 478*A*.
 - eutectic, structure, 108.
- Lead-lithium alloys,** constitution, 467*A*.
- Lead-tellurium alloys,** magnetic analysis, 43.
- Lead-thorium alloys,** Ludwig - Soret effect, 484*A*.
- Lead-tin alloys** (see also *Solders*), eutectic, crystallization, 106 (*Note*); structure, 106, 108.
- Ludwig-Soret effect, 484*A*.
 - magnetic analysis, 37.
- Lead-zinc alloys,** electrolysis, 478*A*.
- Lead-zinc-antimony alloys,** constitution, 467*A*.
- Line spectra.** See *Spectra*.
- Liquation** (see also *Inverse segregation*), theories, 243.
- Liquids,**
- flow, measurement of quick changes, 594*A*.
 - velocity of outflow, measurement, 594*A*.
- Lithium** (see also *Alkali metals*),
- electrical conductivity, 391*A*.
 - estimation in lead alloys, 578*A*.
 - reaction with nitrogen, 391*A*.
 - specific heat, 391*A*.
 - spectrum, spark, 538*A*.
 - thermal conductivity, 391*A*.
- Lithium - lead alloys,** constitution, 467*A*.
- Local Sections,** programmes, 1926-1927, 5.
- Locomotives,**
- bearings, casting with calcium-lead alloys, 713*A*.
 - boilers, corrosion, 496*A*.
 - driving box facing, casting in place of, 675*A*.
 - driving boxes, types and repair, 675*A*.
 - firebox stay-bolts, 675*A*.
 - fireboxes, welding, 683*A*.
- Lubrication of—**
- Fine mechanisms, 596*A*.
 - Metals, 381*A*.
- Ludwig-Soret effect,** 243, 484*A*.

Magnesite. See *Refractory materials.*

Magnesium,

action of liquid ammonia solns. of salts of alkali and alk. earth metals on, 441*A.*; oxygen-nitrogen mixtures, 434*A.*

anodes, periodic phenomena, 630*A.*

boiling point, 433*A.*

casting, 711*A.*

castings, properties, 468*A.*

fluxes, 711*A.*

foundries, 711*A.*

latent heat of fusion, 431*A.*

melting, 711*A.*; elect., 722*A.*

moulds for, 711*A.*

pistons, compared with aluminium and Silumin pistons, 453*A.*

production, 671*A.*; electrolytic, 635*A.*

properties, 671*A.*

scrap, remelting, 711*A.*

separation from alkali metals, 574*A.*

soils, preparation, 436*A.*

sublimation pressure, 433*A.*

survey, 391*A.*

uses, 671*A.*

Magnesium alloys (see also *Elektron*, &c.),

casting, 468*A.*

constitution, 468*A.*

future developments, 671*A.*

mechanical properties, 663*A.*

survey, 391*A.*

use in aircraft, 663*A.*

Magnesium-aluminium alloys, constitution, 452*A.*

Magnesium-aluminium-zinc alloys, mechanical properties, 663*A.*

Magnesium-copper alloys,

hardness, 94.

mechanical properties, 93.

microstructure, 96.

tensile properties, 95.

Magnesium dizincide, crystal structure, 523*A.*

Magnesium plumbide, crystal structure, 522*A.*

Magnesium-silver alloys,

476*A.*

compound AgMg , atomic structure, 531*A.*

Magnesium - zinc alloys, compound MgZn_2 , influence on ageing capacity of aluminium alloys, 452*A.*

Magnetic analysis as a means of studying structure of non-magnetic alloys, 29 (*Papcr*).

Magnetic permeability of—

Cobalt, effect of hydrostatic pressure, 378*A.*

Iron, effect of hydrostatic pressure, 378*A.*

Nickel, effect of hydrostatic pressure, 378*A.*

Magnetic properties of—

Atoms, 429*A.*

Nickel, 396*A.*, 397*A.*

Magnetic reluctivity relationship, 756*A.*

Magnetic susceptibility, apparatus for measurement, 30.

Magnetic susceptibility of—

Cerium, 416*A.*

Lanthanum, 416*A.*

Praseodymium, 416*A.*

Yttrium, 416*A.*

Magnetism, book review, 775*A.*

Manganese,

boiling point, 433*A.*

deposition at mercury dropping cathode, 625*A.*

estimation, bismuthate method, 582*A.*; in rich alloys, 581*A.*; microchemical, use of pyrophosphates, 582*A.*

Manganese,

ferro- (see *Ferro-manganese*),

history, 392*A.*

latent heat of fusion, 432*A.*

melting point, 392*A.*

occurrence, 392*A.*, 663*A.*

optical constants, 429*A.*

properties, 392*A.*

pure, prepn., 391*A.*

separation from zinc by Na_2S , 574*A.*

transformation heat, 432*A.*

transformations, 392*A.*

uses, 663*A.*

Manganese-aluminium alloys,

equilibrium relations, 452*A.*

properties, 469*A.*

uses, 469*A.*

Manganese-brass,

ingots for sand-castings, A.S.T.M. specifications, 661*A.*

sand-castings, A.S.T.M. specifications, 662*A.*

Manganese-"bronze." See *Manganese-brass.*

Manganese-copper alloys,

properties, 469*A.*

segregation, 483*A.*

solid solutions, thermoelect. properties, 481*A.*

uses, 469*A.*

- Manganese-copper-aluminium alloys**,
 crystal structure, 522*A*.
 properties, 469*A*.
 uses, 469*A*.
- Manganese-copper-tin alloys**,
 properties, 469*A*.
 uses, 469*A*.
- Manganese-copper-zinc alloys**,
 constitution, 465*A*.
 properties, 469*A*.
 uses, 469*A*.
- Manganese-iron alloys** (see also *Ferro-manganese*),
 mechanical properties, 469*A*.
 physical properties, 469*A*.
- Manganese-silver alloys**,
 properties, 469*A*.
 uses, 469*A*.
- Manganin**,
 Hall effect, relation to temp., 480*A*.
 specific resistance and temp. coeffs., 460*A*.
- Mass to weight ratios**, 532*A*.
- Masurium**, 385*A*.
- Materials of construction**, book review, 776*A*.
- Mathiessen's law**, extension, 428*A*.
- May Lecture**, 329, 331.
- Mechanical properties**. See under specific properties.
- Melting**, electric, 287, 299.
- Melting furnaces**. See *Furnaces*.
- Melting of—**
 alloys, accumulation of admixtures, 711*A*.
 Aluminium, electric, 304, 722*A*.
 Brass, electric, 314, 722*A*.
 Magnesium, 711*A*.; elect., 722*A*.
 Metals, 710*A*.
 Nickel-brass, 713*A*.
 Type metal, elect., 722*A*.
 White metal, elect., 722*A*.
- Melting point of—**
 Aluminium, effect of cold-work, 422*A*.
 Beryllium, 375*A*.
 Germanium, 386*A*.
 Manganese, 392*A*.
 Metals, effect of cold-work, 422*A*.
 Platinum, 399*A*.
 Potassium, 407*A*.
 Sodium, 407*A*.
 Tantalum, 408*A*.
- Melting pot**, electric, 710*A*.
- Members**,
 deaths, 2.
 election, 14, 329.
 obituary notices, 351.
- Membership curve**, 2.
- Mercury**,
 adsorption of ions, 394*A*.
 anodes, periodic phenomena, 630*A*.
 arc rectifiers, 664*A*.
 atoms, excitation potentials, 540*A*.; magnetic moment, 393*A*.
 contact switches, 664*A*.
 critical potentials, significance in terms of metastable atoms and radiation, 394*A*.
 detection, 570*A*.
 distillation, apparatus, 593*A*.; in vacuum, simple apparatus, 592*A*.
 dropping electrode, adsorption of ions, 394*A*.; researches with, 625*A*.; 626*A*.; 629*A*.
 electrical resistance, 426*A*.
 electro-capillarity, influence of colloidal solns., 626*A*.
 estimation, colorimetric, 582*A*.; in minute quantities, 582*A*.; in minute quantities, colorimetric, 582*A*.; new methods, 580*A*.
 gas compressor, 663*A*.
 gold-free, prepn., 392*A*.
 normal cathode fall of potential, effect of alkali or alkali earth metals, 393*A*.
 overvoltage, cathodic, 629*A*.; hydrogen, 628*A*.; in liquid ammonia and in water, 628*A*.
 photoelectric properties, 392*A*.
 poisoning, 752*A*.; 753*A*.
 solid, metallography, 513*A*.
 solubility of copper, 470*A*.
 solubility of metals of iron group, 470*A*.
 specific gravity, 392*A*.
 spectrum, anomalous Zeeman effect of line 5791 and its satellite — 0·124, 541*A*.; band fluorescence, 539*A*.; bands at λ 2536 and λ 2540, 539*A*.; continuous, 539*A*.; effect of helium on intensity, 541*A*.; explosion, 539*A*.; 550*A*.; fluorescence, 539*A*.; intensity and width of lines, 541*A*.; luminescence, 540*A*.; *L*-series, precision measurements, 547*A*.; magnetic separation of line 5770 into nonet of special type, 541*A*.; new line, 546*A*.; new terms, 547*A*.; spark, in extreme red, 538*A*.; spark, in extreme ultra-violet, 539*A*.; time intervals between appearance of certain lines, 541*A*.; variations of intensity of lines of a triplet, 541*A*.
 surface tension, 392*A*.

- Mercury**,
 titration, potentiometric, alone and in presence of other metals, 582*A.*;
 with potassium cyanide, 582*A.*
 transmutation into gold, 439*A.*, 440*A.*
 transmutation of lead into, 440*A.*
 vapour, absorption coeff. for slow electrons, 540*A.*; adsorption by activated wood charcoal, 394*A.*; danger, 752*A.*, 753*A.*; duration of phosphorescence, 393*A.*; electrically excited, anomalous dispersion by, 394*A.*; formation of negative ions, 394*A.*; ionization potential, 394*A.*; mechanism of reactions photosensitized by, 393*A.*; photoelect. ionization, 540*A.*; resonance potential, 394*A.*; selective dispersion at $\lambda 2536$ absorption line, 541*A.*
 vapour lamp of high intensity, electrolysis of dichromic acid under, 394*A.*
 X-ray diffraction, 523*A.*
Mercury alloys. See *Amalgams.*
Mesothorium 2,
 disintegration, 409*A.*
 half-period, 409*A.*
Metal spraying. See *Spraying.*
Metallization. See *Spraying.*
Metallography (see also *Photomicrography*),
 book reviews, 777*A.*, 778*A.*
 books, 758*A.*, 761*A.*
 high-power, 512*A.*
 polishing machine, 515*A.*
 progress, 510*A.*
 report of A.S.T.M. Cttee., 510*A.*
 specimens, selection and preparation, 510*A.*
 term, definition, 511*A.*
 terms relating to, standard definitions, 511*A.*
 ultra-violet, 512*A.*
 X-ray, glossary of terms, 511*A.*; report of A.S.T.M. Cttee., 510*A.*
Metallurgical literature, use, in research, 747*A.*
Metallurgist in industry, 745*A.*
Metallurgy,
 application to engineering, 746*A.*
 as profession, 745*A.*
 book reviews, 769*A.*, 770*A.*, 773*A.*, 778*A.*, 779*A.*, 783*A.*, 784*A.*
 books, 757*A.*, 760*A.*, 765*A.*
 developments during last 50 years, 745*A.*
 teaching, value of problems, 746*A.*
 theoretical, practical deductions from, 746*A.*
Meyer's analysis, 380*A.*
Microphotography. See *Photomicrography.*
Microscopes,
 illuminators, 515*A.*
 metallurgical, care of eyes when using, 515*A.*
 objectives, list of British and foreign, 515*A.*
 tube length, 515*A.*
Miguet electric furnace, 721*A.*
Miguet electrode, 721*A.*
Milk, action on metals and alloys, 497*A.*
Milling, cutting velocity and cutting pressure, 701*A.*
Mixtures, theory, and the logarithmic mixture rule, 484*A.*
Molecular rays, deflection in magnetic field, 533*A.*
Molecular structure, 532*A.*
 magnetism and, 532*A.*
Molecular weight of—
 Lead, variation with temp., 390*A.*
 Tin, variation with temp., 410*A.*
Molecules,
 diatomic, theory of spectra, 556*A.*
 mechanics, undulatory theory, 530*A.*
 monatomic, of rare gases, 533*A.*
 rotation, 533*A.*
Molten metals and alloys,
 attack on certain non-ferrous metals and alloys, 193 (*Paper*).
 equilibria between salts and, 434*A.*
 surface tension, 392*A.*
Molybdenum,
 bibliography, 395*A.*
 book review, 779*A.*
 chemical properties, 394*A.*
 detection, 570*A.*
 estimation in small quantities, 587*A.*
 incandescent, deviation from Lambert's law, 412*A.*; polarization of light emitted, 412*A.*
 metallurgy, 394*A.*
 occurrence, 394*A.*
 oxides, prepn. of chemically pure, 413*A.*
 photoelectric emission, 428*A.*
 physical properties, 394*A.*
 position in normal potential series, 632*A.*
 salts, prepn. of chemically pure, 413*A.*
 secondary electron emission, 395*A.*
 single crystal wires, tenacity, 418*A.*
 thermionic emission, 413*A.*
 uses, 394*A.*

- Molybdenum**,
 working, 395*A*.
 X-ray scattering, 395*A*.
Molybdenum-carbon system, crystal structure, 524*A*.
Molybdenum-iron alloys, constitution, 470*A*.
Molybdenum-steels,
 manufacture, 395*A*.
 working, 395*A*.
Molybdenum-tungsten alloys,
 solid solutions, resistance limits, 477*A*.
Monel metal (see also *Nickel alloys*),
 action of vanilla extracts, 665*A*.
 filter cloths for lubricating oils, 673*A*.
 refining furnaces, electric, 722*A*.
 rings, manuf., 701*A*.
 springs, 665*A*.
 tensile properties at elevated temps., 479*A*.
 uses, 673*A*.
Montegal, properties, 445*A*.
Moulding,
 dry-sand, of small work, 707*A*.
 green-sand, of small work, 707*A*.
 loam, methods, 706*A*.
 losses, reduction, 707*A*.
Moulding machines, working, 706*A*.
Moulding sands,
 cohesion, 709*A*.
 cutting machines, 708*A*.
 for aluminium foundries, 708*A*.
 gas permeability, measurement, 709*A*.; relation of grain-size and grain-form, 709*A*.
 grading, 707*A*., 708*A*.
 grain-size, connection of chem. compn., 707*A*.
 heat transference, 709*A*.
 laboratory investigation, present status, 708*A*.
 mixers, mechanical, 708*A*.
 physical properties, effect of mulling, 709*A*.
 preparation, 708*A*.
 requirements, 708*A*.
 sieve tests, 707*A*.
 tests, 708*A*., 709*A*.; standard, 709*A*.
Moulds,
 long-life, 715*A*.
 metal, water-cooled, 707*A*.
 permanent, 715*A*.
 preparation, 706*A*., 707*A*.
 wall thickness, influence on casting, 707*A*.
Muffles, heating phenomena in, 718*A*.
Mumetal, magnetic shield for sensitive galvanometers, 597*A*., 598*A*.
Muntz metal (see also *Brasses*, and under names of constituent metals),
 condenser tube plates, A.S.T.M. specifications, 661*A*.
Museum exhibits, cleaning and restoration, book, 760*A*.
National Physical Laboratory, collected researches, 764*A*.
National Research Council (U.S.A.), list of publications, 756*A*.
Naval brass. See *Brass*.
Neumann bands, 512*A*.
Nickel,
 absorption of hydrogen and carbon dioxide, 396*A*.
 anodes, effect of impurities, 625*A*.; wear, 625*A*.
 anodic behaviour in dil. sulphuric acid, 628*A*.
 boilers, destruction by heating gas, 490*A*.
 boiling point, 433*A*.
 book review, 778*A*.
 brittleness, 395*A*.
 carbide, 397*A*.
 catalytic action, 397*A*., 398*A*.
 chemically pure, uses, 664*A*.
 coinage, book, 758*A*.
 crucibles, prolonging life for sodium peroxide fusions, 562*A*.
 deoxidation, 395*A*.
 deposition, acid control of baths, 644*A*.; at mercury dropping cathode, 625*A*.; building plating tank, 644*A*.; commercial, 644*A*.; compn. and properties of solutions, 644*A*.; discussion, 644*A*.; H-ion control of baths with quinhydrone electrode, 644*A*.; on aluminium, 644*A*.
 deposits, durable, 644*A*.; protective value, 490*A*.
 effect on brasses. See *Nickel-brasses*.
 electrical resistance down to $1 \cdot 3^\circ$ abs., 387*A*.
 electrodeposition potentials, 627*A*.
 estimation, acidimetric, by means of nickel dicyanodiamidine, 583*A*.; in minute quantities, colorimetric, 583*A*.; in presence of iron, electrolytic, two causes of error, 583*A*.; volumetric, 583*A*.
 ferro-magnetism, and quantum state of its atoms, 396*A*.

Nickel,

- finishes, black, 509A.
 - Hall effect in evaporated films, 378A.
 - industry, 664A.
 - ionization potentials of nitrogen and iron on, 437A.
 - latent heat of fusion, 432A.
 - magnetic analysis, 33.
 - magnetic permeability, effect of hydrostatic pressure, 378A.
 - magnetic properties of single crystals, 397A.
 - magnetic spectrum of wires, 397A.
 - magnetic transformation, 429A.; heat, 396A.
 - magnetization, 396A.; discontinuities, 397A.; sp. heat and, 397A.
 - magneto-thermal phenomena, 396A.
 - manifolds, influence on acidity, H-ion concn. and colour of wort, 665A.
 - mattes, removal of iron, 749A.
 - membranes, prepn. for ultra-filtration, 665A.
 - non-magnetic films, 378A.
 - optical constants, 429A.
 - overvoltage, hydrogen, 628A.; in liquid ammonia and in water, 628A.
 - passivity, periodic, 631A.
 - photoelectric emission, 428A.
 - production, 750A.
 - rings, manuf., 701A.
 - separation from chromium, electrolytic, 574A.
 - single crystals, magnetic properties, 397A.
 - sols, preparation, 436A.
 - specific heat, 396A., 432A.
 - spectral emissivity as function of temp., 408A.
 - spectrum, absorption, 542A.; arc., 542A.
 - uses, 664A.; in heat-treating high-speed wire drills, 665A.
- Nickel alloys** (see also *Constantan*, *Monel metal*, *Nickel-brass*, *Permalloy*, &c.),
- acid-resisting, 498A.
 - book review, 778A.
 - corrosion of single rolls, 490A.

Nickel-brass,

- casting, 662A., 713A.
- composition, 662A.
- cracking, in course of annealing, 465A.
- deoxidation, 662A.
- hairsprings, manuf. and properties, 116.

VOL. XXXVII.

Nickel-brass,

- melting, 713A.; electric, 293.
 - moulding, 662A., 713A.
 - special, 465A.
 - tensile properties, 465A.
- Nickel-chromium alloys,**
- constitution, 471A.
 - manufacture, 653A.
 - solid solutions, lattice structure, 470A.
 - uses, 653A.
- Nickel-chromium-iron alloys,** constitution, 470A.
- Nickel-cobalt alloys,** constitution, 457A., 458A.
- Nickel-copper alloys,**
- colour, 460A.
 - deposition, electrolytic, 643A.
 - effect on brasses. See also *Nickel-brasses*.
 - electrical resistance, 460A.
 - melting, electric, 293.
 - properties, 472A.
 - solid solutions, thermoelect. properties, 481A.
- Nickel-copper-aluminium alloys,** Hall effect, relation to temp., 480A.
- Nickel-copper-zinc alloys.** See *Nickel-brass*.
- Nickel-iron alloys** (see also *Mumetal*, *Permalloy*, &c.),
- constitution, 471A.
 - cores for current transformers, 665A.
 - lattice constant, relation to density, 474A.
 - magnetization, 473A.
 - solid solutions, lattice structure, 470A.
 - specific heat, 473A.
 - temper colours, 473A.
- Nickel-iron-carbon alloys,** lattice constant, relation to density, 474A.
- Nickel-iron-cobalt alloys,** electrodeposition potentials, 627A.
- Nickel-iron meteorites,** structure, 474A.
- Nickel rash,** control and treatment, 751A.
- Nickel silver.** See *Nickel-brass*.
- Nickel-steels.** See *Steels*.
- Nickel-tungsten alloys,** wires, tenacity, 418A.
- Niobium.** See *Columbium*.
- Nitric acid,**
- action on aluminium, 373A.; on metals and alloys, 498A.
 - resistant metals and alloys, 500A.
- Nitrogen,**
- reaction with lithium, 391A.
 - spectrum, extreme ultra-violet, wavelength standards, 533A.

3 G

- Nitrogen-oxygen mixtures**, action on metals, 434*A*.
Nomenclature, 747*A*.
- Obituary notices**, 351.
Occlusion of gases, 436*A*.
Officers, election, 13.
Oil-fired furnaces. See *Furnaces*.
Oil fuels (see also *Fuels*),
 burning, 729*A*.
 industrial uses, 729*A*.
Oligodynamic action of metals, 440*A*.
Optical constants of—
 Metals, detm., 429*A*.
 Tungsten, changes with temp., 412*A*.
Optical Convention, exhibits at, 596*A*.
Organization, scientific, book, 774*A*.
Osmium,
 crystal structure, 523*A*.
 detection, 584*A*.
 estimation in small quantities, 584*A*.
 spectrum, *K*-series emission, 547*A*. ;
 M-series X-ray, 542*A*.
Ounce metal, A.S.T.M. specifications, 661*A*.
Overpotential, theory, 629*A*.
Overvoltage,
 anodic, measurements with cathode ray oscillograph, 628*A*.
 review of work, 627*A*.
Overvoltage of—
 Cadmium in liquid ammonia and in water, 628*A*.
 Copper, hydrogen, 628*A*. ; in liquid ammonia and in water, 628*A*.
 Gold, hydrogen, 628*A*.
 Iron in liquid ammonia and in water, 628*A*.
 Lead in liquid ammonia and in water, 628*A*.
 Mercury, cathodic, 629*A*. ; hydrogen, 628*A*. ; in liquid ammonia and in water, 628*A*.
 Nickel, hydrogen, 628*A*. ; in liquid ammonia and in water, 628*A*.
 Platinum, hydrogen, 628*A*.
 Silver in liquid ammonia and in water, 628*A*.
 Zinc, hydrogen, 629*A*. ; in liquid ammonia and in water, 628*A*.
Oxidation potentials, effect of electrode material, 631*A*.
Oxygen,
 estimation in refined copper, 583*A*.
 Oxygen.
 spectrum, bands in ultra-violet, 542*A*. ; extreme ultra-violet, wavelength standards, 533*A*.
 Oxygen-nitrogen mixtures, action on metals, 434*A*.
- Paint**,
 aluminium, uses, 506*A*.
Palladium,
 detection, 584*A*.
 estimation in small quantities, 584*A*.
 Hall effect in evaporated films, 378*A*.
 latent heat of fusion, 432*A*.
 separation from platinum, 584*A*.
 spectrum, *K*-series, precision measurements, 542*A*.
Palladium alloys, hairsprings, 117.
Palladium-copper alloys,
 electrical conductivity, 480*A*.
 thermal conductivity, 480*A*.
Paramagnetism, 429*A*.
Parkerizing of metals, 506*A*.
Paschen-Back effect, partial intensities of Zeeman components, 538*A*. , 553*A*.
Passivity, 629*A*.
 theory, electronic, 630*A*.
Passivity of—
 Aluminium, 374*A*. ; periodic, 631*A*.
 Cobalt, periodic, 631*A*.
 Iron, periodic, 631*A*.
 Nickel, periodic, 631*A*.
Pattern plate, 705*A*.
Patterns,
 economies, 705*A*.
 irregular shape, 705*A*.
 making, 705*A*.
 storage, 705*A*.
 thin section, 705*A*.
Periodic classification of elements, 443*A*. , 444*A*.
Periodicals abstracted, 356*A*.
Permalloy, crystal structure, 523*A*.
Pewter, ancient Chinese, 461*A*.
pH, determination, 622*A*. , 623*A*.
Phase rule, 485*A*.
Phosphoric acid,
 action on metals and alloys, 498*A*.
 estimation by means of a uranyl salt, using liquid amalgams, 563*A*.
Phosphor-bronze,
 Hall effect, relation to temp., 480*A*.
 hairsprings, manuf. and properties, 116.
 wires, tenacity, 418*A*.

- Photoelectric cell, alkali metals, 673*A*.
 Photoelectric effect, theory, 428*A*.
 Photoelectric emission from—
 Metals as function of temp. of
 exciting radiations, 428*A*.
 Oxide-coated filaments, 428*A*.
 Photoelectric properties of mercury,
 392*A*.
 Photomicrographs, A.S.T.M. standard
 rules governing preparation, 511*A*.
 Photomicrography (see also *Metallo-*
graphy),
 book, 762*A*.
 screen holder, 515*A*.
 Photosensitivity of Selenium, 405*A*.
 Physical constants, book review, 781*A*.
 Physical properties. *See also* under
 specific properties.
 Physics,
 books, 759*A*., 761*A*., 763*A*., 764*A*.,
 767*A*.
 history, book, 759*A*.
 Pickling,
 equipment, material for, 500*A*.
 fumes, removal, 673*A*.
 solutions, practical chem. control,
 507*A*.
 Pickling of—
 Metals, equipment, 748*A*.
 Tinplate, 748*A*.
 Pinch effect in electric furnaces, 308.
 Pipes,
 joints, 675*A*.
 manufacture and lay-out, 674*A*.
 Plastic deformation (see also *Deforma-*
tion, &c.),
 flow of material during, 699*A*., 700*A*.
 power expended, 700*A*.
 Plastic deformation of—
 Crystal aggregates, 421*A*.
 Crystals, 421*A*.
 Zinc single crystals, 414*A*.
 Plasticity of metals, 421*A*., 422*A*.
 Platinum,
 anodic behaviour in dil. sulphuric
 acid, 628*A*.
 catalysts, velocity of hydrogen elec-
 trode reaction on, 400*A*.
 catalytic decomposition of nitric
 oxide, 401*A*.; of nitrous oxide,
 400*A*.
 catalytic hydrogenation by, theory,
 400*A*.
 colloidal, in silicic acid gel, rhythmic
 diurnal bands, 389*A*.
 crystals, 402*A*.
 detection, 584*A*.
 displacement by hydrogen under high
 pressure, 399*A*.
 Platinum,
 electrical conductivity, influence of
 absorbed gas, 399*A*.; influence of
 pressure, 399*A*.
 electrical resistance down to 1.3°
 abs., 387*A*.
 electrodes, passage of electricity
 between, *in vacuo*, 399*A*.
 estimation in minute quantities,
 583*A*., 584*A*.
 gel, prepn., 401*A*.
 Hall effect in evaporated films,
 378*A*.
 history, 665*A*.
 latent heat of fusion, 432*A*.
 melting point, 399*A*.
 native, density, 398*A*.; existence in
 quartz veins at Cabo de Gata,
 398*A*.; hardness, 398*A*.; micro-
 structure, 398*A*.
 occurrence, 665*A*.; in Norwegian
 rocks and minerals, 583*A*.
 overvoltage, hydrogen, 628*A*.
 oxide-coated filaments, photoelect.
 emission from, 428*A*.; variation
 of work-function with temp., 401*A*.
 photoelectric emission, 428*A*.; in-
 fluence of absorbed gas, 399*A*.
 separation from platinum metals,
 584*A*.; from ruthenium, 575*A*.
 spectral emissivity as function of
 temp., 408*A*.
 spectrum, *K*-series emission, 547*A*.;
 L-series, precision measurements,
 547*A*.; *M*-series X-ray, 542*A*.
 substitute for bomb calorimeters,
 589*A*.
 surface, interaction of hydrogen and
 carbon dioxide on, 400*A*.
 thermionic and photoelectric emis-
 sion, concurrent variations with
 state of surface, 401*A*.
 thermionic emission of incandescent,
 in vapours of iodine, 402*A*.
 trade regulations, 665*A*.
 wires, tenacity, 418*A*.
 Platinum black, adsorption of gases,
 476*A*.
 Platinum metals,
 analytical reactions, new, 574*A*.
 behaviour to silver and gold in cupel-
 ling heats from 1100° to 1200°C.,
 476*A*.
 detection, 584*A*.
 estimation, 584*A*.; potentiometric,
 584*A*.
 geochemistry, 583*A*.
 preparation from iridosmine, 402*A*.
 separation, 574*A*.

- Platinum metals**,
titration, potentiometric, 584*A*.
uses, 665*A*.
- Plumbing fixtures**, U.S. Govt. master specification, 674*A*.
- Polariscope** for determining feeble polarization, 597*A*.
- Polarization of—**
Metals, anodic, oscillograph studies, 626*A*.; electrolytic, diffusion layer, 626*A*.; measurement, 627*A*.; used as electrolytes, 627*A*.
Zinc in neutral and acid solns. of zinc salts by a.c. and d.c., 626*A*.
- Polonium**, radioactivity, effects of sunlight, 403*A*.
- Potassium** (see also *Alkali metals*),
chemical constants, 408*A*.
combination with carbon, 404*A*.
estimation in potassium salts as perchlorate, 584*A*.; polarimetric, 584*A*.; quantitative, by means of electrometric titration, 584*A*.
ionized, spectrum, 542*A*.
ions, dependence of free path in various gases on their velocity, 526*A*.
latent heat of vaporization, 408*A*.
melting point, 407*A*.
preparation of small quantities, 404*A*.
radioactivity, 404*A*.
spectrum, flash arc, 542*A*.; luminescence, 542*A*.
titration, electrometric, 584*A*.
vapour, thermionic phenomena caused by, 543*A*.
vapour pressure, 407*A*., 416*A*.
- Potassium amalgams**, interaction of water and, effect of light, 470*A*.
- Potassium ferricyanide**, durability as etching reagent, 514*A*.
- Potentials**, electrode. See *Electrode potentials*.
- Potentiometers**,
British made, 598*A*.
improvements, 598*A*.
portable, 598*A*.
Tinsey-Gall, applications, 598*A*.
- Pouring**. See *Casting*.
- Powders**,
pressed, strength on annealing, 482*A*.
unmelted, agglomeration, 435*A*.
- Praseodymium**, magnetic susceptibility, 416*A*.
- Precious metals**. See *under names of precious metals*.
- Precipitation**, electrical, progress, 756*A*.
- President**. See *Dewrance, (Sir) John*.
- Presidential Address**, 21.
- Pressing of brass**, 700*A*.
- Pressure**, high, materials to withstand, 674*A*.
- Pressure die-casting**. See *Die-casting*.
- Pure metals**, production, advances, 417*A*.
- Pyrometers** (see also *Thermocouples*),
controller, 619*A*.
filament, elect. heated, 617*A*.
for surface temperature measurement, 617*A*.
gas, 619*A*.
optical, calibration, 618*A*.
radiation, considerations, 618*A*.; German recommended practice, 618*A*.; types, 618*A*.
resistance, 618*A*.
Siemens incandescent filament, 619*A*.
spectro-micro-, 618*A*.
thermocouple, construction, 615*A*.; use, 615*A*.
thermo-electric, 617*A*.
total-radiation, influence of lens absorption, 619*A*.
- Pyrometric cones**,
characteristics, 620*A*.
European and American, comparison of softening points, 620*A*.
Seger, renumbering, 619*A*.
- Pyrometry**
in the foundry, 615*A*., 616*A*., 617*A*.
radiation, principles, 618*A*.
spectral, of glowing bodies, 619*A*.
terms, standard definitions, 614*A*.
- Pyrophoric alloy**, preparation, 634*A*.
- Qualitative analysis**. See *Analysis*.
- Quantitative analysis**. See *Analysis*.
- Quantum dynamics**, equations, operator calculus and solution of, 531*A*.
- Quantum mechanics**, 556*A*.
- Quaternary alloys**. See *Alloys*.
- Quenching**. See *Heat-treatment*.
- Quicksilver**. See *Mercury*.
- Quinhydrone electrode**, application to measurement of pH values in solns. containing copper ions and other bivalent ions, 622*A*.; behaviour in solns. of neutral copper sulphate, 623*A*.
- Radioactivity of—**
Lead, effects of sunlight, 403*A*.
Polonium, effects of sunlight, 403*A*.
Potassium, 404*A*.
Rubidium, 404*A*.
Thorium, 404*A*.
Uranium, 404*A*.

- Radiology**
 book review, 770*A*.
 industrial, 613*A*.
- Radiology of castings, A.S.T.M. recommended practice**, 612*A*.
- Radium**
 radiation, absorption measurements, 542*A*.
 separation from barium by ionic migration method, 575*A*.
 spectrum, β -ray, 542*A*., 543*A*.
- Radium-C**,
 existence, 404*A*.
 γ -radiation, 543*A*.
 half-period, 404*A*.
 straggling of α -particles from, 404*A*.
- Radium-D**,
 electrodeposition, 404*A*.
 electrolysis, 405*A*.
- Radium-E**,
 electrodeposition, 404*A*.
 electrolysis, 405*A*.
- Radon**, ionization in spherical vessels, 405*A*.
- Rare earth metals** (*see under names of rare earth metals*),
 magnetic susceptibility, 416*A*.
- Rare earths**,
 detection, 568*A*.
 separation by basic pptn., 575*A*.;
 from uranium alkali uranylalicylates, 576*A*.
- Rare metals**. *See under names of rare metals*.
- Rays, α** ,
 anomalous scattering, 526*A*., 529*A*.
 stopping powers of metals, 443*A*.
- Rays, cathode**,
 book, 762*A*.
 scattering, 442*A*.
- Rays, γ** ,
 secondary radiations produced by, 443*A*.
 spectroscopy of, 554*A*.
- Rays, Röntgen**,
 absorption, theory, 529*A*.
 applied, book review, 770*A*.
 book, 762*A*., 763*A*., 764*A*.
 diffraction by crystals, bearing of Compton effect, 549*A*.
 interferences, influence of temp., 521*A*.
 mass scattering coefficient, 443*A*.
 polarization of scattered, 549*A*.
 reflection by crystals, and Compton effect, 520*A*.
 refraction by method of total reflection, 536*A*.; in prisms of various materials, 443*A*.
- Rays, Röntgen**,
 refractive index, determination, 595*A*.
 scattered, *J* phenomenon, 552*A*.
 term values, critical potentials and, 550*A*.
- Reaming of brass tubes**, 699*A*.
- Recrystallization** (*see also Crystal growth*), 420*A*., 421*A*.
 nuclei, 518*A*.
 temperature, relation to melting temp., 419*A*.
- Recrystallization of—**
 Aluminium, 372*A*., 517*A*.
 Copper, 517*A*.; wire, 521*A*.
 Face-centred metals, 517*A*.
 Noble metal alloys, 482*A*.
 Silver, 517*A*.
- Recuperators**, 719*A*.
- Refining, electrolytic, during past 25 years**, 636*A*.
- Refining of—**
 Bismuth, 653*A*.
 Copper, electrolytic, analyses of cell voltages, 637*A*.; electrolytic, improvements in series system developed by Nichols Copper Co., 636*A*.; electrolytic, sp. resistivity of electrolytes and method of calculation, 637*A*.; electrolytic, 25 years' progress, 636*A*.
- Tin**, 666*A*.
- Reflecting power**. *See Optical constants*
- Refractive index**. *See Optical constants*.
- Refractive index of Selenium** (red crystalline), 405*A*.
- REFRACTORY MATERIALS—**
 action of slags, 737*A*.
 American industry, 734*A*.
 British Refractories Research Association, review of work of, 734*A*.
 bulk volume, 735*A*.
 cement, 744*A*.
 coatings, highly resistant, 736*A*.
 efficiency, influence of slags, flame impingements, and thermal expansion, 737*A*.
 for blast furnaces, 736*A*.
 for brass melting furnaces, 734*A*.
 for electric furnaces, 316, 736*A*.
 for furnaces burning coal dust, 736*A*.
 for melting pure metals, 736*A*., 737*A*.
 foundry, report of Cttee. of American Foundrymen's Association, 734*A*.

Refractory materials—

- life, influence of slags, flame impingements, and thermal expansion, 737A.
- load test, effect of atmospheric conditions, 735A.
- pore volumes, 735A.
- porosity, 735A.
- requirements, 737A.
- resistance to temp. changes, 735A.
- selection, 736A.; rôle of sp. heat, 734A.
- spalling, 744A.
- specifications, 734A.
- specific gravity, 735A.
- standardization suggestions, 734A.
- testing by dyeing, 735A.; in Germany, 737A.
- tests, practical, 735A.

Andalusite, 743A.

Bauxites, thermal analysis, 739A.

Bricks, manuf. from boiler-house ash and clinker, 743A.

Carbon, graphitic, melting point, 742A.; properties, 743A.

Carborundum, behaviour under working conditions, 743A.

Clays (see also *Kaolin*); rational analysis, 739A.; thermal analysis, 739A.

Cyanite, mullite refractories formed by calcining, 739A.

Cyanite clay, dissociation of cyanite into mullite, 739A.; equilib. considerations, 739A.

Diaspore clays, shrinkage, 739A.

Firebrick made by different processes, comparison of uniformity of strength and texture, 738A.

Fireclay, changes in structure on heating, 738A.; properties, 741A.; U.S. Govt. master specifications, 738A.

Fireclay brick, comparison of German and American, 738A.; manuf., 738A.; specifications, 738A.; uses, 738A.; U.S. Govt. master specification, 739A.

Fireclay-coal ash mixtures, fusion points, 739A.

Fused oxides, thermal expansion, 743A.

Graphite for crucibles, clay for mixing with, 737A.; thermal expansion, 742A.

Kaolin, behaviour at high temp., 740A.

Magnesite, fused, 743A.

Refractory materials—

Quartz, clear fused, uses and manuf., 743A.

Silica, amorphous, for severe service, 742A.

Silica bricks, addition of chromium oxide, 741A.; dilatometric analysis, 740A.; influence of oxide admixtures on phys. properties, 741A.; lime bonded, effect of repeated burning on structure and properties, 741A.; properties, 741A.; scientific tests, 741A.; testing for quality, 740A.

Silicon carbide, recrystallized, use, 742A.

Sil-O-Cel, 743A.

Tungsten powder, 737A.

Zirconia, uses, 743A.

Remelting, effect on compn. of alloys, 711A.

Report of Council, 1.

Report of Hon. Treasurer, 9.

Research, 754A., 755A.

Industrial, co-operative, book, 759A.

metallurgical, development since world war, 745A.

physical, modern aspects, 754A.

problems in chemistry, list, 755A.

pure science, need for greater financial support, 754A.

reports, 755A.

Resistance, electrical. See *Electrical resistance*.

Rhenium, 385A.

Rhodium,

detection, 584A.

estimation in small quantities, 584A.

separation from platinum, 584A.; from platinum and iridium, 584A.

spectrum, arc, 543A.

Risers, 706A.

Riveted joints, strength, 679A.

Riveting, pneumatic, 679A.

Rockwell hardness testing machines. See *Testing machines*.

Rolling,

cold-, costs, 701A.

relation between power and output, 700A.

Rolling-mill,

cold-, six-roll, cluster type, 701A.

conversion of steam drive to electric drive, 701A.

reversing, equipment, 701A.

spindles, protection, 701A.

- Rolling of—
 Copper-arsenic-oxygen alloys, 145.
 Copper-bismuth alloys, 174.
 Roll of the Institute, 1.
 Röntgen analysis. See *Crystal structure*.
 Röntgen rays. See *Rays, Röntgen*.
 Röntgen spectrum. See *Spectrum*.
 Ropes, metal wire, 695A.
 Rose's metal, transformation phenomena, 455A.
 Royal Society, year-book, 765A.
 Rubidium (see also *Alkali metals*),
 analysis, quantitative, 566A.
 displacement by iron, 376A.
 preparation of small quantities, 404A.
 radioactivity, 404A.
 spectrum, flash arc, 543A.
 vapour, thermionic phenomena caused by, 543A.
 vapour pressures, 416A.
 Rupture, 609A.
 modulus, relation to diam. of test-bars, 602A.
 Russ induction electric furnace, 306.
 Ruthenium,
 crystal structure, 523A.
 detection, 570A., 584A.
 estimation in small quantities, 584A.
 separation from platinum, 584A.
 spectrum, arc regularities, 543A.
 Salt driers, materials for use in, 501A.
 Sampling of ferro alloys, 566A.
 Sands, moulding. See *Moulding sands*.
 Scabs, cause and remedies, 712A.
 Scandium, spectrum, magnetic resolution, 543A.
 Scientific paradoxes, book review, 780A.
 Scientific societies, year-book, 765A.
 Scleron, mechanical properties, 454A.
 Scrap metal,
 classification, standard, 671A.
 magnetic separator, 748A.
 utilization, 747A., 748A.
 Screen (sieve), definition of term, 756A.
 Screens, wire, British standard table, 612A.; laboratory tests, 612A.
 Season cracking. See *Internal stress*.
 Secondary metals, 747A., 748A.
 Seger cones, renumbering, 619A.
 Segregation in—
 Copper-aluminium alloys, 483A.
 Copper-manganese alloys, 483A.
 Iron castings, 483A.
 Selenium,
 atomic weight, 405A., 425A.
 colloidal, 406A.
 Selenium,
 cooling curves, 405A.
 crystalline, light sensitiveness, 406A.
 estimation by means of potassium permanganate, 584A.; quantitative, 584A.
 heating curves, 405A.
 heat of transformation, 405A.
 latent heat of fusion, 405A.
 photosensitivity, 405A.
 red crystalline, dielectric const., 405A.; prepn., 405A.; refractive index, 405A.; sp. heat, 405A.
 specific heat, 405A.
 spectrum, fluorescence, 544A., 545A.
 vapour, resonance rays, 544A.
 Self-diffusion in solid metals, 434A.
 Sensitiveness in metals, 603A.
 Separation. See *Analysis*.
 Series spectra. See *Spectra*.
 Shearer X-ray tube, modification, 595A.
 Sheet metal gauges, unification, 699A., 748A.
 Sherardizing, 506A.
 electro-, of large parts, 503A.
 Silica bricks. See *Refractory materials*.
 Silicon, high-purity, preparation, 750A.
 Silicon-aluminium alloys (see also *Silumin, &c.*),
 electrical conductivity, 84.
 hardness, 82.
 papers published in 1926, critical discussion, 453A.
 sand-cast, modification and properties, 453A.
 solubility of silicon, 453A.
 tensile properties, 82.
 Silicon-calcium-aluminium alloys,
 electrical conductivity, 84.
 hardness, 81.
 tensile properties, 81.
 Silicon-chromium alloys,
 manufacture, 653A.
 uses, 653A.
 Silicon-copper alloys, properties, 460A., 461A.
 Silicon-manganese, electric furnace for, 722A.
 Silumin (see also *Aluminium-silicon alloys*),
 action of magnesium sulphate solns., 488A.; of potassium chloride solns., 488A.; of sodium chloride solns., 488A.
 improvement, 453A.
 occlusion of gases, 436A.
 pistons, compared with aluminium and magnesium pistons, 453A.

Silver,

- anisotropic, 380*A*.
 - anodes, periodic phenomena, 630*A*.
 - atomic weight, 406*A*., 407*A*.
 - cathodic disintegration in hydrogen, 407*A*.
 - cleaning, 750*A*.
 - crystal structure, 522*A*.
 - cupellation losses, effect of air, 564*A*.
 - density, 406*A*.
 - detection, 570*A*.
 - electrical resistance down to 1.3° abs., 387*A*.
 - electro-deposits, arrangement of micro-crystals, 513*A*.
 - estimation, microchemical, 585*A*.
 - evaporation, effect of cold-working, 422*A*.
 - ionized, regularities in spectrum, 544*A*.
 - latent heat of fusion, 432*A*.
 - melting, electric, 293.
 - molten, elect. resistance, 426*A*.
 - overvoltage in liquid ammonia and in water, 628*A*.
 - photoelectric emission, 428*A*.
 - recrystallization, 517*A*.
 - separation from gold, Batch process, 635*A*.; conductivity of electrolytes, 636*A*.
 - solder, British standard specification, 679*A*.
 - sols, Bredig's, stability and constitution, 407*A*.
 - specific heat, 406*A*., 432*A*.
 - spectrum, conditions of appearance and structure of bands between $\lambda 3330$ and $\lambda 3358$, 544*A*.; *K*-series, precision measurements, 542*A*.
 - sterling flatware, American stock items, 666*A*.
 - thermoelectric properties, 481*A*.
 - valve action in aqueous solns. of potassium silver cyanide, 633*A*.
 - X-ray refraction, 443*A*.
- Silver alloys,**
- new, 476*A*.
 - physical properties, 491*A*.
 - tarnish resistance, 491*A*.
- Silver-aluminium alloys,** ageing phenomena, 454*A*.
- Silver amalgams,**
- constitution, 469*A*.
 - crystal structure of Ag_3Hg_4 , 523*A*.
- Silver-antimony alloys,**
- thermal expansion, 481*A*.
 - thermoelectric properties, 481*A*.

Silver-copper alloys,

- eutectic, structure, 103.
 - solid solutions, disintegration, 483*A*.; thermoelect. properties, 481*A*.
- Silver-gold alloys,**
- action of nitric acid, 495*A*.
 - electrical conductivity, 480*A*.
 - equilibrium relations in liquid and solid state, 466*A*.
 - thermal conductivity, 480*A*.
- Silver-magnesium alloys,** 476*A*.
- compound AgMg ,** atomic structure, 531*A*.
- Silver-manganese alloys,**
- properties, 469*A*.
 - uses, 469*A*.
- Silvering of mirrors,** new method, 666*A*.
- Single crystals,**
- preparation, 417*A*., 516*A*.
 - tenacity, as affected by plastic deformation, 418*A*.; modulus of torsion and, 418*A*.
- X-ray rotation photographs,** interpretation, 550*A*.
- Single crystals of—**
- Aluminium,** behaviour under tension, 371*A*., 372*A*.; effects of torsion on thermal and elect. conductivities, 371*A*.
- Bismuth,** thermal conductivity, 418*A*.; thermal e.m.f., 418*A*.
- Cadmium,** thermal conductivity, 418*A*.; thermal e.m.f., 418*A*.; thermal expansion, 415*A*.; thermoelect. properties, 415*A*.
- Iron,** longitudinal magneto-resistance, 419*A*.; tenacity, 418*A*.
- Molybdenum,** tenacity, 418*A*.
- Nickel,** magnetic properties, 397*A*.
- Tin,** thermal conductivity, 418*A*.; thermal e.m.f., 418*A*.
- Tungsten,** history of development, 411*A*.; prepn. of filaments by Pintsch process, 411*A*.
- Zinc,** behaviour under stress, 414*A*.; thermal conductivity, 418*A*.; thermal e.m.f., 418*A*.; thermal expansion, 415*A*.; thermoelect. effect, 414*A*.; thermoelect. properties, 415*A*.; twinning, 417*A*.
- Slags,** granulation, 710*A*., 748*A*.
- Slip-bands,** 511*A*.
- Société Française de Physique,** exhibition of scientific apparatus, 599*A*.
- Sodium** (see also *Alkali metals*),
- absorption of hydrogen, 408*A*.
 - chemical constants, 408*A*.

- Sodium**,
 detection, 570*A*.
 electrical conductivity, 391*A*.
 estimation, gravimetric, 585*A*.; in lead alloys, 578*A*.
 latent heat of vaporization, 408*A*.
 melting point, 407*A*.
 production, 671*A*.
 properties, 671*A*.
 specific heat, 391*A*.
 spectrum, flash arc, 544*A*.; polarization of resonance fluorescence, 544*A*.
 thermal conductivity, 391*A*.
 uses, 671*A*.
 vapour pressure, 407*A*., 416*A*.
- Sodium amalgams**, interaction of water and, effect of light, 470*A*.
- Soft metals**, microscopic examination, preparation of specimens, 514*A*.
- Soft-soldering**. See *Soldering*
- Soldering**,
 book, 762*A*.
 compounds, 680*A*.
- Soldering of aluminium**, 680*A*.
- Solders** (see also under names of constituent metals),
 aluminium, 680*A*.
 brazing, British standard specification, 679*A*.
 conservation of tin, 666*A*.
 estimation of lead, 587*A*.; solder, 587*A*.
 hard, properties, 680*A*.
 penetration of brass, 183.
 silver, British standard specification, 679*A*.
 soft, properties, 680*A*.
 special, properties, 680*A*.
- "Soldo" soldering compound**, 680*A*.
- Solidification of alloys**, 250.
- Solid solutions** (see also *Alloys*), 345.
 compounds in, 484*A*.
 miscibility gaps in, 484*A*.
 supersaturated, disintegration, 483*A*.
 theory, 484*A*.
 thermoelectric properties, 481*A*.
- Solid state**,
 chemistry of, 417*A*.
 diffusion in, 417*A*.
- Sols**, metal, effect in delaying detonation in internal combustion engines, 437*A*.; preparation, 436*A*.
- Space lattice**. See *Crystal lattice*.
- Spark spectra**. See *Spectra*.
- Specific gravity**, terms relating to, definitions, 612*A*.
- Specific gravity of mercury** 392*A*.
- Specific heat**, determination at high temps., new method, 430*A*.
- Specific heat of—**
 Aluminium, 432*A*.
 Antimony, 432*A*.
 Bismuth, 432*A*.
 Cadmium, 432*A*.
 Chromium, 432*A*.
 Cobalt, 396*A*., 432*A*.
 Copper, 432*A*.
 Gold, 432*A*.
 Iron, 432*A*.
 Lead, 432*A*.
 Lithium, 391*A*.
 Nickel, 396*A*., 432*A*.
 Nickel-iron alloys, 473*A*.
 Selenium, 405*A*.
 Silver, 406*A*., 432*A*.
 Sodium, 391*A*.
 Tin, 432*A*.
 Tungsten, 411*A*.
 Zinc, 432*A*.
- Spectra**,
 absorption, produced by explosions of various elements, 550*A*.
 band, origin, 553*A*.
 broadening, apparatus for, 554*A*.
 continuous, quantum theory, 550*A*.
 flame, and chemical reactions, 554*A*.
 Fraunhofer lines, width, 555*A*.
 line, transformation into continuous spectrum by passage of radiation through an absorbing soln. of certain critical density, 553*A*.
 lines, intensity measurements, 555*A*.; occurrence of harmonics in, 554*A*.
 magnetic, effect of constant magnetic field, 554*A*.
 molecular, interpretation, 556*A*.
 multiplets, intensity measurements, 555*A*.
 stellar, absorption lines, 551*A*., 552*A*.
 ultra-violet, projection, 594*A*.
- X-ray**, dependence of intensity of lines upon number of cathode electrons, 548*A*.; exception to intensity rule relating to, 548*A*.; intensities in *L*-series, 548*A*.; *K*-series measurements, 549*A*.; satellites of lines, 548*A*.; screening constants of magnetic doublets, 549*A*.
- Spectral emissivity of—**
 Gold as function of temp., 408*A*.
 Nickel as function of temp., 408*A*.
 Platinum as function of temp., 408*A*.
 Tantalum as function of temp., 408*A*.

- Spectrograph**, vacuum, 594*A*.
X-ray, focusing, for use at low temps., 521*A*.
- Spectrometer**, ultra-red, 594*A*.
X-ray, with which wave-lengths are read directly on an ordinary micrometer screw, 594*A*.
- Spectroscopic analysis**, quantitative, 553*A*., 560*A*.
- Spectroscopy**, applications in chemical and metallurgical testing, 613*A*.
 books, 757*A*.
X-ray, development during 1921-1925, 548*A*.; importance in discovery of new elements, 548*A*.
- Spectrum of—**
Alkali metals, doublets, 547*A*.; intensity relations in doublets of principal series, 547*A*., 548*A*.
Alkaline earths, intensity relations of triplet components, 535*A*.
Aluminium, extreme ultra-violet, wave-length standards, 533*A*.
Aluminium oxide, band, 534*A*.
Antimony in magnetic field, 545*A*.
Argon, *M*-doublet, 534*A*.; series, 534*A*.
Atomic system having two electrons, 551*A*.
Beryllium, series, 534*A*.
Bismuth, fine structure, 534*A*.; fluorescence, 545*A*.; in magnetic field, 545*A*.; *K*-series emission, 547*A*.; *L*-series, precision measurements, 547*A*.; series, 534*A*.
Cadmium, effect of elect. field, 546*A*.; fine structure, 534*A*.; fluorescence, 535*A*.; new lines, 546*A*.; red line $\lambda 6438.7 \text{ \AA}$., change of wave-length, 534*A*.; resonance lines, 535*A*.; under heavy current excitations, 553*A*.
Cesium, luminescence, 535*A*.; *1s-md* series, 535*A*.
Calcium, *H* and *K* lines in O-type stars, 536*A*.; *K* X-ray absorption edge, 536*A*.; spark doublets, 535*A*.; stationary lines in O- and B-type stars, 536*A*.
Carbon, extreme ultra-violet, wave-length standards, 533*A*.
Copper, arc, 536*A*.; arc, Zeeman effect and, 536*A*.; explosion, 550*A*.; quartet and doublet terms, 536*A*.
- Spectrum of—**
Didymium, ultra-red absorption, 537*A*.
Elements of first and second large groups, fundamental terms, 554*A*.
Europium, arc, new lines, 537*A*.
Gold, coincidence of some lines of thallium, 537*A*.; *K*-series emission, 547*A*.; *L*-series, precision measurements, 547*A*.
Hafnium, arc, 573*A*.
Helium, time intervals between appearance of certain lines, 541*A*.
Hydrogen, continuous, 537*A*.
Iridium, *K*-series emission, 547*A*.; *L*-series, precision measurements, 547*A*.; *M*-series X-ray, 542*A*.
Iron, explosion, 550*A*.
Lanthanum, terms, 537*A*.
Lead, arc, 538*A*.; explosion, reversal of lines, 538*A*.; in magnetic field, 545*A*.; *K*-series emission, 547*A*.; *L*-series, precision measurements, 547*A*.
Lead isotopes, band, 538*A*.
Light elements, mass, 553*A*.
Lighter elements, Röntgen *L*-series, 549*A*.
Lithium, spark, 538*A*.
Lithium-like atoms, 538*A*.
Lower elements, X-ray, 549*A*.
Mercury, anomalous Zeeman effect of line 5791 and its satellite — 0.124, 541*A*.; band fluorescence, 539*A*.; bands at $\lambda 2536$ and $\lambda 2540$, 539*A*.; continuous, 539*A*.; effect of helium on intensity, 541*A*.; explosion, 539*A*., 550*A*.; fluorescence, 539*A*.; intensity and width of lines, 541*A*.; *L*-series, precision measurements, 547*A*.; luminescence, 540*A*.; magnetic separation of line 5770 into nonet of special type, 541*A*.; new line, 546*A*.; new terms, 547*A*.; spark, in extreme red, 538*A*.; spark, in extreme ultra-violet, 539*A*.; time intervals between appearance of certain lines, 541*A*.; variations of intensity of lines of a triplet, 541*A*.
Metals excited by means of high tension and heavy current, 554*A*.; under heavy current excitations, 553*A*.
Molecules (diatomic), theory, 556*A*.
Nickel, absorption, 542*A*.; arc, 542*A*.

Spectrum of—

Nitrogen, extreme ultra-violet, wave-length standards, 533A.

Osmium, *K*-series emission, 547A.; *M*-series X-ray, 542A.

Oxygen, bands in ultra-violet, 542A.; extreme ultra-violet, wave-length standards, 533A.

Palladium, *K*-series, precision measurements, 542A.

Platinum, *K*-series emission, 547A.; *L*-series, precision measurements, 547A.; *M*-series X-ray, 542A.

Potassium, flash arc, 542A.; (ionized), 542A.; luminescence, 542A.

Radium, β -ray, 542A., 543A.

Rhodium, arc, 543A.

Rubidium, flash arc, 543A.

Ruthenium, arc regularities, 543A.

Scandium, magnetic resolution, 543A.

Selenium, fluorescence, 544A., 545A.

Silver, conditions of appearance and structure of bands between $\lambda 3330$ and $\lambda 3358$, 544A.; (ionized), regularities, 544A.; *K*-series, precision measurements, 542A.

Sodium, flash arc, 544A.; polarization of resonance fluorescence, 544A.

Sodium-like atoms, 538A.

Solutions, spark, apparatus for producing, 594A.

Sulphur group, fluorescence, 545A.

Tantalum, *K*-series emission, 547A.; *L*-series, precision measurements, 545A.

Tellurium, fluorescence, 545A.

Thallium, coincidence of some lines of gold, 537A.; *K*-series emission, 547A.; *L*-series, precision measurements, 547A.

Thorium, helium lines in, 546A.; *L*-series, precision measurements, 547A.; lines of transformation products in, 546A.

Tin, arc, 545A.; arc, excitation of enhanced lines, 545A.; explosion, self-reversal of lines, 545A.; in magnetic field, 545A.

Tungsten, *K*-series, 526A.; *K*-series emission, 547A.; *L*-series, precision measurements, 547A.

Uranium, helium lines in, 546A.; lines of transformation products in, 546A.; *L*-series, precision measurements, 547A.

Vanadium, ionized, multiplets in, 546A.

Spectrum of—

Zinc, effect of elect. field, 546A.; new line, 546A.; new terms, 547A.; radiation emitted by optically excited vapour, 546A.; resonance lines, 535A.; under heavy current excitations, 553A.

Spelter. See Zinc.

Spraying of—

Aluminium on grate bars, 505A.

Lead, modified pistol for, 505A.

Spraying of metals,

Meurer powder method, 504A.

present position, 504A.

Schoop method, improved, 504A.

theory and practice, 504A.

Sputtering apparatus, new, 595A.

Standardization of metals, 747A.

Stark effect from point of view of Schroedinger's quantum theory, 553A.

Steel,

chrome-nickel-, primary crystallization, 712A.

hairsprings, manuf. and properties, 114.

mild, penetration by brazing solder and other metals, 215 (*Paper*).

nickel-, dependence of elect. resistance upon compn., temp., and heat-treatment, 474A., 475A.; relation of lattice const. to density, 474A.

Stellite, welding rod, 691A.

Stelliting of metals, 505A., 653A.

Still casting, 713A.

Storage batteries, 634A.

Stresses (see also *Internal stress*), local, 602A.

Strontium,

detection, 571A.

estimation, 579A.; microchemical, 585A.

Student members, election, 14, 329.

Sulphur,

estimation in refined copper, 583A.

influence on properties of non-ferrous metals, 482A.

Sulphur-cadmium mixtures, chemical reactions in solid phase, 436A.

Sulphur group, spectrum, fluorescence, 545A.

Sulphuric acid,

action on metals and alloys, 498A.

resistance of metals and alloys, 500A.

Superconduction, 426A.

Surface temperatures, measurement, 617A.

- Surface tension,**
 measurement, 612*A.*; by chainomatic balance, 592*A.*; by ring method, 592*A.*
- Surface tension of—**
 Bismuth, 392*A.*
 Mercury, 392*A.*
 Molten metals and alloys, 392*A.*
- Surf-alloy,** 503*A.*
- Sweden,** manufacture of tin, 750*A.*
- Systems,**
 binary. See *Alloys, binary.*
 ternary. See *Alloys, ternary.*
- Tammann electric furnace,** 721*A.*
- Tantalum,**
 analysis, 566*A.*
 anode films, electrostatic capacity, 632*A.*
 anodic behaviour in dil. sulphuric acid, 628*A.*
 ductile, production, 666*A.*
 estimation, 583*A.*
 incandescent, deviation from Lambert's law, 412*A.*; polarization of light emitted, 412*A.*
 melting point, 408*A.*
 photoelectric emission, 428*A.*
 separation from columbium, 575*A.*
 spectral emissivity as function of temp., 408*A.*
 spectrum, *K*-series emission, 547*A.*;
L-series, precision measurements, 545*A.*
 use, 666*A.*
 wires, tenacity, 418*A.*
- Tellurium,**
 estimation by means of potassium permanganate, 584*A.*; in presence of ferric iron, selenium, and copper, electrometric, 586*A.*; quantitative, 584*A.*; rapid electrolytic, by means of reduced potential, 585*A.*
 spectrum, fluorescence, 545*A.*
- Tellurium-antimony alloys,** magnetic analysis, 42.
- Tellurium-bismuth alloys,** magnetic analysis, 41, 46.
- Tellurium-lead alloys,** magnetic analysis, 43.
- Tellurium-tin alloys,** magnetic analysis, 40.
- Temperature, measurement.** See *Pyrometry.*
- Tempering.** See *Annealing, Heat-treatment, &c.*
- Tensile properties of—**
 Aluminium alloys, effect of atmospheric exposure, 486*A.*
 Aluminium-calcium-silicon alloys, 81.
 Aluminium-silicon alloys, 82.
 Aluminium single crystals, 371*A.*, 372*A.*
 Arsenical copper, 127.
 Copper-arsenic-oxygen alloys, 147.
 Copper-bismuth alloys, 175.
 Magnesium-copper alloys, 95.
 Metals, calculation from Brinell hardness, 608*A.*
 Monel metal at elevated temps., 479*A.*
 Nickel-brasses, 465*A.*
 Sheet metals, effect of size and shape of test-specimen, 607*A.*
 Stainless iron at elevated temps., 479*A.*
 Zinc, effect of cold-rolling, 414*A.*
- Tension testing.** See *Testing.*
- Ternary alloys.** See *Alloys.*
- TESTING, METHODS OF—**
Testing,
 Committee E-1 of A.S.T.M., report, 600*A.*
 compression, A.S.T.M. methods, 610*A.*; theory, 610*A.*
 fatigue, 603*A.*
 general articles, 600*A.*, 601*A.*
 hardness, Brinell method, 604*A.*; 605*A.*, 606*A.*; indentation, 604*A.*, 605*A.*, 606*A.*; of soft metals, 604*A.*; pendulum method, 607*A.*; relation of Brinell to Rockwell numbers, 606*A.*; Rockwell method, 606*A.*; scratch, bibliography, 604*A.*
 impact, replies to questionnaire, 603*A.*; significance, 603*A.*
 instruction in, 601*A.*
 magnetic, 611*A.*
 micro-hardness, 604*A.*
 standardization of methods, 600*A.*
 tension, 607*A.*, 608*A.*; of thin sheet metals, 608*A.*
 tension-elongation diagram, 609*A.*
 terms relating to, definitions, 600*A.*
 torsion, new twist meter for, 602*A.*
 Wöhler fatigue specimens, 603*A.*
- Testing machines,**
 Alternating-stress testing, electro-magnetic, 602*A.*
 Avery universal, 610*A.*
 box measures for, 611*A.*
 Brinell hardness, motor-driven, 605*A.*
 Buckton universal, 610*A.*

Testing, methods of—

- Testing machines,
 - endurance, 609*A*.
 - extensometers for threads and wires, 609*A*.; mechanical autographic, 609*A*.; new type, 609*A*.
- Firth hardnessmeter, 607*A*.
- hardness, 605*A*.; 606*A*.; 607*A*.
- hydraulic, 610*A*.
- impact, calibration, 603*A*.
- spring manometers for, 611*A*.
- straining apparatus for breaking wires and ropes, 601*A*.
- torsion, Amsler, 602*A*.
- verification, A.S.T.M. methods, 610*A*.; 611*A*.

Testing of—

- Brass sheet, 600*A*.
- Castings, 601*A*.
- Hairspring strip, 119.
- Thin sheet metals, 600*A*.

Tests,

- bearing, 610*A*.
- hole shearing, 610*A*.
- impact, notched-bar, value, 603*A*.; repeated, 604*A*.
- notched-bar, comparison of static and dynamic, 609*A*.
- tensile, comparison of static and dynamic, 609*A*.; with notched test-pieces, 609*A*.

Thallium,

- crystal structure, 523*A*.
- electrode potential, 409*A*.
- estimation as thallous chromate, 586*A*.
- latent heat of fusion, 432*A*.
- separation from other elements, 586*A*.
- spectrum, coincidence of some lines of gold, 537*A*.; *K*-series emission, 547*A*.; *L*-series, precision measurements, 547*A*.
- transformation heat, 432*A*.

Thallium amalgams, metallography, 513*A*.**Thallium-bismuth alloys, thermoelectric properties,** 481*A*.**Thermal conductivity.** See *Conductivity*.**Thermal electromotive force of—**

- Bismuth single crystals, 418*A*.
- Cadmium single crystals, 418*A*.
- Single crystals of non-cubic metals, 418*A*.
- Tin single crystals, 418*A*.
- Zinc single crystals, 418*A*.

Thermal expansion. See *Expansion*.**Thermal ionization of elements, experimental proof,** 437*A*.**Thermal treatment.** See *Heat-treatment*.**Thermionic effect, theory,** 429*A*.**Thermocouples (see also *Pyrometers*),**

- metals and alloys for, 616*A*.
- portable device for measurement of surface temps., 617*A*.
- small, construction, 616*A*.
- temp. measurement with, 616*A*.

Thermoelectric effect, 428*A*.**Thermoelectric effect in zinc, single crystals,** 414*A*.**Thermoelectric power of—**

- Aggregates, 481*A*.
- Alloys, 481*A*.
- Antimony, 481*A*.
- Antimony-silver alloys, 481*A*.
- Antimony-tin alloys, 481*A*.
- Bismuth, 481*A*.
- Bismuth-thallium alloys, 481*A*.
- Silver, 481*A*.
- Tin, 481*A*.

Thermoelectric properties of solid solutions, 481*A*.**Thermo-element,**

- German recommended practice, 618*A*.
- vacuum, 617*A*.

Thermometers,

- placing of, 615*A*.
- Quartz-gallium for high temps., 614*A*.
- resistance, calibration at oxygen boiling point and carbon dioxide sublimation point, 614*A*.

- tension and resistance for use in region of temp. of liquid nitrogen and hydrogen, 590*A*.

testing, 614*A*.**Thermometry,** 614*A*.**Thermoregulator,**

- mercury, interruptor for use with, 590*A*.

toluene-mercury, automatic, 590*A*.**Thermoscope for liquid-air baths,** 615*A*.**Thermostat, gas-controlled, prevention of flickering in flames of,** 590*A*.**Thomson effect, influence of strain,** 430*A*.**Thomson effect in tungsten,** 410*A*.**Thorium,**

- book review, 768*A*.
- detection, 568*A*.; drop reactions, 571*A*.; in incandescent filament, 571*A*.

ductile, prepn., 409*A*.**estimation in small quantities,** 587*A*.**radioactivity,** 404*A*.

- spectrum, helium lines in, 546*A*.; lines of transformation products in, 546*A*.; *L*-series, precision measurements, 547*A*.

thermionic emission, 413*A*.

- Thorium - lead alloys**, Ludwig - Soret effect, 484*A*.
- Thorium-X**, estimation, quantitative, 586*A*.
- Tin**,
 anodes, periodic phenomena, 630*A*.
 book review, 768*A*.
 chemical properties, 666*A*.
 conservation in solders and dipping baths, 666*A*.
 deposition at mercury dropping cathode, 626*A*.; electrolytic, 645*A*.
 detection, blowpipe method, 571*A*.
 estimation, electrolytic, 577*A*.; in solder by calculation on the Archimedeian principle, 587*A*.; oxidimetric, by means of bismuth amalgam, 564*A*.
 latent heat of fusion, 431*A*., 432*A*.
 manufacture in Sweden, 750*A*.
 molecular weight, variation with temp., 410*A*.
 molten, elect. resistance, 426*A*.
 occlusion of gases, 436*A*.
 occurrence, 666*A*.
 penetration of brass, 183.
 phosphor-, A.S.T.M. specifications, 666*A*.
 physical properties, 666*A*.
 recovery. See *Detinning*.
 refining, 666*A*.
 removal from tinplate. See *Detinning*.
 single crystals, thermal conductivity, 418*A*.; thermal e.m.f., 418*A*.
 sols, preparation, 436*A*.
 specific heat, 432*A*.
 spectrum, arc, 545*A*.; arc, excitation of enhanced lines, 545*A*.; explosion, self-reversal of lines, 545*A*.; in magnetic field, 545*A*.
 thermoelectric properties, 481*A*.
 titration in white metals with potassium bromide, 586*A*.; potentiometric, with potassium bromate, 587*A*.; with ferric chloride, using indigocarmine as indicator, 587*A*.
 Zeeman effect, 545*A*.; in certain enhanced lines, 545*A*.
- Tin alloys**. See *Babbitt metals*, *Bearing metals*, *Solders*, &c.
- Tin-aluminium-zinc alloys**, corrosion, 454*A*.
 physical properties, 454*A*.
- Tin amalgams**, metallography, 513*A*.
- Tin-antimony alloys**, magnetic analysis, 44.
 thermoelectric properties, 481*A*.
- Tin-bismuth alloys**, magnetic analysis, 36.
 viscosity, 455*A*.
- Tin-cadmium alloys**, eutectic, structure, 108.
- Tin-copper alloys** (see also *Bronzes*), equilibrium diagram, 188.
 eutectic, 188, 235.
 magnetic analysis, 46.
 microstructure, 189.
 viscosity, 455*A*.
- Tin-copper-antimony alloys**, constitution, 477*A*.
- Tin-copper-zinc alloys**, constitution, 465*A*.
 properties, 465*A*.
- Tin-iron alloys**, constitution, 477*A*.
- Tin-lead alloys** (see also *Solders*), eutectic, crystallization, 106 (*Note*); structure, 106, 108.
 Ludwig-Soret effect, 484*A*.
 magnetic analysis, 37.
- Tin-manganese-copper alloys**, properties, 469*A*.
 " Tin sweat," 251.
 uses, 469*A*.
- Tin-tellurium alloys**, magnetic analysis, 40.
- Tin-zinc alloys**, electrical conductivity, 480*A*.
 eutectic, structure, 103, 108.
 thermal conductivity, 480*A*.
- Tinning of—**
 Iron and steel wire, 502*A*.
 Iron castings, 504*A*.
- Tinning**,
 pots, elect. heated, 722*A*.
 processes, comparison of old and new, 503*A*.
- Tinplate**,
 badly produced, dangers, 504*A*.
 corrosion of containers, 491*A*.
 discoloration of canned foods, 666*A*.
 pickling, 748*A*.
 scrap, recovery of tin, 637*A*., 667*A*.
- Titanium**,
 absorption of hydrogen, 413*A*.
 action of oxygen-nitrogen mixtures, 434*A*.
 atomic weight, 410*A*.
 book review, 768*A*.
 detection, drop reactions, 571*A*.
 uses, 668*A*.
- Titanium-aluminium alloys**, compounds, 454*A*.
- Titanium chloride**, analysis, 410*A*.

- Titration.** See *Analysis*.
- Torsion testing.** See *Testing*.
- Torsional vibration**, damping properties of metals in, 602*A*.
- Transmutation of metals**, 439*A*., 440*A*.
- Treasurer's Report**, 9.
- Trouton's law**, extension to fusion of metals, 431*A*.
- Tubes**, condenser. See *Condenser tubes*.
- Tungsten**,
 arc lamps, 668*A*.
 bars, hollowing by central fusion, 411*A*.
 brightness, 410*A*.
 colour temperature, 410*A*.
 density, effect of working, 410*A*.
 detection, 568*A*.
 electrical resistance, 410*A*.; effect of working, 410*A*.
 electrodes, carefully purified, sparking potentials of discharge tubes containing, 412*A*.
 estimation by distillation in current of air and carbon tetrachloride vapour, 586*A*.; in ferro-tungsten by calculation on the Archimedean principle, 587*A*.; in small quantities, 587*A*.; oxidimetric, using liquid amalgams, 563*A*.
 filaments, grain boundary phenomena, 411*A*.; influence of crystal structure on stability of form, 412*A*.; manuf., 668*A*.
 incandescent, deviation from Lambert's law, 412*A*.; polarization of light emitted, 412*A*.
 optical constants, changes with temp., 412*A*.
 oxides, prepn. of chemically pure, 413*A*.
 photoelectric emission, 428*A*.
 physical properties at high temp., 410*A*.; effect of working, 410*A*.
 position in normal potential series, 632*A*.
 powder, A.S.T.M. specifications, 668*A*.
 salts, prepn. of chemically pure, 413*A*.
 single crystal, prepn. of filaments by Pintsch process, 411*A*.; history of development, 411*A*.
 specific heat, 411*A*.
 spectral emissivity, 410*A*.
 spectrum, explosion, 412*A*.; *K*-series, 526*A*.; *K*-series emission, 547*A*.; *L*-series, precision measurements, 547*A*.
- Tungsten**,
 surface, interaction of carbon dioxide and hydrogen on, 412*A*.
 thermal conductivity, 410*A*.
 thermal expansion coeff., 610*A*.
 thermionic and photoelectric emission, concurrent variations with state of surface, 401*A*.
 thermionic emission, 410*A*., 413*A*.
 Thompson effect, 410*A*.
 thoria in, 411*A*.
 total radiation intensity, 410*A*.
 vaporization rate, 410*A*.
 wires, elect. explosion, 412*A*.; tenacity, 418*A*.
- Tungsten-carbon system**, crystal structure, 524*A*.
- Tungsten-cobalt alloys**, constitution, 458*A*.
- Tungsten-cobalt-chromium alloys**. See *Stellite*.
- Tungsten-iron alloys**, constitution, 477*A*.
- Tungsten-molybdenum alloys**, solid solutions, resistance limits, 477*A*.
- Tungsten-nickel alloys**, wires, tenacity, 418*A*.
- Type metal**, melting, elect., 722*A*.
- Undercooling of alloys**, 244.
- United States of America**,
 Bureau of Standards, book review, 782*A*.; chemistry in metallurgical division, 747*A*.
 Chicago University, abstracts of theses, 767*A*.
 Colleges and universities, honours courses in, 755*A*.
 foundry conditions, 703*A*.
 Graduate research students in chemistry, second census, 755*A*.
 National Research Council, list of publications, 756*A*.
- Uranium**,
 isotopes, 413*A*.
 preparation, 750*A*.
 radioactivity, 404*A*.
 spectrum, helium lines in, 546*A*.; lines of transformation products in, 546*A*.; *L*-series, precision measurements, 547*A*.
- Vacuum**, high, production by means of Langmuir's pumps, 593*A*.
- Valves**, design, for pressure of 3½ tons, 674*A*.

- Vanadic acid**, detection by means of hydrogen peroxide, 571*A*.
- Vanadium**,
 absorption of hydrogen, 413*A*.
 estimation, action of potassium iodide on vanadophosphoric acid, 588*A*.
 occurrence, 749*A*.
 spectrum (ionized), multiplets in, 546*A*.
 uses, 668*A*, 749*A*.
- Vanadium, ferro-**. See *Ferro-vanadium*.
- Vanadium-iron alloys**, temper colours, 473*A*.
- Vapour pressure of—**
 Cadmium, adjusted, 415*A*.
 Caesium, 416*A*.
 Copper, 433*A*.
 Gold, 433*A*.
 Liquid and solid metals, 432*A*.
 Potassium, 407*A*, 416*A*.
 Rubidium, 416*A*.
 Sodium, 407*A*, 416*A*.
 Zinc, adjusted, 415*A*.
- Viscosity of—**
 "Aluminium-bronze," 380*A*.
 Bismuth-tin alloys, 455*A*.
 Brasses, 380*A*.
 Copper, 380*A*.; at high temps., 481*A*.
 Copper alloys at high temps., 481*A*.
 Copper-tin alloys, 455*A*.
- Vivian & Co., Ltd., H. H.**, Birmingham works, 747*A*.
- Volatilization of metals from elect.** heated filaments, book review, 772*A*.
- Voltmeters**,
 permanent magnet, 599*A*.
 triode, 599*A*.
- Wash-bottles**, non-spattering, continuous-stream, 589*A*.
- Wasters**, 712*A*.
- Watson electric furnace**, 304.
- Welded joints**,
 strength, 686*A*.
 tests required by British Admiralty and Lloyd's Register of Shipping, 689*A*.
- Welded pressure vessels**, safety, 684*A*.
- Welders**, eye protection, 687*A*.
- Welding**,
 acetylene, dissolved, 698*A*.; dry, 697*A*.; explosions, 698*A*.; production, 697*A*.; purification, 697*A*.
 acetylene generators, improvements, 696*A*, 697*A*.
 added metals in, 690*A*.
- Welding**,
 autogenous, recommendations of 8th Federal Congress of Italian Association of Steam Boiler Users, 687*A*.
 blowpipes, care in handling, 693*A*.; consumption of acetylene, 694*A*.; essential innovation, 694*A*.; improvement, 693*A*.; increasing yield, 694*A*.; oxy-acetylene flame and yield, 693*A*.; return of oxygen, 694*A*.
 book review, 773*A*.
 bronze rod, 684*A*.
 electric arc, 688*A*.; as manufacturing process, 689*A*.; controller, 692*A*.; deposit efficiency of electrodes, 691*A*.; ductile welds, 689*A*.; factors affecting arc stability, 691*A*.; factors affecting penetration, 689*A*.; heat distribution in arc, 689*A*.; in locomotive works, 686*A*.; of easily oxidizable wires, 691*A*.; transformers, 691*A*.
 electrodes, copper-tungsten, 691*A*.; efficiency, 691*A*.; metallic, value of current when using, 692*A*.; steel, effect of surface, 691*A*.
 examples, 684*A*, 685*A*.
 department, centralized, 685*A*.
 discussion, 686*A*.
 filler rod, 690*A*.
 flux powders with aluminium content, 691*A*.
 gas cylinders, second report of research ettee., 696*A*.; Swiss regulations, 695*A*.
 gas outlets, prevention of freezing up, 693*A*.
 gas regulators, consumption pressure gauge 695*A*.; improvements, 694*A*.
 Liverpool school, 685*A*.
 machine, Seneca, 693*A*.; at British Industries Fair, 693*A*.; efficiency, 692*A*.; for India, 692*A*.; portable, 693*A*.; Westinghouse automatic, 693*A*.; Wilson, 693*A*.
 oxy-acetylene, 688*A*.
 oxy-benzol, 688*A*.; apparatus, 695*A*.
 oxygen, cost, 696*A*.; production, 696*A*.
 oxygen cylinders, handling, 696*A*.
 preparation of materials, &c., 687*A*.
 scientific supervision, 685*A*.
 shops, distribution of oxygen, 695*A*.
 spot, Amesweld machine, 692*A*.; Gibb air-operated machine, 692*A*.; machines, 689*A*.

- Welding,**
 Stellite rod, 690*A.*
 use of atomic hydrogen, 689*A.*, 690*A.*
Welding of—
 Aluminium, 680*A.*, 681*A.*, 682*A.*;
 autogenous, 680*A.*, 681*A.*
 Aluminium alloys, autogenous, 681*A.*
 Cans, barrels, or tanks, fire risks,
 684*A.*
 Copper, 682*A.*, 683*A.*; autogenous,
 683*A.*; oxy-acetylene, 682*A.*,
 683*A.*
 Duralumin, 682*A.*
 Lead, autogenous, 684*A.*
 Sheet metal structures, 685*A.*
Wheatstone bridge, control key,
 598*A.*
White metals (see also *Babbitt metals*
 and under names of constituent
 metals),
 bearing alloys, fluidity tests, 477*A.*
 melting, elect., 722*A.*
Wire,
 electric, manuf., 699*A.*
 electrically exploded, 553*A.*, 554*A.*
 hard-drawn, crystal structure, 517*A.*
 rings, former, 699*A.*
 screen cloth, mounting for corrosion
 tests, 676*A.*; specifications, 676*A.*
Wire gauges,
 indicator for, 749*A.*
 unification, 748*A.*
Worked metals, distribution of energy
 in, 379*A.*
- X-ray crystal analysis.** See *Crystal structure.*
X-ray crystal structure. See *Crystal structure.*
X-ray spectra. See *Spectra.*
X-ray spectrograph. See *Spectrograph.*
X-ray Spectrometer. See *Spectrometer.*
X-rays. See *Rays, Röntgen.*
X-rays, examination of metals by. See *Radiology.*
- "Y" aluminium alloys** See *Aluminium alloys.*
Yield point, 422*A.*
Yttrium,
 magnetic susceptibility, 416*A.*
 preparation, 413*A.*
 properties, 413*A.*
Yttrium oxide, pure, preparation,
 575*A.*
- Zeeman effect,** phenomena accompany-
 ing observed in weak magnetic
 fields, 552*A.*
Zeeman effect in—
 Antimony, 545*A.*
 Bismuth, 545*A.*
 Lead, 545*A.*
 Tin, 545*A.*; (certain enhanced lines),
 545*A.*
- Zinc,**
 action of cement, 497*A.*
 allotropy, 415*A.*
 anodes, periodic phenomena, 630*A.*
 British specifications, 668*A.*, 669*A.*
 coarse-grained, plastic deformation,
 414*A.*
 coatings, 502*A.*, 503*A.*; micro-
 structure, 513*A.*; Preece test,
 503*A.*
 corrosion, atmospheric, 493*A.*; effect
 of temp. on liberation of hydrogen
 by, 492*A.*; in alkaline solns.,
 493*A.*
 deposition from electrolytes contain-
 ing gelatine and aluminium sul-
 phate, electrolytic, 645*A.*; from
 sulphate baths, electrolytic, 645*A.*;
 on positive pole of simple voltaic
 cell, 645*A.* See also *Galvanizing.*
 deposition potential in zinc sul-
 phate soln., influence of proportion
 of gelatine in electrolyte, 645*A.*
 detection, qualitative, potassium co-
 balticyanide as reagent, 571*A.*
 dissolution in hydrochloric acid,
 492*A.*; sulphuric acid, 492*A.*
 dust, passivity, 669*A.*
 electrical resistance down to 1.3° C.,
 387*A.*
 electrodes, polarization in neutral
 and acid solns. of zinc salts by
 d.c. and a.c., 626*A.*
 electrolytic, 25 years' progress, 635*A.*
 estimation, gravimetric, by means of
 cyanamide, 588*A.*; microchemical,
 use of pyrophosphates, 582*A.*;
 titrimetric, 588*A.*
 estimation of cadmium, 578*A.*
 evaporation, effect of cold-working,
 422*A.*
 latent heat of fusion, 431*A.*, 432*A.*
 metallurgy in Tonkin, China, 751*A.*
 molten, elect. resistance, 426*A.*
 occlusion of gases, 436*A.*
 optical constants, 429*A.*
 overvoltage, hydrogen, 629*A.*; in
 liquid ammonia and in water, 628*A.*
 oxide, free energy of formation,
 415*A.*

- Zinc,**
 photoelectric emission, 428*A*.
 poisoning, 753*A*., 754*A*.
 production, electrolytic, 635*A*.
 pure, chem. properties, 414*A*.; comparison with commercial grades, 414*A*.; phys. properties, 414*A*.; properties at normal and elevated temps., 415*A*.
 recovery, 751*A*.
 rolled, proposed outline for specifications, 669*A*.
 roofing, 670*A*.
 separation from arsenic, 572*A*.; from copper, 575*A*.; from nickel with hydrogen sulphide, 575*A*.
 single crystals, behaviour under stress, 414*A*.; thermal conductivity, 418*A*.; thermal e.m.f., 418*A*.; thermal expansion, 415*A*.; thermoelect. effect, 414*A*.; thermoelect. properties, 415*A*.; twinning, 417*A*.
 slab, impurities, 670*A*.
 sols, preparation, 436*A*.
 solution in acids, catalytic action of metals on, 492*A*.
 specifications, British standard, 758*A*.
 specific heat, 432*A*.
 spectrum, effect of elect. field, 546*A*.; new line, 546*A*.; new terms, 547*A*.; radiation emitted by optically excited vapour, 546*A*.; resonance lines, 535*A*.; under heavy current excitations, 553*A*.
 tensile strength, effect of cold-rolling, 414*A*.
 titration, electrometric, 588*A*.; visual conductometric, 588*A*.
 twinning, 417*A*.
 uses, 670*A*.
 vapour, equilib. with carbon monoxide and carbon dioxide, 415*A*.
 vapour pressure, adjusted, 415*A*.
 workers, occupational syndrome among, 753*A*., 754*A*.
Zinc ague, 754*A*.
Zinc alloys, for die-casting, résumé of work of Cttee. of Deutsche Gesellschaft für Metallkunde, 478*A*.
Zinc-aluminium alloys, transformation in solid state, 478*A*.
Zinc - aluminium - cadmium alloys, mechanical properties, 448*A*.
Zinc-aluminium-tin alloys, corrosion, 454*A*.
 physical properties, 454*A*.
Zinc-antimony alloys, magnetic analysis, 40.
Zinc-bismuth alloys, electrolysis, 478*A*.
Zinc-cadmium alloys, constitution, 478*A*.
 electrolysis, 478*A*.
 eutectic, formation of twin deformations, 483*A*.; structure, 108.
Zinc-copper alloys (see also *Brasses*), α -solid solution, diffusion of zinc, 462*A*.
 constitution, 462*A*.
 electrode potential, 463*A*.
 hardness, 463*A*.
 magnetic analysis, 45.
 solid solutions, thermoelect. properties, 481*A*.
Zinc-copper-manganese alloys, constitution, 465*A*.
Zinc-copper-tin alloys, constitution, 465*A*.
 properties, 465*A*.
Zinc-gold alloys, compound AuZn, atomic structure, 531*A*.
Zinc-lead alloys, electrolysis, 478*A*.
Zinc-lead-antimony alloys, constitution, 467*A*.
Zinc - magnesium alloys, compound MgZn₂, influence on ageing capacity of aluminium alloys, 452*A*.
Zinc - magnesium - aluminium alloys, mechanical properties, 663*A*.
Zinc-manganese-copper alloys, properties, 469*A*.
 uses, 469*A*.
Zinc-tin alloys, electrical conductivity, 480*A*.
 eutectic, structure, 103, 108.
 thermal conductivity, 480*A*.
Zirconia. See *Refractory materials*.
Zirconium, atomic weight, 415*A*.
 book review, 768*A*.
 detection, 568*A*.; drop reactions, 571*A*.
 modification changes, 415*A*.
 possible uses, 670*A*.
 precipitation with picric acid, 588*A*.
 separation from iron, 575*A*.; from other metals by fractional distillation, 575*A*.; from titanium, 575*A*.
 thermionic emission, 413*A*.

NAME INDEX.

[The letter "A." following a page number denotes a reference to the section of the Journal dealing with abstracts, &c.]

- Abate, W. L.** Managing a brass shop, 749A.
- Abbink, J. H.** See Dorgelo, H. B.
- Abel, E., and O. Redlich.** Ternary system Pb-Sb-As, 467A.
- Aborn, Robert H.** See Frölich, Per K.
- Adam, R.** Detection and detn. of impurities in Al and its alloys by spectrographic method, 568A.
- Adams, F. W., and R. H. Kean.** Measurement of surface temps. II.—Comparison of various methods, 617A.
- Adcock, F.** Alloys of Fe research. V.—Prepn. of pure Cr, 377A.
- Addicks, Lawrence.** Electrolytic refining during past 25 years, 636A.
- Adinolfi, E.** Influence of X-rays on crystn. of Bi, 375A.
- Agassiz, R. L.** Progress of metals in 1925. Outlook for 1926, 745A.
- Agt, F. P. G. A. J. van.** See Keesom, W. H.
- A'Hearn, F. M.** Shrinking a cylinder on brass liner, 662A.
- Aitchison, Leslie.** Steel and light alloys as engineering materials, 649A.
- Alexander, Alexander.** Obituary notice, 351.
- Alexander, George James.** Cu at low temps., 380A.
- Allen, Norman Percy.** Elected member, 16.
- Allen, R. H.** Radiation, 648A.
- Allen, S. J. M.** Absorption of X-rays of wave-length down to 0.08 Å., 552A.
- Allmand, A. J., and H. C. Cocks.** Effect of superposed a.c. on polarizable primary cell, Zn-H₂SO₄-C. II.—H.-F. current, 627A.; polarization of Zn electrodes in neutral and acid solns. of Zn salts by d.c. and a.c.—I., 626A.
- Althammer, W.** Graphical representation of quaternary and quinary systems, 485A.
- Altwickier, Hubert.** Influence of CuO₂ on electrolytic and refined Cu, 382A.
- Améen, E., and H. Willners.** Mould gases of iron, 748A.
- Anderson, C. Travis.** See Maier, Charles G.
- Anderson, D. G., and A. N. Ogden.** Foundry blacking, 706A.
- Anderson, D. S.** *Correspondence on* "The Penetration of Mild Steel by Brazing Solder and Other Metals," 237.
- Anderson, Robert J.** Al alloy permanent-mould castings, 715A.; atomic picture of Duralumin and its crystal structure, 521A.; mech. properties of Duralumin sheet as affected by heat-treatment, 450A.; outlook for Al, 646A.; prodn. of secondary Al and Al alloys from scrap, 704A.
- Anderson, W. Y., and W. P. Conly.** Elect. resistance furnaces, 725A.
- Andrade, E. N. da C.** Book: "The Structure of the Atom," 757A.
- Andreevsky, A.** See Ipatief, V.
- Andrews, E.** Al paint, 648A.; welding, 686A.
- Andrews, Jas. P.** Appn. of diffraction halos to electricity, 601A.
- Anfilogoff, N. L.** See Partington, J. R.
- Ångström, Tord K.** Light alloys in aeronautical design, 447A.
- Anrep, G. V., and A. C. Downing.** Quant. measurement of quick changes in outflow of liquids, 594A.
- Arakatsu, Bunsaku.** Reversal of lines in explosion spectrum of Pb, 538A.
- Arakatsu, Bunsaku, and Masaru Shoda.** Self-reversal of lines in explosion spectrum of Sn, 545A.
- Archbutt, S. L.** Al alloy castings, 713A.; *discussion on* "Note on the Magnesium-Rich Magnesium-Copper Alloys," 101; *discussion on* "The Mechanism of Inverse Segregation in Alloys," 275.

- Archer, R. M.** Some sensitive reflecting flowmeters, 594*A*.
- Archer, Robert S.** Hardening of metals by dispersed constituents pptd. from solid solns., 479*A*.
- Archer, Robert S.,** and L. W. Kempf. Modification and properties of sand-cast Al-Si alloys, 453*A*.
- Arkel, A. E. van,** and I. H. de Boer. Sepn. of Zr from other metals, including Hf by fractional distillation, 575*A*.
- Arkel, A. E. van,** and M. G. von Bruggen. Recrystn. phenomena in Al, 517*A*.
- Arkel, A. E. van,** and P. Koets. Nature of recrystallization nuclei in metals, 518*A*.
- Armstrong, E. F.,** and T. P. Hilditch. Catalysis by solid surfaces, 438*A*.
- Arnatt, Robert Francis.** Elected student member, 330.
- Arndt, H.** *See* Bauer, O.
- Arrouet, Marcel.** Miguet electrode and Miguet furnace, 721*A*.
- Asterblum, Maria.** Duration of phosphorescence of Hg vapour, 393*A*.
- Aston, F. W.** Mass spectra and isotopes, 524*A*.
- Atchison, Charles Foster.** Elected member, 16.
- Ato, Sunao,** and Isaburo Wada. Analysis of alkali group, 567*A*.
- Aubel, Edm. van.** Thermoelect. power of alloys, 481*A*.
- Aubel, Paul K.** *See* Rouse, Edwin W.
- Aupperle, James A.** Protective coatings for metals.—I.—III., 506*A*.
- Austin, Harold Samuel.** Elected member, 16.
- Austin, J.** Methods of preventing corrosion of condenser tubes, 508*A*.
- Austin, Leonard S.** Book: "The Metallurgy of the Common Metals," 757*A.*, (review) 784*A*.
- Avery, J. W.,** and C. J. Smithells. Effect of working on phys. properties of W, 410*A*.
- Awbery, J. H.,** and Ezer Griffiths. Latent heat of fusion of some metals, 431*A*.
- Aydelotte, Frank.** Honours courses in American colleges and universities, 755*A*.
- Bablik, Heinz.** Detn. of quality of Zn coatings, 503*A.*; modern galvanizing practice, 502*A.*; Preece test, 503*A*.
- Bachmann, W.,** and C. Brieger. Heat of wetting of oils and metals and its relationship to lubricating power, 381*A*.
- Bacon, V. R.** Design of tubular Cu buses, 656*A*.
- Badger, Richard M.** New sputtering apparatus, 595*A*.
- Bailey, (Miss) Ethel H.** Elected member, 329.
- Bailey, G. L.** Discussion on "The Mechanism of Inverse Segregation in Alloys," 276.
- Bailey, T. Lewis.** Metal pickling, 748*A*.
- Baillet, A.** Prepn. of moulding sands in foundry, 708*A*.
- Bain, Edgar C.** Atomic behaviour of hardenable Cu alloys, 522*A*.
- Bain, Edgar C.,** and William E. Griffiths. Fe-Cr-Ni alloys, 457*A*.
- Baker, Herbert Brereton.** *See* Riley, Harry Lister.
- Baker, T. B.** Hg contact switches and connecting boards, 664*A*.
- Baker, T. Y.** Optical multiplier, 596*A*.
- Balasse, G.** Luminescence of K vapour produced by electrodeless discharge, 542*A*.
- Balasse, G.,** and O. Goche. Spectrum of luminescence of Cs produced by electrodeless discharge, 535*A*.
- Balke, C. W.** Prodn. and uses of ductile Ta, 666*A*.
- Ballay, M.** Ludwig-Soret phenomena in alloys, 484*A*.
- Bamford, Percy George.** Elected member, 16.
- Bamford, T. G.,** and Harold Harris. Book: "The Metallurgist's Manual," 757*A.*, (review) 783*A*.
- Bancroft, Wilder D.** 25 years of theoretical electrochemistry, 621*A*.
- Banlier, M. A.** Lightening of automobile vehicles by use of light metals, 652*A*.
- Banner, E. H. W.** Single control bridge key, 598*A*.
- Bannister, C. O.** *See* Garland, H.
- Barclay, W. R.** Discussion on "Electric Furnaces in Non-Ferrous Metallurgy," 302; production of Ni, 750*A*.
- Bardet, J.,** and C. Toussaint. Sepn. of Hf and arc spectrum of this element, 573*A*.
- Bardwell, E. S.,** and Roy H. Miller. Pulverized coal as fuel for Cu-refining furnaces, 732*A*.

- Barkas, Wilfred W.** Photophoresis of colloidal particles in aqueous solns., 436A.
- Barkla, C. G., and S. R. Khastgir.** Scattered X-rays. *J* phenomenon.—IV., 552A.
- Barkla, C. G., and Gladys I. Mackenzie.** Scattered X-rays. *J* phenomenon.—VII., 552A.
- Barkla, C. G., and W. H. Watson.** Control of *J* phenomenon.—VI., 552A.
- Barlow, Alfred Charles.** Elected member, 329.
- Barr, William M.** Causes of pitting and corrosion in loco. boilers, 496A.
- Barratt, T., and R. M. Winter.** Thermal conductivity of wires, 430A.
- Barrows, Walter S.** Building Ni plating tank, 644A.; cleaning systems, 640A.; doubling life of iron dipping baskets, 641A.; mechanical electroplating of metal, 638A.; Ni anodes and their use, 625A.; obtaining durable Ni deposits, 644A.; plating generator, 640A.; producing colour combinations, 639A.; protecting metal against corrosion, 509A.; regulating plating solns., 639A.; research needed in spotting out troubles, 640A.; treating cyanide sores, 640A.
- Barton, A. W.** Existence and half-period of RaC, 404A.
- Barton, Francis Rickman.** Elected member, 15; book: "Nickel Coinage," 758A.
- Bary, Jean.** See Cournot, Jean.
- Bassett, W. H.** Be-Cu alloys, 460A.; non-ferrous alloys for severe service in chem. industries, 497A.
- Bassett, W. H., and H. A. Bedworth.** Estimation of O and S in refined Cu, 583A.
- Bassett, W. H., and J. C. Bradley.** Action of reducing gases on heated Cu, 383A.; exudations on Cu castings, 383A.
- Batchelor, Roger P., J. William Fehnel, Robert M. Thomson, and Katherine R. Drinker.** Clinical and lab. investigation of effect of metallic Zn, of zinc oxide, and of zinc sulphide upon health of workmen, 754A.
- Baud, Paul.** Book: "Chimie industrielle," 758A.
- Bauer, O.** Behaviour of Fe, red-brass, and brass in salt water at ordinary temp. and at temps. and pressures in boiler, 489A.
- Bauer, O., and H. Arndt.** Action of Zn, Sn, Al, and Mg on Cu contg. cuprous oxide, 380A.
- Bauer, O., and O. Vollenbruck.** Detns. of hardness and measurements of potential with Zn-Cu alloys, 463A.
- Bauer, O., O. Vogel, and K. Zepf.** Behaviour of Fe, red-brass, and brass towards salts and salt mixtures contained in alk. sewage at ordinary temps. and at temps. and pressures in boiler, 489A.
- Baum, Theodor.** Explanation of phenomena of cathode sputtering, 441A.
- Baumann, Richard.** Hardness and tensile strength, 608A.; hardness of soft metals, 604A.; instruction in testing of materials, 601A.; tensile strength and hardness of light metals and brass, 464A.
- Baw, Hla.** Elected member, 16.
- Bawden, A. T.** See Foulk, C. W.
- Baxter, Gregory Paul.** 32nd annual report of Cttee. on atomic wts. Detns. published in 1925, 425A.
- Baxter, Gregory Paul, and Albert Quigg Butler.** Revision of at. wt. of Ti. Analysis of titanium tetrachloride.—II., 410A.
- Bayerle, V.** Researches with Hg dropping cathode. V.—Deposition of As, Sb, and Bi, 625A.
- Baylis, J. R.** Effect of temp. on liberation of H gas by corrosion of Fe and Zn, 492A.
- Beals, C. S.** Regularities in spectrum of ionized Ag, 544A.
- Beams, J. W.** Time interval between appearance of spectrum lines in spark and in condensed discharges, 550A.
- Beams, J. W., and P. N. Rhodes.** Time intervals between appearance of certain spectrum lines of He and of Hg, 541A.
- Bean, R. D.** Use of pyrometers in casting of non-ferrous metals, 615A.
- Bearden, J. A.** Measurements and interpretation of intensity of X-rays reflected from NaCl and Al, 374A.
- Bechert, K., and L. A. Sommer.** Arc-spectrum of Ni, 542A.
- Beck, F. W.** Screen holder for photomicrography, 515A.
- Beck, Guido.** Theory of photoelect. effect, 428A.

- Beck, R.** Duralumin, 450*A*.
Becker, August. *See* Lenard, Philipp.
Becker, Karl. Röntgenographic detn. of coeff. of linear expansion, 610*A*.; röntgenographic method for detn. of coeffs. of thermal expansion at high temps., 610*A*.
Becker, R. Plasticity, strain-hardening, and recrystn., 421*A*.
Beckinsale, S. *See* Moore, H.
Bedford, Eustace J. Prodn. of pressure die-castings.—I., 716*A*.
Bedreag, C.-G. Physical system of the elements, 444*A*.
Bedworth, Herbert Arthur. Elected member, 329; *see* Bassett, W. H.
Beebe, Ralph Alonzo. Heat absorption of CO on Cu catalyst, 384*A*.
Beese, Norman C. *See* Sawyer, Ralph A.
Béhounek, F. Origin of penetrating radiation of atmosphere, 390*A*.
Bekier, E., and St. Treciak. Velocity of soln. of Cu in aqueous solns. of ferric chloride, 381*A*.
Belaiew, N. T. *Discussion on* "Note on the Crystallization of the Lead-Tin Eutectic," 109; *discussion on* "The Penetration of Mild Steel by Brazing Solder and Other Metals," 229.
Benedetti-Pichler, A. Qual. micro-analysis. I.—Potassium cobalticyanide as reagent in qual. detection of Zn and Bi, 571*A*.; qual. micro-analysis. II.—Method of carrying out Bi reaction of Vanino-Treubert, 569*A*.
Benedicks, Carl. Book: "Metallographic Researches," 758*A*., (review) 777*A*.; high-power microscopy, 512*A*.
Benedicks, Carl, and Per Sederholm. Abnormal expansion of Invar, 472*A*.
Benedict, W. Bearing metal to withstand high loads, 646*A*.
Bengough, G. D., and J. M. Stuart. Anodic oxidation of Al and its alloys as protection against corrosion, 486*A*.
Bengough, G. D., and H. Sutton. Protection of Al and its alloys against anodic corrosion, 507*A*.
Bengtsson, Ernest, and Erik Svensson. Conditions of appearance and structure of bands of Ag between λ 3330 and λ 3358, 544*A*.
Bennett, Ellis Haslam. Elected member, 15.
Bennington, E. T. Handling materials in foundry, 705*A*.; lifting loads that slow up prodn., 705*A*.
Bent, H. E., and G. A. Hunt. Non-spattering, continuous stream wash-bottle, 589*A*.
Bentley, Hubert. Footstep bearings, 646*A*.
Benton, Arthur F. Adsorption of gases by platinum black, 476*A*.; gel of metallic Pt, 401*A*.
Beresovski-Chestov, Tatiana. Book: "Statistique intellectuelle de la France," 758*A*.
Berg, Otto. Röntgen spectroscopy and discovery of new elements, 548*A*.; X-ray spectroscopy and detection of eka-manganeses, 560*A*.
Berg, Otto, and Ida Tacke. Eka-manganese. II.—X-ray spectroscopic part, 385*A*.
Berg, O. W. *See* Gleditsch, (Mlle.) E.
Berg, R. New methods for sepn. and detn. of metals by help of ortho-hydroxyquinoline. I.—Sepn. and detn. of Cu, 580*A*.
Bergeon, Paul. 100,000 amp. furnace at St. Julien de Maurienne, 722*A*.; power factor of elect. furnace, 724*A*.
Bergeon, Paul, and ——— Bunet. Furnaces for electrochemistry, 721*A*.
Berger, M. Hydraulic testing and breaking machine, 610*A*.
Bergkamp, Erich Schwarz. Kuhlmann micro-balance. Use of porcelain, quartz, and glass filtering crucibles in microchem. analysis, 561*A*.
Bergstrom, F. W. Displacement of metals from solns. of their salts by less electropositive elements. III.—Action of liquid ammonia solutions of salts of alkali and alk. earth metals on Mg and other elements, 441*A*.
Berkmann, Sophie, J. Böhm, and H. Zocher. Anisotropic Cu, Ag, and Au, 380*A*.
Bernal, J. D. Interpretation of X-ray, single crystal, rotation photographs, 550*A*.
Bernhardt, Fritz. Experiments relating to transformation of Hg into Au, employing high-pressure Hg arc lamp, 440*A*.
Berry, E. R. Clear fused quartz, 743*A*.
Berthelot, J. *See* Marie, C.
Berthenod, J. Vector diagram for elect. furnaces, 724*A*.

- Beyne, Edgar.** Detn. of Zn by titrimetry, 588A.
- Bhatnagar, S. S.,** Mata Prasad, and D. M. Mukerji. Effect of light on interaction of water and Na and K amalgams, 470A.
- Bidwell, C. C.** Thermal conductivity of Li and Na by modified Forbes bar method, 391A.
- Bieler, E. S.** Band spectra of Pb isotopes, 538A.
- Bierbaum, Christopher H.** *Correspondence on "The Mechanism of Inverse Segregation in Alloys,"* 281.
- Billaz, A.** Zn and problem of corrosion, 493A.
- Binns, Fred.** Elected student member, 330.
- Birch, E. W.** See Richardson, D.
- Bird, R. M.** Mining and prepn. of Eastern moulding sands, 708A.
- Blain, Ray.** Soldering, 680A.
- Blake, F. C.,** James Lord, and A. E. Focke. Solid solns. of Cr and Ni and of Fe and Ni, 470A.
- Blankenstein, Friedr.** See Scheel, Karl.
- Blau, Ernst.** Electrode regulation in elect. arc furnaces, 725A.
- Blazey, Clement.** Cu and cuprous oxide, 383A.; *paper on "Brittleness in Arsenical Copper,"* 51.—*Discussion:* R. Genders, 65; N. F. S. Hubbard, 65; J. H. Grant, 66; R. Lloyd Gibbins, 66.—*Correspondence:* F. Johnson, 67.
- Blechschiidt, Erich.** Cathode dispersion in relation to working conditions. Cathode dispersion problems.—II., 442A.
- Bleeker, (Miss) C. E.** Flame spectra and chem. reactions, 554A.
- Bliss, Orville J.** Elected member, 330.
- Blum, William.** Cr plating is expanding, 642A.; future trends in electrochemistry, 621A.; teaching principles of deposition, 637A.; see Thomas, C. T.
- Blum, William,** and H. S. Rawdon. Principles of electrolytic studies on corrosion, 494A.
- Blumer, Hans.** Scattering of light by small spheres, 515A.
- Bode, Kurt.** See Ruer, Rudolf.
- Bodenstein, Max.** Theory of catalytic hydrogenation by Pt, 400A.
- Bodenstein, Max,** O. Hahn, O. Hönigschmidt, R. J. Meyer. Seventh Report of German Atomic Weight Cttee., 425A.
- Boer, J. H. de.** See Arkel, A. E. van.
- Boer, J. H. de,** P. Clausius, and G. Zecher. Simple method of prepn. of small quantities of K, Rb, or Cs, 404A.
- v. Bogandy, St.,** and M. Póányi. Rapid analysis of brass, 566A.
- Boggio-Lera, Enrico.** See Piutti, Arnaldo.
- Bogitch, B.** Granulation of slags, 710A.; granulation of slags and metals, 748A.; removal of Fe from Cu and Ni mattes, 749A.
- Böhm, J.** Weissenberg Röntgen goniometer, 595A.; see Berkmann, Sophie.
- Böhm, J.,** and O. Hassel. Crystal structure of CaSi_2 , 521A.
- Böhm, W.** See Schurmann, E.
- Böhnke, Paul.** Light metals—steels, 649A.
- Bolton, T.** Elected Vice-President, 13.
- Bondarenko, Gregor W.** Elected member, 15.
- Bonsack, W.** System Sn-Cu-Sb, 477A.
- Booze, M. C.** Foundry refractories, 737A.; refractories for blast-furnaces and coke-ovens, 736A.
- Born, Max.** Book: "The Mechanics of the Atom," 758A.
- Bornet, L.** Coloured reactions of cyanogenine with heavy metals, 567A.
- Bothe, W.** Attempt to affect magnetically the Compton effect, 550A.; polarization of scattered X-rays, 549A.
- Botschwar, A. A.** Relation of temp. of commencement of grain formation to m.p. of metals, 419A.
- Böttger, Kurt,** and Wilhelm Böttger. Iodometric detns. III.—Reaction between atmospheric oxygen and acid iodide solns., 576A.
- Böttger, Wilhelm.** See Böttger, Kurt.
- Bouldoires, Jean.** Transformations of Al-bronzes, 458A.
- Boutaric, A.** Book: "La Physique moderne et l'électron," 758A.
- Bowden, F. P.** See McAulay, A. L.
- Bowen, I. S.,** and S. B. Ingram. Wavelength standards in extreme ultra-violet spectra of C, N, O, and Al, 533A.
- Bowen, I. S.,** and R. A. Millikan. Series spectra of beryllium BeI and Be_{II} , 534A.; stripped Yt (Y_{III}) and Zr (Zr_{IV}), 546A.
- Bowen, Joseph Cecil.** Elected member, 329.

- Boyd, R. A.** See Jauncey, G. E. M.
- Boyer, M. W.,** and J. Buss. Measurement of surface temps. I.—Portable thermocouple device compensated for heat losses, 617*A*.
- Boyer, Sylvester.** High-temp. thermometer, 614*A*.
- Boynton, H. C.** Report of Cttee. E-4 of A.S.T.M. on metallography, 510*A*.
- Brace, P. H.** *Correspondence on* "Electric Furnaces in Non-Ferrous Metallurgy," 324.
- Bradley, J. C.** Relation of annealing temp. to conductivity of Cu wire, 382*A*.; see Bassett, W. H.
- Bradley, M. J.,** C. Z. Rosecrans, and R. M. Corbin. Theoretical and recorded pressures in oxygen bomb detns., 731*A*.
- Bradley, W. M.** See Foote, H. W.
- Bragg, W. L.** X-ray analysis of crystal structures and its relation with chem. constitution, 516*A*.
- Brallier, Paul S.** Chlorination of metals, 435*A*.
- Braly, Ad.** New blowpipe method for detection of Sn in minerals, 571*A*.; rapid distinction of grains or foil of Pt, Pd, Pt-Ir, and osmiridium by pyrognostic reactions, 570*A*.
- Brandt, L.** New methods of detg. Cu, As, and Hg, 580*A*.
- Bray, John Leighton.** Elected member, 16.
- Braymer, D. H.** See Roe, A. C.
- Bredemeier, H.** Thermodynamical treatment of appearance of miscibility gaps and compds. in solid solutions, 484*A*.
- Bregman, Adolpf.** Recovery of scrap Cu, 748*A*.
- Breit, G.** Appn. of Pauli's method of co-ordination to atoms having 4 magnetic parts, 531*A*.
- Breitinger, G.** See Grube, G.
- Brennen, Helbert.** Isotopes of Pb, 390*A*.
- Bressier, J.** See Fabrègue, —.
- Brett, C. W.** Reclamation of defective castings, 685*A*.
- Brezina, J.** Researches with Hg dropping cathode. VI.—Electrodeposition of Mn and complexity of Mn ions in ammoniacal soln., 625*A*.
- Bridgman, P. W.** Thermal conductivity and thermal e.m.f. of single crystals of several non-cubic metals, 418*A*.
- Brieger, C.** See Bachmann, W.
- Briggs, Dennis Brook.** Book: "Quantitative Analysis," 758*A*.
- Briggs, G. H.** Straggling of α -particles from RaC, 404*A*.
- Brillouin, Marcel.** Plasticity of solids, 421*A*.
- Briscoe, Henry Vincent Aird,** Percy Lucock Robinson, and George Edward Stephenson. Elect. explosion of tungsten wires, 412*A*.
- Britton, George T.,** and James W. McBain. Amalgams of Au and Hg, 469*A*.
- Britton, Hubert Thomas Stanley.** Electrometric studies of pptn. of hydroxides. I.—Pptn. of magnesium, manganese, ferrous, cobalt, nickel, and thorium hydroxides by use of hydrogen electrode, 558*A*.; II.—Pptn. of hydroxides of Zn, Cr, Be, Al, bivalent Sn, and Zr by use of hydrogen electrode, and their alleged amphoteric nature, 558*A*.; III.—Pptn. of cerite group of rare earths and of yttrium hydroxide by use of hydrogen electrode, 559*A*.; IV.—Pptn. of mercuric, Cd, Pb, Ag, cupric, uranic, and ferric hydroxides by use of oxygen electrode, 559*A*.
- Briwul, A. A.** Modification of method of detg. sulphate according to Jellinek, 585*A*.
- Brockman, C. J.** 25 years of electrochemistry, 621*A*.
- Brode, Robert B.** Absorption coeff. for slow electrons in Hg vapour, 540*A*.
- Broder, J.** See Moscicki, I.
- Bronn, J.** High-frequency furnaces, 726*A*.
- Brookland, Julius Lucretius.** Elected member, 16.
- Brown, David.** Elected student member, 15.
- Brown, Denton J.** Electrolytic sepn. of metals, 572*A*.
- Brown, E. W.** Pb poisoning among oxyacetylene welders in scrapping naval vessels, 751*A*.
- Browning, B. L.** See Schrenk, W. T.
- Brownsdon, H. W.** *Discussion on* "Electric Furnaces in Non-Ferrous Metallurgy," 300; *discussion on* "Penetration of Brass by Tin and Solder," 230.
- Bruère, P.** Construction of stable colorimetric standards for use in measurement of pH values, 623*A*.ⁿ

- prepn. of colorimetric standards for rapid examination of weakly acid or alk. zone, 623*A*.
- v. Bruggen, M. G.** See Arkel, A. E. van.
- Bruhns, G.** New precision burettes, 589*A*.
- Bruin, T. L. de.** Spectrum of ionized K, 542*A*.
- Brükl, Alfred.** See Moser, Ludwig.
- Brunetti, Rita.** Discovery and *K*-absorption const. of element No. 61, 417*A*.
- Bruylants, P., F. Lafortune, and L. Verbruggen.** New detn. of atomic wt. of Se, 405*A*.
- Bruyne, N. A. de, and R. W. W. Sander-son.** Electrostatic capacity of Al and Ta anode films, 632*A*.
- Buchner, G.** Standardization of metals and alloys, 747*A*.
- Bücker, H.** Use of elect. heated salt-bath furnace, 677*A*.
- Buckley, H.** Book: "A Short History of Physics," 759*A*.
- Budgen, N. F.** Al¹-Cd-Zn alloys, 448*A*.; influence of Cd on Al, 448*A*.; production of Cd, 653*A*.; zinc-Cd alloys, 478*A*.
- Bulmer, Frederick M. R., and E. A. Mackenzie.** Control and treatment of nickel rash, 751*A*.
- Bunet, —.** See Bergeon, —.
- Burgarth, Hugiberth.** Relations between theoretical considerations of valency and elect. resistance of metals, 427*A*.
- Burgess, F.** Oil burning for general uses, 729*A*.
- Burrows, Henry Wilson.** Elected student member, 330.
- Burstyn, Walther.** Benedicks and Knudsen effect, 430*A*.
- Buschlinger, H.** Al as raw material in apparatus industry, 488*A*., 648*A*.; Al as working material in inorg. chemistry, 488*A*.
- Buss, J.** See Boyer, M. W.
- Butler, Albert Quigg.** See Baxter, Gregory Paul.
- Butler, J. A. V.** Equilib. of heterogeneous systems including electrolytes. II.—Equilib. at interfaces and theory of electro-capillarity, 624*A*.
- Butler, J. A. V., W. E. Hugh, and D. H. Hey.** Effect of electrode material on oxidation potentials, 631*A*.
- Butts, Allison.** See Stoughton, Bradley.
- Cabrera, B.** Magnetism of structure of atoms and molecules, 532*A*.
- Cadenbach, Gustav.** See Fredenhagen, Karl.
- Cady, H. P.** See Groening, A. A.
- Caldwell, James.** Elect. welded construction, 689*A*.
- Calthrop, J. E.** Effects of torsion on thermal and elect. conductivities of Al, with special reference to single crystals, 371*A*.
- Campa, Maria.** Hall effect in Sb in weak fields, 374*A*.
- Campbell, Alan Newton.** Anodic behaviour of ferro-Mn, 469*A*.
- Campbell, Albert.** New stop-watch, 596*A*.
- Campbell, Donald F.** Paper on "Electric Furnaces in Non-Ferrous Metallurgy," 287.—*Discussion*: H. W. Brownson, 300; W. R. Barclay, 302; A. G. Lobley, 304; M. Haas, 306; H. H. Hayes, 306; O. Frick, 308; W. Rosenhain, 309.—*Replies to Discussion*, 311, 313.—*Correspondence*: J. L. Christie, 313; J. Frith, 314; H. W. Gillett, 314; H. E. Marten, 316; D. D. Miller, 318; P. H. Brace, 324.—*Reply to Correspondence*, 325.
- Campbell, H. L.** Effects of moisture absorption on properties of dry-sand cores, 705*A*.; methods of detg. properties of cores made with cereal binders, 706*A*.; standard sand for use in testing core binders, 706*A*.
- Campbell, William.** Report of Cttee. B-2 of A.S.T.M. on non-ferrous metals and alloys, 564*A*.; report of Sub-Cttee. I. of E-4 of A.S.T.M. on selection and preparation of samples for metallographic examination, 510*A*.; 25 years of metallography, 510*A*.
- Campion, A.** Fuel economy in foundry, 728*A*.
- Campion, Edward Winslow.** Elected member, 15.
- Canals, E.** Vol. detn. of Ca in mineral substances contg. phosphoric acid, Mg, Fe, and Al, 579*A*.
- Canneri, G., and L. Fernandes.** Analyt. sepn. of rare earths from uranium alkali uranyl-salicylates, 576*A*.
- Cantello, R. C.** Methane equilib.—II., 439*A*.
- Capp, J. A.** Report of Cttee. B-I. of A.S.T.M. on Cu wire, 654*A*.;

- report of Cttee. E-I. of A.S.T.M. on methods of testing, 600*A*.
- Carpenter, C. B.** Value of problems in teaching metallurgy, 746*A*.
- Carpenter, Cranston H.** Electrically heated bath furnaces, 677*A*.
- Carpenter, H. C. H.** Methods of growing large metal crystals, 516*A*.
- Carpenter, H. C. H., and S. Tamura.** Formation of twinned metallic crystals, 417*A*.; prodn. of large Cu crystals, 379*A*.
- Carr, J. T.** Arc welding of seams in steel plates, 685*A*.
- Carr, Richard Eshott.** Elected member, 16.
- Carter, N. M.** *See* Shrum, G. M.
- Carter, Rufus Preston.** Elected student member, 330.
- Caspari, Fritz.** Elected member, 16.
- Cassie, A. M.** *See* Robinson, H. R.
- Cattelain, E.** Use of hydrazine sulphate in iodometry, 562*A*.; use of organo-metallic complexes in gravimetric analysis, 557*A*.
- Caven, R. M.** Book: "Atoms and Molecules," 759*A*.
- Centnerszwer, Mieczyslaw.** Thickness of passive layer of surface, and speed of soln. of Al, 374*A*.
- Centnerszwer, Mieczyslaw, and M. Straumanis.** Catalytic phenomena when Zn is dissolved in acids, 492*A*.; overvoltage of H on finely divided metals and its connection with catalytic action of metals on soln. of Zn, 492*A*.
- Centnerszwer, Mieczyslaw, and W. Zablocki.** Rate of soly. of Al, 374*A*.
- Chadwick, J.** Artificial disintegration of elements, 525*A*.
- Challans, Eric William.** Elected student member, 330.
- Chen, Lan Hua.** *See* Harkins, William D.
- Chenault, R. L.** *See* Mohler, F. L.
- Chevenard, P.** Alloys of Fe, Cr, and Ni, 471*A*.; apparatus for detg. thermal transformations of steels and anomalies in special alloys, 591*A*.; new form of differential dilatometer, 591*A*.; reversible anomaly of cupro-nickels in region of paramagnetic state, 460*A*.; *see* Portevin, A.
- Chikashige, Masumi.** Relation between colour and structure of alloys, 482*A*.
- Christie, John L.** *Correspondence on* "Electric Furnaces in Non-Ferrous Metallurgy," 313; *see* Webster, Wm. Reuben.
- Chwolson, Orest-Danilovič.** Book: "Die Physik 1914-1926," 759*A*.; book: "Traité de physique," 759*A*.
- Clark, Frances Hurd.** 470° C. transition point in cast 60:40 brass, 463*A*.; heat-treatment, microstructure, and hardness of 60:40 brass, 463*A*.
- Clark, George L.** Book: "Applied X-Rays," 759*A*., (review), 770*A*.; *see* Frölich, Per K.
- Clark, L. H.** Secondary radiations produced by γ -rays and their effect upon γ -ray absorption measurements, 443*A*.; centrifugals for handling corrosive materials, 501*A*.
- Clarke, R. R.** Visual judgment of non-ferrous metal temperatures, 710*A*.
- Clausius, P.** *See* Boer, J. H. de.
- Clennell, J. E.** Vol. estn. of Ni and Co, 583*A*.
- Clenshaw, J. C.** *See* Tapsell, H. J.
- Cloke, Paul.** Resistance of Cu at high temps., 380*A*.
- Coats, Harry P.** Device for arc-welding easily oxidizable wires, 691*A*.
- Cochrane, H. H.** Copper's superiority in high voltage transmission, 656*A*.
- Cocks, H. C.** *See* Allmand, A. J.
- Cocks, William Trevor.** Elected member, 16.
- Colcord, F. F.** Parting plant of U.S.S. Lead Refinery, Inc., 637*A*.
- Colcord, F. F., E. F. Kern, and J. J. Mulligan.** Conductivity of electrolytes used in electrolytic sepn. of Ag and Au, 636*A*.
- Collins, Hawksworth.** Structure of Pb, 531*A*.
- Collins, W. D., H. V. Farr, Joseph Rosin, G. C. Spencer, and Edward Wichers.** Recommended specifications for analytical reagent chemicals, 562*A*.
- Collis, Edgar L., and H. M. Vernon.** Comparison of old and new tinning processes, 503*A*.
- Colvin, Fred H.** Connecting rods in Stutz shops, 651*A*.; how Curtiss makes metal aircraft propellers, 651*A*.
- Combs, John Morris.** Electric hoists, 705*A*.
- Commentz, Carl.** Use of Al in ship-building, 648*A*.
- Compton, Arthur H.** Book: "X-Rays and Electrons," 759*A*.

- Compton, K. T.** Cumulative ionization in stellar atmospheres, 555*A*.
- Compton, K. T.,** and C. H. Thomas. Soft X-rays: improvements in technique and new results for C, Cu, and W, 537*A*.
- Condon, Edward.** Theory of intensity distribution in band systems, 553*A*.
- Cone, C. F.** Medium temp. furnace installations, 723*A*.
- Conly, W. P.** *See* Anderson, W. Y.
- Connolly, T. F.** Microscope tube length, 515*A*.
- Consigny, J.** Stopping powers of metals for α -rays, 443*A*.
- Constable, F. H.** Initial stages of dehydrogenation and isomeric change of allyl alcohol by Cu catalyst, 383*A*; structure of catalytically active Cu, 513*A*.
- Conzelmann, W.** *See* Manthey, E.
- Cooley, W. B.** *See* Hineline, H. D.
- Corbin, R. M.** *See* Bradley, M. J.
- Corey, R. B.** *See* Laubengayer, A. W.
- Cork, J. M.** *See* Stephenson, B. R.
- Corse, W. M.** Al-bronze—an acid-resisting material, 657*A*; metal-lurgy 50 years ago and now, 745*A*.
- Corson, M. G.** Book: "Aluminium," 759*A.*, (review), 768*A.*; Cu alloys for high temps., 459*A.*; Cu-Be alloys, 459*A.*, 460*A.*; Cu hardened by new method, 461*A.*; Cu-Si alloys, 460*A.*; improving elect. conductor alloys, 673*A.*; Mn in non-ferrous alloys, 469*A*.
- Cosens, C. R.** Valve voltmeter with self-contained batteries, 598*A*.
- Costa, J.-L.** Mass spectra of some light elements, 553*A*.
- Coster, D.,** and M. J. Druyvesteyn. Satellites of Röntgen diagram lines, 548*A*.
- Cournot, Jean,** and Jean Bary. Certain electrolytic deposits on Al and light alloys; their adhesion and resistance to sea-water, 641*A*.
- Cournot, Jean,** and R. Pagès. Sequel to study of viscosity at high temps., 481*A.*; tests on viscosity of Cu and its alloys, 380*A*.
- Cournot, Jean,** and Eugène Perot. Cementation of Al by means of Cu, 506*A*.
- Courtines, —.** Model of periodic table, 444*A*.
- Crane, Charles Richard, (II.).** Elected member, 15.
- Crawford, C. A.** Selecting metal pickling equipment, 748*A*.
- Crawshaw, J. E.** *See* Foley, Francis B.
- Creasy, P. F.** Elect. heat for machine-shop, 723*A*.
- Crepaz, Enrico.** Constitution of binary alloys of Cu and Zn, 462*A.*; gravimetric detn. of Na, 585*A*.
- Crew, W. H.** New effect in photoelect. emission from oxide-coated filaments, 428*A*.
- Cronin, J. J.** *See* Goggin, J. F.
- Crosby, V. A.** Core oil specifications, 706*A*.
- Cunliffe, P. W.,** R. G. Franklin, R. E. W. Maddison, and L. Reeve. Photochemical technique. III.—Quartz-mercury lamp in use, 595*A*.
- Cuny, L.** Detn. of Cu by means of permanganate, 580*A*.
- Curtis, Frank W.** Driving-box practice at C. and N.W. shops, 675*A.*; welding and air equipment in Danville shops, 692*A*.
- Cyr, H. M.** Pure zinc, 414*A*.
- Czochralski, J.** Silumin: process for improvement, 453*A*.
- Czochralski, J.,** and E. Rassow. Binary alloys of Pb with Li up to 2.2% Li, 467*A*.
- Dadiou, Armin.** Electromotive behaviour of Al, 373*A*.
- Daevies, Karl.** Elected member, 329.
- Dahl, Hermann.** Use of old metals and metallic residues, 748*A*.
- Dahl, Otto.** *See* Masing, Georg; *see* Tammann, G.
- Daniels, Samuel.** Effect of reheating on Al-Cu-Ni-Mg and Al-Cu-Fe-Mg (piston) alloys, 449*A.*; fusion-joining of metallic materials in aircraft construction, 687*A.*; properties of some sand-cast alloys Al contg. Si and Mg, 451*A.*; properties of some sand-cast Al-Mg₂Si alloys, 452*A.*; rapid method for heat-treatment of Al-Cu-Ni-Mg (piston) alloy, 677*A.*; sand-cast alloys of Al contg. Co, 449*A*.
- Daniels, Samuel,** and D. M. Warner. Mech. properties of Al-Cu-Si alloy as sand-cast and as heat-treated, 449*A*.
- Danz, H.** *See* Magnus, A.
- Darby, Ernest R.** Fluidity tests of white-metal bearing alloys, 477*A*.

- Darwin, C. G.** Book: "Recent Developments in Atomic Theory," 759A.
- Davenport, Edmund S.** Grain boundary phenomena in W filaments, 411A.
- Davey, Wheeler P.** Study of crystal structure and its appns. IV. and V.—Bragg method of crystal analysis. VI.—Powder method of crystal analysis, 517A.; theory of mechanism of crystal growth, 519A.
- Davidsohn, J.** Keeping quality of thiosulphate solns., 562A.
- Davidson, Edward.** Elected member, 16.
- Davies, Ann Catherine.** Electron as key to atomic structure, 527A.
- Davies, Ann Catherine,** and Frank Horton. Crit. potentials and X-ray term values, 550A.
- Davies, Earl C. H.,** and Victorian Sivertz. Rythmic diurnal bands of Au and Pt in silicic acid gel, 389A.
- Davies, E. L.,** and G. H. Livens. Kinetic theory of metallic conduction and scattering of electrons by atoms, 426A.
- Davies, Leonard.** Elected member, 16.
- Davis, C. H.** See Deussen, H. N. van.
- Daweke, L. E.** See Oberhoffer, P.
- Dawidowski, Roman.** Isotherms of flame stream in metallurgical furnaces, 730A.
- Dawson, J. R.** Strength of welded joints, 686A.
- Daynes, H. A.** Paschen galvanometer, 597A.
- Dean, George.** At. wt. of C and Ag, 406A.
- Dean, R. S.** See Zickrick, Lyall.
- Dean, R. S.,** and J. L. Gregg. General theory of metallic hardening, 420A.
- Dean, R. S.,** Lyall Zickrick, and F. C. Nix. Pb-Sb system, and hardening of Pb alloys, 467A.
- De Blois, Lewis A.** Book: "Industrial Safety Organization," 759A.
- de Boer.** See Boer.
- de Bruin.** See Bruin.
- De Bruyn, C. A. Lobry.** See Lobry de Bruyn, C. A.
- de Bruyne.** See Bruyne.
- Decouffé, —.** Strength of riveted joints, 679A.
- de Fleury.** See Fleury.
- De Foe, O. K.** See Jauncey, G. E. M.
- de Goloubinoff, —.** See Goloubinoff.
- de Hemptinne.** See Hemptinne.
- Dejardin, Georges.** Spark spectrum of Hg in extreme ultra-violet, 539A.
- Delauney, Eugène.** New method for quant. analysis by means of X-rays, 560A.
- Denigès, Georges.** New method of detecting and of quickly detg. Co by spectroscopy and colorimetry, 569A.
- Denina, Ernesto.** New theory of Féry for lead accumulator, 633A.
- Dennis, L. M.** Poisoning by Hg vapour, 753A.
- Dennison, David M.** Rotation of molecules, 533A.
- De Remer, J. G.** Mercury compressor, 663A.
- Dern, G.** See Rothert, C.
- de Rubies.** See Rubies.
- Desch, Cecil H.** Chemistry of solids, 417A.; growth of metallic crystals, 518A.
- de Schulthess.** See Schulthess.
- Desgranges, A.** Repairing oil-saturated crank-cases, 682A.; see Granjon, R.
- Deussen, H. N. van, L. I. Shaw,** and C. H. Davis. Phys. properties and methods of tests for sheet brass, 600A.
- Deutsch, Oscar.** Elected member, 15.
- Dew, Walter A.,** and Hugh S. Taylor. Adsorption and heat of adsorption of ammonia gas on metallic catalysts, 438A.
- de Waard.** See Waard.
- de Wisniewski.** See Wisniewski.
- Dewrance, (Sir) John.** Elected President, 13; "Presidential Address," 21; reply to vote of thanks, 18; reply to vote of thanks to Council, 14.
- Dews, H. C.** Contraction in alloy casting, 712A.; discussion on "The Mechanism of Inverse Segregation in Alloys," 278.
- De Young, A.** Pulverizing coal in foundry, 732A.
- Dicken, C.** Al castings, 713A.
- Dicksee, Cedric Bernard.** Elected member, 15.
- Dieckhaus, Jos.** Elected member, 16.
- Diepschlag, E.,** and H. Pannek. Relations of grain-size and grain-form to gas-permeability of moulding sand, 709A.
- Dietert, H. W.,** and H. W. Wakefield, jun. Sand control in foundry, 708A.
- Dijkstra, D. W.** See Jaegen, F. M.
- Dinkler, W.** Segregation phenomena, 483A.

- Dirac, P. A. M.** Effect of Compton scattering by free electrons in stellar atmosphere, 549*A*.
- Disch, J.** Thermal expansion of some substances.—II., 434*A*.
- Dix, E. H., jun., and W. D. Keith.** Equilib. relations in Al-Mn alloys of high purity, 452*A*.; etching characteristics of constituents in commercial Al alloys, 512*A*.
- Dix, E. H., jun., and H. H. Richardson.** Equilib. relations in Al-Cu alloys of high purity, 449*A*.
- Dixon, Harold B.** Life and work of Ludwig Mond, 745*A*.
- Doan, G.** System Al-Ca-Si, 448*A*.
- Doan, Richard L.** Refraction of X-rays by method of total reflection, 536*A*.
- Dobbs, E. J.** Commercial deposition of Ni, 644*A*.
- Donald, M. B.** Corrosion, 495*A*.
- Donner, Gerhard.** Elected member, 330.
- Dorenfeldt, (Mme.) —.** See Gleditsch, (Mlle.) E.
- Dorgelo, H. B.** Intensity relations of triplet components of alk. earths and spark doublets of Ca, 535*A*.
- Dorgelo, H. B., and J. H. Abbink.** "Red" and "blue" argon spectrum in extreme ultra-violet, 534*A*.
- Döring, Th.** Advances in field of metal analysis in 1925, 557*A*.
- Dorsey, N. Ernest.** Measurement of surface tension, 612*A*.
- Dowell, J. H.** Deflection of bars, 596*A*.
- Downes, T. W.** Hardness testing of thin Duralumin sheet, 605*A*.
- Downing, A. C.** Simplified moving magnet galvanometer, 597*A*.; see Anrep, G. V.
- Doyle, J. A.** Selection of fuel for heat-treatment of metal, 728*A*.
- Drath, G.** See Sauerwald, F.
- Dresbach, M., and H. R. Hosmer.** Polarization of metals used as electrodes, 627*A*.
- Drinker, Katherine R.** See Batchelor, Roger P.
- Drossbach, Paul.** Theoretical potential of Al, 373*A*.
- Druce, J. G. F.** Discovery of eka- and dvi-manganese, 386*A*.
- Druyvesteyn, M. J.** See Coster, D.
- Duffieux, —.** Origin of band spectra, 553*A*.
- Duhme, E., and A. Lotz.** Note on paper by Miethe and Stammreich on "Gold from mercury," 440*A*.
- Dunn, John Stanley.** Diffusion of Zn in α series of solid soln. in Cu, 462*A*.
- Durand, William F.** Science and engineering, 755*A*.
- Durbin, F. M.** Dependence of free path of K ions in various gases on velocity, 526*A*.
- Durrell, L. W., Fred G. Person, and Charles F. Rogers.** Measurement of surface tension by chainomatic balance, 592*A*.
- Durville, P. H. G.** Still casting of metals, 713*A*.
- Dusaugue, E.** New light alloy of high mech. strength for wires and elect. cables: "Almelec," 452*A*.
- Duschnitz, B.** Development of W single crystals and prodn. of W single crystal filaments, 411*A*.
- Du Tot, Stuart Clair.** Elected member, 15.
- Dye, D. W.** Magnetic screening of galvanometers, 597*A*.
- Dyson, G. Malcolm.** Chemistry and metallurgy of Zr and Hf, 670*A*.; Mn: its alloys and uses, 663*A*.; mettg. and uses of Bi, 653*A*.; mettg. and uses of Sn, 666*A*.; mettg. and uses of V and Ti, 668*A*.
- Eardley-Wilmot, V. L. Mo.** Metallurgy, uses, occurrence, mining, and concn. of ores, 394*A*.
- Eastman, E. D.** Thermoelect. effects and heat capacity of electrons in metals, 428*A*.
- Eckart, Carl.** Operator calculus and the solution of equations of quantum dynamics, 531*A*.
- Eckart, William Rankine.** Elected member, 16.
- Eddington, A. S.** Absorption of radiation inside a star, 551*A*.; limiting case in theory of radioactive equilib., 551*A*.
- Edgar, James.** See Shaw, Ben.
- Edgington, George.** Education in foundry, 746*A*.
- Edmondson, W., and A. Egerton.** Chem. and other thermal const. of Na and K, 408*A*.; vapour pressures and m.p. of Na and K, 407*A*.
- Edwards, C. A.** Problems of casting metals and alloys, 711*A*.
- Edwards, F. C.** Contraction stress, 712*A*.; gates and risers, 706*A*.
- Edwards, Junius David.** Al from Oersted to Arvida, 371*A*.; Al paint,

- 648A.; Al paint in factory, 649A.; 50 years' progress in Al, 646A.; *see* Tosterud, Martin.
- Edwards, Junius David**, and Cyril S. Taylor. Resistivity of Al-Cd alloys, 448A., 449A.
- Eegriwe, Edwin**. Delicate colour reaction for detection of Sb and W, 568A.
- Effenterre, P.** Electrolytic manuf. of Mg, 635A.
- Egan, Leonard W.** Complete electrification of foundry industry, 720A.
- Egeberg, Birger**. Elected member, 329.
- Egerton, A.** *See* Edmondson, W.
- Eggert, H.** Passivity, 629A.
- Ehrenfeucht, Wiktor**. Resonance rays of Se vapour, 544A.
- Ehrenhaft, F.** Existence of sub-electrons, 528A.; velocity of small spheres in gases and their elect. charges, 528A.
- Eichinger, A.** *See* Ros, M.
- Eimer, August**. Early days in carbide and ferrochrome industries, 635A.
- Ekwall, Per**. Detn. of Pb by oxidation with persulphate, 581A.
- Eldridge, Arthur H.** *See* Vallance, Reece H.
- Eldridge, C. H.** *See* Fink, Colin G.
- Eldridge, John A.** Crit. potentials of spark lines of Hg, 539A.; Whittaker's atomic model, 529A.
- Elicabe, Alberto.** *See* Gans, Ricardo.
- Ellington, O. C.** British standard table of wire screens.—II., 612A.
- Ellis, A. R.** Scientific supervision of welding, 685A.
- Ellis, C. D.**, and W. A. Wooster. Relative intensities of groups in magnetic β -ray spectra of RaB and RaC, 543A.
- Ellis, O. W.** Influence of pouring temp. and mould temp. on properties of lead-base anti-friction alloy, 466A.
- Ellsworth, Vivian M.**, and J. J. Hopfield. Oxygen bands in ultra-violet, 542A.
- Emelianova, N. V.** Researches with Hg dropping cathode. VII.—Ni and Co, 625A.
- Endell, K.**, and R. Harr. Influence of oxide admixtures on phys. properties of silica bricks, 741A.
- Endo, Hikozi.** *See* Honda, Kôtarô.
- Engel, Gerhardt.** Cutting velocity and cutting pressure in milling, 701A.
- Epstein, Paul S.** Stark effect from point of view of Schroedinger's quantum theory, 553A.
- Erbacher, Otto.** *See* Hahn, Otto.
- Ernst, F. A.** Equipment for high-pressure reactions, 674A.; high-pressure research equipment, 674A.
- Erwin, James.** Mosque of St. Sophia re-roofed with Zn, 670A.
- Eskeland, Sigurd.** Variations in intensity of lines of a Hg triplet, 541A.
- Esnault-Pelterie, R.** Apparatus to measure Hertzian hardness, 606A.
- Esser, Hans**, and Paul Oberhoffer. New universal dilatometer, 592A.
- Estey, Roger S.** Effortless silver cleaning, 750A.
- Estill, H. W.**, and R. L. Nugent. New confirmatory test for Al, 568A.
- Evans, B. S.** Apparatus for continuous percolation and for filtration in neutral atm., 561A.
- Evans, Derek Curtis.** *See* Russell, Alexander Smith.
- Evans, Ulick R.** Book: "Die Korrosion der Metalle," 760A.; book: "The Corrosion of Metals," 760A., (review) 783A.; discussion on "Penetration of Brass by Tin and Solder," "The Attack of Molten Metals on Certain Non-Ferrous Metals and Alloys," and "The Penetration of Mild Steel by Brazing Solder and Other Metals," 224; ferroxyl indicator in corrosion research, 493A.; fundamental principles of corrosion, 495A.; porosity and intensive corrosion, 494A.
- Evans, W. A.** Little danger in zinc, 753A.
- Everett, L. E.** Elect. heat-treating of steel castings, 723A.
- Everette, Willis Eugenes.** Elected member, 329.
- Ewing, (Sir) J. Alfred.** Modern aspects of phys. research, 754A.
- Eyles, A.** Autogenous welding of Al and its alloys, 681A.; autogenous welding of Cu by oxy-acetylene process, 683A.; cast welding Al, 682A.; conservation of Sn in solders and dipping baths, 666A.; tinning iron castings, 504A.; welding Al alloy castings, 681A.
- Fabrigue, —**, and J. Bressier. Detection of Bi, 569A.
- Faden, J. L.** Lead-bath furnace improves tool hardening, 677A.

- Faden, J. L.**, and J. D. McManus. Elect. annealing at Walworth plant, 723.A.
- Fairchild, C. O.**, and M. F. Peters. Characteristics of pyrometric cones, 620.A.
- Fairhall, Lawrence T.** Colorimetric detn. of minute amts. of Ni. Potassium dithio-oxalate as sensitive reagent, 583.A.
- Fajans, K.** Relation between atomic wt., life period, and manner of transformation of isotopes, 524.A.
- Farmakides, N. M.** See Müller, Robert.
- Farr, C. C.** Structure of atom, 532.A.
- Farr, H. V.** See Collins, W. D.
- Faust, ———.** Competition of metal alloys, 672.A.
- Fehnel, J. William.** See Batchelor, Roger P.
- Feigl, F.** Capillary chem. processes in spot reactions, 568.A.
- Feigl, F.**, and I. Pollak. Microchem. detn. of Ag, 585.A.
- Felch, D. H. W.** Building a valve for pressure of $3\frac{1}{2}$ tons, 674.A.
- Fernandes, Lorenzo.** See Canneri, G.; see Rolla, Luigi.
- Feussner, Otto.** Practical deductions from theoretical metallurgy, 746.A.
- Feussner, Otto**, and E. Ramb. Damping properties of some metals in torsional vibration, 602.A.
- Fink, Colin G.** Recent advances in electro-deposition, 637.A.
- Fink, Colin G.**, and C. H. Eldridge. Restoration of ancient bronzes, 749.A.
- Fink, Colin G.**, and Li Chi Pan. Insoluble anodes for electrolysis of brine, 497.A.
- Finkeldey, William H.** Microstructure of Zn coatings, 513.A.
- Finney, B.** Cutting costs in non-ferrous plant, 703.A.
- Finney, W. R.**, and H. W. Young. Scale and corrosion problems in gasoline plants, 497.A.
- Fischbeck, Kurt.** Coating of Cu by S vapour, 381.A.
- Fischer, A.** Book: "Elektroanalytische Schnellmethoden," 760.A.
- Fischer, H.** Does an injurious amount of Pb vapour arise in lead burning? 751.A.
- Fischer, Joseph.** Book: "Die Zerstäubungserscheinungen bei Metallen," 760.A.
- Fischer, P.** Elect. conductivity of solid oxide mixtures, 426.A.
- Fischer, V.** Equilib. relations for Bi-Cd and Pb-Sb in liquid and solid state, 455.A.; equilib. relations for metallic alloys in liquid and solid state with an appn. to Au-Ag alloys, 466.A.; thermodynamics of changeable substances with applications, 484.A.
- Fischer, Wilhelm.** Ironless induction furnace, 726.A.; see Wever, Franz.
- FitzGerald, F. A. J.** Appn. of recrystallized silicon carbide, 742.A.; recrystallized silicon carbide as refractory, 742.A.; use of elect. furnaces at Niagara Falls, 1902-1926, 720.A.
- Fitzpatrick, C. J.** Bronze worm-gear planks produced by centrifugal casting, 715.A.; centrifugally cast bronze gears, 715.A.; worm-wheel castings, 714.A.
- Flaschner, E.** See Strebing, R.
- Fleischmann, R.** Transformation phenomena exhibited by easily fusible alloys (Rose's metal), 455.A.
- Fletcher, J. E.** Current American foundry practice, 703.A.; moulding sands, 707.A.; the mould—its function and prepn., 707.A.
- Fleury, R. de.** Magnesium, 711.A.; see Portevin, A. M.
- Flowers, A. E.** Cream separator presents corrosion problems, 497.A.
- Fluch, Paul.** Acidimetric detn. of Ni by means of nickel dicyanodiamidine, 583.A.
- Focke, A. E.** See Blake, F. C.
- Foerster, Fritz.** Form of electrolytically deposited metals, 638.A.
- Fogg, H. C.** See Goggin, J. F.
- Foley, Francis B.** Amorphous cement and formation of ferrite in light of X-ray evidence, 522.A.
- Foley, Francis B.**, and J. E. Crawshaw. Effect of air gap in explosion system on prodn. of Neumann bands, 512.A.
- Foot, H. W.**, and W. M. Bradley. Detn. of Ca by conversion of the oxalate to carbonate, 578.A.
- Foot, Paul D.** Relation between metallurgy and atomic structure, 532.A.; see Mohler, F. L.
- Forbes, George Shannon**, and Philip Albert Leighton. Electrolysis of dichromic acid under Hg vapour lamp of high intensity, 394.A.
- Ford, (Miss) Grace W.** See Hanson, D.

- Foresti, B.** Catalysis by action of subdivided metals. III.—Heat of adsorption of H on Ni, 397A.
- Forrer, R.** Discontinuities in magnetization of Ni, 397A.; *see* Weiss, Pierre.
- Forselles, Albert af.** Manuf. of tin in Sweden, 750A.
- Förster, —.** Measurement of high temps., and improved elect. heated filament pyrometer, 617A.
- Forster, R.** Crystal lattice of Permalloy, 523A.
- Foss, Feodore F.** Elected member, 15.
- Foulk, C. W., and A. T. Bawden.** New type of end-point in electro-metric titrations and its appn. to iodometry, 576A.
- Fourment, Marcel.** World's mineral resources. Different metals.—VII., 749A.
- Fourment, Marcel, and Léon Guillet.** Book: "Métallurgies du Plomb, du Nickel et du Cobalt et Alliages de ces Métaux," 760A., (*review*) 778A.
- Fowler, (Sir) Henry.** Elected Vice-President, 13.
- Fowler, H. W.** *See* Shrum, G. M.
- Fowler, R. H.** Theory of absorption lines in stellar spectra, 552A.
- Fowler, R. H., and E. A. Guggenheim.** Appns. of statistical mechanics to determine properties of matter in stellar interiors. I.—Mean molecular wt. II.—Adiabatics, 556A.
- Fowler, R. H., and E. A. Milne.** Maxima of absorption lines in stellar spectra.—II., 551A.
- Fox, Cyril S.** Book: "Bauxite," 761A.
- Foxwell, G. E., and R. V. Wheeler.** Testing of coke.—I., 730A.
- Fraenkel, W.** Reactions by disintegration of supersaturated solid solutions, 483A.; *see* Lorenz, Richard.
- Fraenkel, W., and J. Spanner.** Transformation of Zn-Al alloys in solid state, 478A.
- Fraine, Walter.** Electrodeposition of Sn, 645A.
- François, Maurice, and (Mlle.) Laure Seguin.** Change of cobalt or metallic As in contact with moist air, 375A.
- Frank, Peter.** Elected member, 15.
- Frankenburger, Walter.** Chem. combination of N and Li and mechanism of reaction, 391A.
- Franklin, Jack.** Elected student member, 16.
- Franklin, R. G.** *See* Cualiffe, P. W.
- Fränz, Hans.** Direction of emission of secondary β -radiation, 442A.
- Frary, Francis C.** Future developments in light metals, 671A.
- Fredenhagen, Karl, and Gustav Cadenbach.** Combination of K with C, 404A.
- Freed, M. L.** Mullite refractories, 739A.
- Freeman, S. B.** Corrosion of condenser tubes, 496A.
- Freise, F. W.** Elect. furnaces for smelting, 720A.
- French, D. K.** Brass services and special goosenecks used by Hackensack Water Co., 662A.
- French, H. J.** Metals for service at high temps., 674A.
- French, Sidney J.** *See* Kahlenberg, Louis.
- Frerichs, R.** Intensity measurements of multiplets, 555A.
- Freund, Hugo.** Colorimetric analysis of some metals, 557A.
- Friauf, James B.** Crystal structure of Mg_2Pb , 522A.; crystal structure of $MgZn$, 523A.
- Frick, Otto.** Discussion on "Electric Furnaces in Non-Ferrous Metallurgy," 308.
- Fricke, R.** Sepn. of Ga from Al and Fe, 574A.
- Fridli, Rudolf.** Sepn. of As from Se, and its gravimetric estn., 572A.
- Friedel, G.** Growth and soln. of crystals, 512A., 518A.; soln. of concave forms in crystals, 512A.
- Friedlander, Alfred.** *See* McCord, C. P.
- Friend, J. Newton.** Periodic sphere and position of rare earth metals, 444A.
- Friend, J. Newton, and W. E. Thorneycroft.** Paper on "Examination of a Fifteenth-Century 'Brass,'" 71; paper on "Note on the Silver Contents of Roman Lead from Folkestone and Richboro' Castle," 73.—*Correspondence*: E. A. Smith, 74.—*Reply to Correspondence*, 75.
- Friman, Einar.** Precision measurements in L-series of elements W to U, 547A.
- Frith, Julius.** *Correspondence on* "Electric Furnaces in Non-Ferrous Metallurgy," 314.
- Fritz, I. C.** New process for preventing freezing up of gas outlets, 693A.
- Fritze, G. A.** Die-casting of Al and brass, 716A.

- Frölich, Per K.** Electrodeposition of Zn from electrolytes contg. gelatine and aluminium sulphate, 645*A*.
- Frölich, Per K.,** George L. Clark, and Robert H. Aborn. Electrochem. and X-ray studies of Pb deposits, 644*A*.
- Frommer, L.** Centrifugal casting, 715*A*.
- Frost, E. C.** See Jones, C. O.
- Fry, Ad.** Heat-resisting metal articles, 499*A*.
- Fuchs, Leopold,** and Wo. Pauli. General colloid chemistry. XVII.—Analysis and constitution of colloidal Au, 388*A*.
- Füchtbauer, Chr.,** and Herm Meier. Intensity relations in doublets of principal series of alkali metals, 547*A*.
- Fujioka, Yoshio.** Effect of elect. field on spectral lines of Zn and Cd, 546*A*.
- Fukuda, Mitsuharu.** Change of wavelength of Cd red line λ 6438.7Å, 534*A*; new lines (1s-2p_{1,3}) of Zn, Cd, and Hg, 546*A*.
- Fukuda, Mitsuharu,** Tamio Kuyama, and Yashushi Uchida. Spectra of metals under heavy current excitation, 553*A*.
- Fulda, W.** Tech. prodn. of Al, 634*A*.
- Fuller, T. S.** Embrittlement of Cu by hot reducing gases, 383*A*.
- Fulweiler, W. H.** Importance of little things in standardization of methods of testing, 600*A*.
- Furman, N. Howell.** See Kolthoff, I. M.
- Fürth, Adolf.** New method for measurement in a.c. electrolysis, 622*A*.
- Furthmann, Ernst.** See Schmidt, Hermann.
- Fuseya, Giichiro,** and Masataka Nagano. Addition agents in electrodeposition. Effect of various conditions on crystalloidal addition agents, 639*A*.
- Fuss, —.** Lautal, 450*A*.
- Futagami, Tetsugoro.** See Nagaoka, Hantaro.
- Gaehr, Paul F.** Projection of ultra-violet lines, 594*A*.
- Galibourg, J.** See Guillet, L.
- Gandhi, N. P.** Elected member, 15.
- Gans, Ricardo,** Alberto Elicabe, and Zelman Weinstock. How do acids attack metals? 495*A*.
- Ganz, Marianne.** See Lorenz, Richard.
- Garard, Ira D.** Simple rule for classification of elements, 444*A*.
- Gardner, H. A.** Metallic primers for new wooden structures, 676*A*.
- Gardner, William.** Book: "Chemical Synonyms and Trade Names," 761*A*, (review) 771*A*.
- Garland, H.,** and C. O. Bannister. Book: "Ancient Egyptian Metallurgy," 761*A*, (review) 769*A*.
- Garner, Maud.** Significance of variation in Smoluchowski coagulation coeff. (β), 436*A*.
- Garner, Maud,** and W. C. M. Lewis. Effect of temp. on rate of coagulation of Au sol, 388*A*.
- Garre, Bernard.** Reactions of metals with solid salts on annealing, 496*A*; strength of pressed metallic powders on annealing, 482*A*.
- Garrett, M. W.** Possibility of transmutation by electronic bombardment, 439*A*; transmutation of Hg into Au, 439*A*.
- Gaschler, A.** Transmutation of Hg into Au, 439*A*.
- Gaviola, E.,** and Peter Pringsheim. Tentative tech. explanation of apparently too small degree of polarization of resonance radiation in magnetic field, 443*A*.
- Gawne, James Orville.** Elected member, 15.
- Gayler, Marie L. V.** Alloys of Fe research. VI.—Prepn. of pure Mn, 391*A*.
- Gazzoni, Ferdinando.** Attempt to determine quantitatively ThX, 586*A*.
- Gebhardt, H.** See Marckwald, M.
- Geel, W. C. van.** Intensities of Zeeman components in partial Paschen-Back effect, 538*A*.
- Geels, P.** See Michels, A.
- Geilman, W.** Detection of small quantities of Ag and Cd, 570*A*.
- Geiss, W.,** and J. A. M. van Liempt. Binary system Co-W, 458*A*; extended law of Mattheissen, 428*A*.
- Geller, R. F.,** and W. L. Pendergast. Comparative tests of some American and German fireclay brick, 738*A*.
- Geller, R. F.,** and E. E. Pressler. Comparison of softening points of some foreign and American pyrometric cones, 620*A*.
- Genders, R.** Discussion on "Brittleness in Arsenical Copper," 65; discussion on "Investigation of the Effects of Impurities on Copper,"

- 178; *discussion on* "The Attack of Molten Metals on Certain Non-Ferrous Metals and Alloys," 226; *paper on* "The Mechanism of Inverse Segregation in Alloys," with an Appendix on "The Accurate Determination of Copper in Bronze by Electrolysis," by R. A. F. Hammond, 241.—*Discussion*: T. Turner, 270; S. W. Smith, 271; F. C. Thompson, 273; S. L. Archbutt, 275; G. L. Bailey, 276; J. D. Grogan, 277; H. C. Dews, 278.—*Replies to Discussion*, 278, 280.—*Correspondence*: C. H. Bierbaum, 281; F. Hargreaves, 281; W. Hume-Rothery, 283; A. J. Phillips, 283.—*Reply to Correspondence*, 285; *paper on* "The Penetration of Mild Steel by Brazing Solder and Other Metals," 215.—*Discussion*: U. R. Evans, 224; S. V. Williams, 226; D. Lewis, 228; N. T. Belaiew, 229; W. H. J. Vernon, 230.—*Reply to Discussion*, 231.—*Correspondence*: D. S. Anderson and G. E. Pool, 237; W. B. Parker, 239.—*Reply to Correspondence*, 240; vote of thanks to Council, 14.
- George, B.** Removal of Sb from Pb by dry method, 750A.
- George, Hans.** Hard brazing of cast iron, 679A.
- George, J. D.** Zn protects Jamaica church steeple, 670A.
- Gerlach, Walter.** Correct execution and interpretation of "quant. spectral analyses," 560A.
- German, H. M.** Standardizing the Brinell hardness test, 605A.
- Gibbins, R. Lloyd.** *Discussion on* "Brittleness in Arsenical Copper," 66; elected member of Council, 13.
- Gibson, A. H.** Piston temps. and heat flow in high-speed petrol engines, 651A.
- Gieseler, H., and W. Grottrian.** Structure of arc spectrum of Pb, 538A.
- Gillett, H. W.** Chemistry in the metallurgical division of the Bureau of Standards, 747A.; *correspondence on* "Electric Furnaces in Non-Ferrous Metallurgy," 314; 25 years of non-ferrous electrothermics: 15 years elect. brass melting, 720A.
- Gilson, E. G.** Some limitations of oil ring bearings, 646A.
- Glass, Myron S.** Variation with temp. of work-function of oxide-coated Pt, 401A.
- Glasstone, Samuel.** Electrolytic polarization. II.—Cathodic overvoltage of Hg, 629A. III.—Diffusion layer, 626A. IV.—Electro-deposition potentials of Fe, Co, and Ni, 627A. V.—Electro-deposition potentials of alloys of Fe, Co, and Ni, 627A.
- Gleditsch, (Mlle.) E., (Mme.)**—Dorenfeldt, and O. W. Berg. Detn. of at. wt. of mixture of Pb isotopes present in clevite from Aust-Agdar, Norway, 390A.
- Glocker, R., and H. Widman.** Process for recrystn. of Ag, Cu, and Al, 517A.
- Gmelin, —.** Book: "Handbuch der anorganischen Chemie," 761A., (*review*) 773A.
- Goche, O.** *See* Balasse, G.
- Goens, E.** *See* Gruneisen, E.
- Goerens, Paul.** Elected member, 15.
- Goetz, Alexander.** Book: "Physik und Technik des Hochvakuaums," 761A.
- Goggin, J. F., J. J. Cronin, H. C. Fogg, and C. James.** Metallic U, 750A.
- Goldschmidt, Frieda.** *See* Tiede, Erich.
- v. Göler, Frhr., and G. Sachs.** Behaviour of Al crystals under tension. I.—Geometrical theory, 372A.; rolling and recrystallization—texture of regular face-centred metals.—I., II., 517A.; structure and mech. properties of very pure Al, 372A.
- v. Göler, Frhr., R. Kamop, and G. Sachs.** Behaviour of Al crystals in tensile tests, 371A.
- Goloubinoff, — de.** *See* Travers, —.
- González, F.** *See* Hönigschmid, O.
- Goodman, M. D.** Constant voltage and variable voltage, 691A.; keeping welder in condition, 697A.
- Gordon, W.** Compton effect, according to Schrödinger's theory, 550A.
- Görnandt, Rudolf.** Al finishing industry of Germany, 648A.
- Gosreau, R. C.** Comparison of gas and electricity for industrial heating, 728A.
- Goudsmit, S.** Detn. of terms of La spectrum, 537A.
- Goudsmit, S., J. van der Mark, and P. Zeeman.** Magnetic resolution of Sc spectrum, 543A.
- Gough, H. J.** Recent researches and their bearing on theory of failure of metals, 424A.

- Graham, A. Kenneth.** Bright dipping of metal, 640A.; *see* Müller, John Hughes.
- Granjon, R.,** P. Rosemberg, and A. Desgranges. Practical oxy-acetylene welding, 688A.
- Grant, J. H.** *Discussion on* "Brittleness in Arsenical Copper," 66.
- Green, J. B.** Deposit efficiency of electrodes, 691A.; effect of surface on steel electrodes, 691A.; factors affecting arc stability, 691A.; factors affecting penetration, 689A.; heat-distribution in the arc, 689A.; metallography for welder, 685A.; observation testing by filler rod, 690A.
- Green, P. L.** *See* Hughes, G. F.
- Green, Thomas Edward,** and Cyril Norman Hinshelwood. Catalytic decompn. of nitric oxide at surface of Pt, 401A.
- Greene, R. A.** Reduction of moulding losses, 707A.
- Greenwood, Norris.** Elected member, 16.
- Greer, Willard N.** *See* Parker, Henry C.
- Gregg, J. L.** *See* Dean, R. S.; *see* Sadtler, C. B.
- Gregson, Robert Leonard.** Elected member, 330.
- Grempe, P. Max.** Elect. welding practice, 688A.
- Grenagle, James B.** Elected member, 15.
- Grenall, L. H.** *See* Jordan, Louis.
- Grenet, Louis.** Limiting states of alloys, 483A.
- Griffiths, Albert.** Prevention of flickering in flames of gas-controlled thermostat, 590A.
- Griffiths, Ezer.** *See* Awbery, J. H.
- Griffiths, William E.** *See* Bain, Edgar C.
- Grigorovitch, Konstantin Petrovitch.** Elected member, 330.
- Grimm, Albert.** *See* Prandtl, Wilhelm.
- Groening, A. A.,** with H. P. Cady. Decompn. potentials and metal over-voltages in liquid ammonia and in water, 628A.
- Grogan, J. D.** *Discussion on* "The Mechanism of Inverse Segregation in Alloys," 277; *paper on* "The Influence of Calcium on Aluminium Containing Silicon," with an Appendix on "The Estimation of Calcium in Aluminium Alloys" by P. G. Ward, 77.—*Discussion*: H. Sutton, 89; Max Haas, 90; F. C. Thompson, 90.—*Replies to Discussion*, 91.
- Gronwall, T. H.,** and Victor K. La Mer. Extension of Debye-Hückel theory of strong electrolytes to conc. soln., 633A.
- Grossmann, Marcus A.** Nature of Cr-Fe-C diagr., 457A.
- Grotewold, Kurt.** American experiences with acid-resisting and alkali-resisting alloys, 499A.
- Grottrian, W.** M-doublet in spectrum of A, 534A.; *see* Gieseler, H.
- Groume-Grjmaillo, W. E.** Elected member, 15.
- Grubb, A. A.,** L. H. Marshall, and C. V. Nass. Thermocouple for ladle temp. of brass, 616A., 617A.
- Grube, G.,** and G. Breiting. Electrochem. behaviour of Cr. III.—Equilib. potential Cr/Cr++ in sulphate solns., 631A.
- Grun, K.** Testing of materials, 600A.
- Grüneisen, E.,** and E. Goens. Metal crystals. III.—Thermal expansion of Zn and Cd, 415A.; IV.—Thermoelect. properties of Zn and Cd, 415A.
- Guertler, W. M.** Book: "Metallographie," 761A., (review) 778A.; corrosion resistance of metals and alloys, 499A.; development of investigation of constitution of ternary systems, 485A.; new silver alloys, 476A.; problem of acid-resisting metallic materials, 498A.
- Guggenheim, E. A.** *See* Fowler, R. H.
- Guillet, Léon.** Influence of shrinkage on mech. properties of alloys of Cu and alloys of Al, 459A.; products of metallurgy and the industrial alloys, 671A.; *see* Fourment, M.
- Guillet, Léon,** and J. Calibourg. Heat-treatment of light alloys, 678A.
- Guillet, Léon,** and Albert Portevin. Influence of chem. compn. of alloys on facility of obtaining moulded pieces, 482A.
- Gunderson, L. O.** Corrosion an electrochem. phenomena, 494A.
- Gunther, Otto.** Rust protection through Cr deposits, 505A.
- Günther, P.** Analyt. chem. use of Röntgen spectroscopy, 560A.; quant. Röntgen spectral analysis, 560A.
- Günther-Schulze, A.** Cathodic sputtering. II.—Derivation of laws of disintegration by impact by means of Ag in H, 407A.; effect of addition

- of small proportions of alkali or alkali earth metals to Hg upon normal cathode fall of potential, 393*A.*; valve action of Ag in aqueous solns. of potassium silver cyanide, 633*A.*
- Gurney, R. W.** Number of particles in β -ray spectra. II.—Thorium-B and thorium (C + D), 525*A.*
- Gutbier, A.** Thermal colloid-synthesis. II.—Colloidal Se, 406*A.*
- Gutbier, A., and Theo. Kautter.** Colloidal Bi, 376*A.*
- Gutmann, M. H.-F.** elect. furnaces, 726*A.*
- Haardt, R.** *See* Levi, G. R.
- Haarmann, D.** Non-complete combustion and firing control, 731*A.*
- Haas, Arthur.** Book: "Atomic Theory," 761*A.*
- Haas, Max.** Corrosion research in England, 493*A.*; *discussion on* "Electric Furnaces in Non-Ferrous Metallurgy," 306; *discussion on* "The Influence of Calcium on Aluminium Containing Silicon," 90; message from the Deutsche Gesellschaft für Metallkunde, 17.
- Haase, Carl.** *See* Masing, Georg.
- Haase, W.** *See* Riesenfeld, E. H.
- Hackspill, L., and H. Pinck.** Displacement of Cs and Rb by Fe, 376*A.*
- Hackspill, L., and A. Sigot.** Continuous automatic apparatus for distilling Hg *in vacuo*, 593*A.*
- Hadfield, (Sir) Robert.** Alloys of Fe and Mn contg. low C, 469*A.*; Mn and its properties, 392*A.*
- Hadjieff, M. D.** Apparatus for automatically washing ppts., 561*A.*
- Hadley, Everett Addison.** Elected member, 330.
- Haehnel, Otto.** Corrosion of lead cable sheaths, 490*A.*; intercrystalline brittleness in telephone cables, 389*A.*
- Haenni, P.** B in Al and Al alloys, 448*A.*
- Hagedorn, F. A.** Arc welding plant in maintenance work, 692*A.*
- Hahn, Friedrich L.** Progress in anal. chem. of light metals, 565*A.*
- Hahn, Friedrich L., and Georg Weiler.** Vol. dein. of Ca by pptn. as oxalate followed by titration with permanganate, 578*A.*
- Hahn, Otto.** Isotopes of U, 413*A.*; *see* Bodenstein, M.
- Hahn, Otto, and Otto Erbacher.** Homogeneity of disintegration and half-period of mesothorium 2, 409*A.*
- Hahn, Otto, and L. Meitner.** β -ray spectrum of Ra, 542*A.*
- Hahnemann, W., H. Hecht, and E. Wilekens.** New testing machine for repeated loading tests, 609*A.*
- Haines, Donal Hamilton.** First tool in research—a comprehensive bibliography, 755*A.*
- Halbertsma, N. A.** Self-starting W arc lamp, 668*A.*
- Hall, Andrew S.** Pyrometer control in brass foundry, 616*A.*
- Hall, Edwin H.** Dual theory of metallic conduction, 425*A.*; four transverse effects and their relations in certain metals, 429*A.*
- Hall, Lawrence P.** *See* Richards, Theodore W.
- Halliwell, George P.** *See* Pilling, Norman B.
- Halstead, Thomas, and Donald P. Smith.** Constitution of alloys Al-Mg from 32 to 48% Mg, 452*A.*
- Hammett, Louis P.** Velocity of H electrode reaction on Pt catalysts, 400*A.*
- Hammond, R. A. F.** *See* Genders, R.
- Hanawalt, J. A., and L. R. Ingersoll.** Non-magnetic films of Fe, Co, and Ni, 378*A.*
- Hanemann, H., and F. Lücke.** Recrystn. and hot-deformation, 420*A.*
- Hanle, W.** Polarization of resonance fluorescence of Na vapour by excitation with circularly polarized light, 544*A.*
- Hannah, J. Dickson.** Construction of small thermocouples, 616*A.*
- Hansen, C. A.** Grading of moulding sands, 708*A.*
- Hansen, M.** Constitution of red brass, 465*A.*; destruction of Ni boilers by heating gas, 490*A.*; *paper on* "Note on the Magnesium-Rich Magnesium-Copper Alloys," 93.—*Discussion*: J. W. Jenkin, 100; S. L. Archbutt, 101.—*Reply to Discussion*, 102.
- Hanser, Klaus.** Cu-Zn alloys, 662*A.*
- Hanson, D.** Fatigue of metals, 424*A.*
- Hanson, D., and (Miss) Grace W. Ford.** *Paper on* "Investigation of the Effects of Impurities on Copper. Part V.—The Effect of Bismuth on Copper," 169.—*Discussion*: R. Genders, 178; L. Taverner, 179;

- W. Rosenhain, 179; R. S. Hutton, 179.—*Reply to Discussion*, 180.—*Correspondence*: F. Johnson, 180.—*Reply to Correspondence*, 181.
- Hanson, D.**, and C. B. Marryat. *Paper on "Investigation of the Effects of Impurities on Copper. Part III.—The Effect of Arsenic on Copper. Part IV.—The Effect of Arsenic Plus Oxygen on Copper,"* 121.—*Discussion*: L. Taverner, 163; W. Rosenhain, 164; T. Turner, 164; N. F. S. Hubbard, 165.—*Reply to Discussion*, 165.—*Correspondence*: F. Johnson, 165.—*Reply to Correspondence*, 167.
- Harada, Takayasu.** Elected member, 330.
- Härden, J.** Refractory articles from tungsten powder, 737A.
- Harder, O. E.** See Reyerson, L. H.
- Hardmeier, W.** Anomalous scattering of α -rays, 526A., 529A.
- Hardy, James.** Elected member, 329.
- Hargitt, T. F.** Hall effect in Bi sputtered films, 376A.
- Hargreaves, F.** *Correspondence on "The Mechanism of Inverse Segregation in Alloys,"* 281; *paper on "Note on the Crystallization of the Lead-Tin Eutectic,"* 106.—*Discussion*: N. T. Belaiew, 109.—*Reply to Discussion*, 109; *paper on "The Application of Strain Methods to the Investigation of the Structure of Eutectic Alloys,"* 103.
- Haring, H. E.** Measuring polarization and resistivity, 627A.
- Harkins, William D.**, T. F. Young, and Lan Hua Chen. Ring method for detn. of surface tension, 592A.
- Harper, James C.** Former for wire rings, 699A.
- Harper, Wm. E.** Modern amalgam procedure, 664A.
- Harr, R.** See Endell, K.
- Harriman, John W.** Die-casting process, 716A.
- Harris, Albert Victor.** Elected member, 16; Stellite surfacing or "Stelliting," 653A.
- Harris, Harold.** See Bamford, T. G.
- Harris, J. A.**, L. F. Yntema, and B. S. Hopkins. Ilinium, 389A.
- Harrison, H. C.** Cyanite-clay refractories.—I., 739A.; see McCaughey, W. J.
- Harrison, T. H.** Concurrent variations in thermionic and photoelect. emission from Pt and W with state of surfaces of these metals, 401A.
- Harrow, Benjamin.** Book: "The Romance of the Atom," 762A.
- Harst, P. A. van der.** Spectra of Sn, Pb, Sb, and Bi in magnetic field, 545A.
- Hartley, Harold J.** *Discussion on "Penetration of Brass by Tin and Solder,"* 224; *paper on "The Attack of Molten Metals on Certain Non-Ferrous Metals and Alloys,"* 193.—*Discussion*: U. R. Evans, 224; R. Genders, 226; F. C. Thompson, 227; D. Lewis, 228; A. Pinkerton, 228; W. H. J. Vernon, 230; T. Turner, 230.—*Replies to Discussion*, 232, 234.—*Correspondence*: W. Hume-Rothery, 235.—*Reply to Correspondence*, 240.
- Hartmann, Fridolin.** Highly-resistant fireproof coatings, 736A.; see Hofmann, K. A.
- Hartmann, Fritz.** See Steinhoff, Eduard.
- Hartmann, M. L.**, and O. B. Westmont. Thermal insulation of elect. furnaces, 736A.
- Hartmann, M. L.**, O. B. Westmont, and S. F. Morgan. Detn. of bulk and pore volumes of refractory materials, 735A.
- Hartree, D. R.** Spectra of some Li-like and Na-like atoms, 538A.
- Hartshorn, L.** Convenient arrangement for measurement of very small currents, 599A.
- Harvey, Dean.** Report of Cttee. B-4 of A.S.T.M. on metallic materials for elect. heating, 672A.
- Hasche, R. L.**, M. Polanyi, and E. Vogt. Spectral distribution of intensity in D-lines of chem. luminescent spectrum of Na vapours, 544A.
- Hassel, O.** See Bohm, J.
- Hatschek, E.**, and P. C. L. Thorne. Metal sols in non-dissociating liquids. II.—Compn. of disperse phase of Ni sols in benzene and toluene, 398A.
- Haug, Adolf.** Pattern plate, 705A.
- Haughton, J. L.** *Correspondence on "Penetration of Brass by Tin and Solder,"* 234.
- Haupt, H.** Behaviour of Fe, red brass, and yellow brass with waste salt solns. of potash industry at ordinary temp. and in boilers under pressure, 489A.

- Haurowitz, Felix.** Preparation of stable metal sols in benzene, 436*A*.
- Hausen, J.** Corrosion researches at Chemisch-Technische Reichsanstalt, Berlin, 493*A*.
- Häusser, F.** Combustibility and strength of metallurgical coke with larger granulation, 729*A*.
- Hay, R.** Phys. properties of Duralumin, 449*A*.
- Hayes, H. H.** *Discussion on* "Electric Furnaces in Non-Ferrous Metallurgy," 306.
- Haywood, William George.** Elected member, 330.
- Heape, Harold.** Obituary notice, 351.
- Heath, F. C.** Elect. furnace practice in bronze foundry, 710*A*.
- Heber, Gustav.** Danger of amalgam fillings, 753*A*.
- Hecht, H.** *See* Hahnemann, W.
- Heckendorn, Alfons.** *See* Rupe, H.
- Heczko, Theodor.** Action of KI on vanadophosphoric acid, 588*A*.
- Hedges, Ernest Sydney.** Liquid-line corrosion, 496*A*; periodic electrochem. passivity of Fe, Co, Ni, and Al, 631*A*; periodic phenomena at anodes of Cu and Ag, 630*A*; periodic phenomena at anodes of Mg, Zn, Cd, Hg, Sn, and Pb, and at an unattackable anode, 630*A*.
- Hedvall, J. A.** Phys. and chem. processes in agglomeration of unmelted powders, 435*A*.
- Heinrich, Sydney George Salter.** Elected member, 16.
- Heisenberg, W.** Quantum mechanics, 556*A*; spectra of atomic systems having two electrons, 550*A*.
- Heisterman, G. C.** Induction furnace produces superior brass, 727*A*.
- Helbig, A. B.** Combustion of fuel in dust form, 732*A*.
- Heller, Richard.** *See* Stock, Alfred.
- Helser, P. D.** Lab. load furnace, 590*A*.
- Hemingway, Lawrence.** Elected member, 16.
- Hemptinne, Marc de.** Thermal expansion of metallic compds., 481*A*.
- Hencky, Heinrich.** Nature of plastic deformation. II.—Flow of plastic substances and loss of energy during forging and rolling, 699*A*.
- Hencky, K.** *See* Knoblauch, Osc.
- Henning, F.** Possibilities of practical temp. measurement below -193°C. , 614*A*; tension- and resistance-thermometer for use in region of temp. of liquid N and H, 590*A*.
- Henning, F., and W. Heuse.** Basis for calibration of opt. temp. scale, 618*A*; spectro-micropycometer and opt. observation of m.p. of Pt and other metals, 618*A*.
- Henry, Pierre.** Diffusion of solids, 434*A*.
- Hepburn, W. M.** Surface combustion and its appn., 731*A*.
- Herasymenko, P.** Researches with Hg dropping cathode. IV.—Changes in overvoltage with concn. of hydriions, 629*A*.
- Herbert, E. G.** Measurement of cutting temps., 701*A*.
- Hermanowicz, E.** *See* Jablczynski, K.
- Herrent, Pierre.** Phase-rule diagrams and their industrial importance, 485*A*.
- Herrmann, Kurt.** Influence of absorbed gas on photoelect. electron emission and elect. conductivity of Pt, 399*A*.
- Herschkowitsch, M.** Titrimetric detn. of Cu with KI, 580*A*.
- Herschman, H. K.** *See* Jordan, Louis.
- Herz, Richard.** Book: "Röntgenstrahlen," 762*A*.
- Herz, W.** Coeff. of expansion and free space, 433*A*.
- Herzog, H. C.** Recent progress of Cr plating in Germany, 642*A*.
- Herzog, R. O., and K. Weissenberg.** Molecule in crystals, 533*A*.
- Heuse, W.** *See* Henning, F.
- Heusler, Fr.** Magnetism and crystal structure of Mn-Al-Cu alloys, 522*A*.
- Heusler, Otto.** Ternary system Cu-Zn-Mn, 465*A*; *see* Tammann, Gustav.
- v. Hevesy, Georg.** Book: "Das element Hafnium," 762*A*.
- v. Hevesy, Georg, and A. Obrutshva.** Self-diffusion in solid metals, 434*A*.
- Hewitt, L. C.** Fusion points of firebrick coal ash mixtures, 739*A*.
- Hey, D. H.** *See* Butler, J. A. V.
- Heyl, Paul R.** Atoms of energy, 532*A*.
- Heyrovský, J.** Researches with dropping Hg cathode. III.—Theory of over-potential, 629*A*.
- Hidnert, Peter, and W. T. Sweeney.** Thermal expansion of graphite, 742*A*.
- Higgins, W. F.** Thermometry, 614*A*.
- Hilditch, T. P.** *See* Armstrong, E. F.

- Hill, A. V.** Mumetal magnetic shield for sensitive galvanometer, 598A.
- Hill, Edwin A.** Crystal angles, measured under the microscope, 520A.
- Hind, H. Lloyd, and W. Brough Randles.** Book: "Handbook of Photomicrography," 762A.
- Hind, Thomas W.** Preventing corrosion with protective coatings, 508A.
- Hineline, H. D., and W. B. Cooley.** Electrodeposition of Cu-Ni alloys, 643A.
- Hinshelwood, Cyril Norman.** *See* Green, Thomas Edward; *see* Hutchinson, William Kenneth; *see* Prichard, Charles Ross.
- Hinshelwood, Cyril Norman, and Charles Ross Prichard.** Comparison between homogeneous thermal decompn. of nitrous oxide and its heterogeneous catalytic decompn. on surface of Pt, 400A.; interaction of CO₂ and H on surface of W, 412A.; relation of homogeneous to catalyzed reactions. Catalytic decompn. of HI, on surface of Au, 387A.
- v. Hippel, Artur.** Cathode atomization problems, 441A.; theory of cathode dispersion. Cathode dispersion problems.—III., 442A.
- Hirata, Hideki.** System of orbital-planes in inner region of an atom, and O-triplets in X-ray spectra belonging to L-series, 529A.
- Hirata, Hideki, and Hisaji Komatsubara.** Arrangement of micro-crystals in Ag deposited by electrolysis, 513A.
- Hirschbrich, E.** Sil-O-Cel, 743A.
- Hjelmstätter, J. D. Roosaf.** Structural materials for aeroplanes, 447A.
- Hoag, J. Barton.** Extreme ultra-violet spectra using large angles of incidence, 594A.
- Hobart, H. M., and W. Sparagan.** Arc welding as manufg. process, 689A.
- Hodler, A.** *See* Magnus, A.
- Hofer, Karl.** Danger of Hg vapour, 753A.
- Hoff, F. A.** Metal-cutting oils and compds., 702A.
- Hoffman, Otto Emil.** Elected member, 15.
- Hoffmann, Fritz G.** Danger of poisoning by Hg in labs., 753A.
- Hofman, F.** M.p. of Pt, 399A.
- Hofmann, K. A., Fridolin Hartmann, and Kurt Nagel.** Action of ammonium chloride vapour on metals and correspondence of ammonium salts with hydroxonium salts as acids, 435A.
- Hoinkiss, Rheinhold.** Elected member, 16.
- Hollingshead, T. E., and T. J. Otterbacher.** Suitability of Monel metal for vanilla flavouring containers, 665A.
- Hollins, C. D.** Foundry progress in sand prepn., 708A.
- Holm, Ragnar.** Contact resistance, 428A.
- Holman, Bernard W.** *Paper on "An Etching Reagent for Copper,"* 69.—*Correspondence:* W. H. Merrett, 69.—*Reply to Correspondence,* 70.
- Holmes, Arthur, and Robert W. Lawson.** Radioactivity of K and its geological significance, 404A.
- Holton, W. B.** *See* Thompson, A. P.
- Homer, Walter Henry.** Elected member, 330.
- Honda, Kôtarô.** Comparison of static and dynamic tensile and notched-bar tests, 609A.; theory of hardening of metals, 420A.
- Honda, Kôtarô, and Hikozi Endo.** *Paper on "Magnetic Analysis as a Means of Studying the Structure of Non-Magnetic Alloys,"* 29.
- Honda, Kôtarô, and Kinnosuké Takahasi.** Indentation hardness of metals, 604A.
- Hönigschmid, O.** *See* Bodenstein, M.
- Hönigschmid, O., E. Zintl, and F. González.** Atomic wt. of Zr, 415A.
- Hoover, Herbert.** Vital need for greater financial support to pure science research, 754A.
- Hopfield, J. J.** *See* Ellsworth, Vivian M.
- Hopkins, A. J.** Modern theory of alchemy, 755A.
- Hopkins, B. S.** Building blocks of the universe, 389A.; *see* Harris, J. A.
- Hori, Takeo.** Absorption spectra produced by explosion of various elements, 550A.; radioactive and non-radioactive isotopes, 524A.
- Hörig, Elizabeth.** *See* Hörig, H.
- Hörig, H., and Elizabeth Hörig.** Radiation pyrometry, 618A.
- Horn, Hans A.** Welding and soldering of Al, 680A.
- Horn, R.** Elect. melting of metals with high thermal conductivity, 721A.; progress in metal working in 1925. I.—Chem. treatment of metals, 747A.

- Horner, Joseph.** Pattern detail and method of moulding axle box, 705*A*.
- Horovitz, Karl.** Focussing X-ray spectrograph for low temps., 521*A*.
- Horton, Frank.** *See* Davies, Ann Catherine.
- Hosmer, H. R.** *See* Dresbach, M.
- Hosokawa, Yahel.** *See* Takemura, Kango.
- Hothersall, A. W.** Acidity of certain electroplating solns., 639*A*.
- Houstoun, R. A.** Theory of absorption of X-rays, 529*A*.
- Houtemans, F. G.** Band fluorescence of Hg vapour, 539*A*; photoelect. ionization of Hg vapour, 540*A*.
- Howard, Frank C.** Elected member, 15.
- Howe, Arthur William.** Elected member, 15.
- Hoyt, Samuel L.** Plastic deformation of a Zn single crystal, 414*A*.
- Hoyt, Samuel L., and T. R. Schermerhorn.** Hardness of Cu, and Meyer's analysis, 380*A*.
- Hubbard, N. F. S.** *Discussion on* "Brittleness in Arsenical Copper," 65; *discussion on* "Investigation of the Effects of Impurities on Copper," 165.
- Huber, H., L. Kirschfeld, and A. Sieverts.** V, Ti, and H, 413*A*.
- Hückel, Walter.** Book: "Katalyse mit Kolloiden Metallen," 762*A*.
- Huff, Ernest.** Uses of Stellite welding rod, 690*A*.
- Huggins, Maurice L.** Atomic radii.—II., 530*A*.
- Hugh, W. E.** *See* Butler, J. A. V.
- Hughes, G. F., and P. L. Green.** Modern induction furnace brass-melting practice, 710*A*.
- Hugill, W., and W. J. Rees.** Effect of repeated burning on structure and properties of lime-bonded silica bricks, 741*A*.
- Hull, Albert W., and J. M. Hyatt.** Secondary electron emission from Mo, 395*A*.
- Hull, F. A.** Report of Sub-Cttee. VIII. of Cttee. A-5 of A.S.T.M. on tests of metallic coated products, 601*A*.
- Humby, Spencer Robert, and Michael Wilcox Perrin.** Deposition of metallic Zn on positive pole of simple voltaic cell, 645*A*.
- Hume-Rothery, William.** Connection between chem. valency, electron grouping, and crystal structure, 520*A*; *correspondence on* "Penetration of Brass by Tin and Solder," 236; *correspondence on* "The Attack of Molten Metals on Certain Non-Ferrous Metals and Alloys," 235; *correspondence on* "The Mechanism of Inverse Segregation in Alloys," 283.
- Humphreys, Cynan Lloyd.** Elected student member, 16.
- Humphries, C. H.** Plating for Cr for wear, 642*A*.
- Hund, F.** Interpretation of molecular spectra.—I., 556*A*.
- Hunt, G. A.** *See* Bent, H. E.
- Hurme, E. A.** Medium and low temp. appns., 722*A*.
- Hurst, J. E.** Development of centrifugal casting process in Gt. Britain and Europe, 714*A*.
- Hutchinson, William Kenneth, and Cyril Norman Hinshelwood.** Interaction of H and N₂O on surface of Au, 387*A*.
- Huth, Friedrich.** Autogenous welding of Al, 681*A*.
- Hutton, R. S.** *Discussion on* "Investigation of the Effects of Impurities on Copper," 179; vote of thanks to President for his address, 17.
- Huybrechts, —.** Analysis of solid fuels, 731*A*.
- Hyatt, J. M.** Secondary electron emission produced by positive Ca ions, 376*A*; *see* Hull, Albert W.
- Hyslop, J. F.** Fireclay refractories, 738*A*.
- Inamullah, Syed.** Elected member, 16.
- Ingersoll, L. R.** *See* Hanawalt, J. A.
- Inglis, N. F.** Hysteresis and fatigue of Wöhler rotating cantilever specimen, 603*A*.
- Ingram, S. B.** *See* Bowen, I. S.
- Inscoc, S. A.** Seaming methods in hollow-ware manuf., 700*A*.
- Ionescu, Th.** Joule effect, explained by Bohr's theory, 428*A*.
- Ipatief, V., and A. Andreevsky.** Displacement of Pt by H under pressure, 399*A*.
- Ipsen, C. L.** Possibilities of industrial heating, 756*A*.
- Irresberger, C.** Fourth foundry exhibition in Düsseldorf, 703*A*.
- Irwin, P. L.** Fatigue of metals by direct stress, 423*A*.

- Isgarischev, N.** Relation of hydration and adsorption to mechanism of development of electromotive power, 624*A*.
- Iskjul, V. I.** Behaviour of kaolin at high temps., 740*A*.
- Israël, H.** Magneto-spectroscopic investigations of Ni wires by means of short Hertzian waves, 397*A*.
- Ives, Herbert E.** Alkali metal photo-elect. cell, 673*A*.
- Ivey, Albert Henry.** Elected member, 330.
- Iwasé, Keizô.** Occlusion of gases by metals and alloys in liquid and solid states, 436*A*.
- Izmailskii, B. A., and B. I. Kopenskii.** Benzidine researches. I.—Passivity of zinc dust, 669*A*.
- Jablczynski, K., and E. Hermanowicz.** Kinetic investigations of velocity of soln. of Al in acids and alkalis, 374*A*.
- Jablonski, L.** Corrosion and protection of Al, 487*A*.
- Jackson, D. H.** Suggested appns. of water de-aeration, 508*A*.
- Jackson, James.** Detinning of cans, 667*A*.
- Jackson, Wilfred J.** Secondary emissions from metals due to bombardment by high-speed positive ions, 442*A*.
- Jaeger, F. G.** Behaviour of carborundum under working conditions, 743*A*.
- Jaeger, F. M., and D. W. Dijkstra.** Proportions of different isotopes in isotopic elements, 524*A*.
- Jaeger, F. M., P. Terpstra, and H. G. K. Westenbrink.** Crystal structure of Ga, 522*A*.
- Jahn, J.** See Schoeller, W. R.
- Jakob, Hans.** See Kohn, Hedwig.
- Jakob, Max.** Thermal conductivity of certain metals and alloys, 430*A*.
- James, C.** See Goggin, J. F.
- James, Robert.** Haulage and winding ropes, 675*A*.
- Jander, G., and O. Pfundt.** Vol. detn. of Zn by visual conductometric titration, 588*A*.
- Jansen, A. F. J.** See Keesom, W. H.
- Jareš, Vojtěch.** Elected member, 15.
- Jarvis, C. W.** Resonance and ionization potentials in Hg vapour, 394*A*; resonance potentials in Ga and In vapours, 537*A*.
- Jarvis, Ernest G.** Bronzes in common usage, 660*A*.
- Jasper, T. M.** See Moore, H. F.
- Jauncey, G. E. M.** Intensity of reflection of X-rays by crystals and Compton effect, 520*A*.
- Jauncey, G. E. M., and R. A. Boyd.** Disappearance of unmodified line in Compton effect, 549*A*.
- Jauncey, G. E. M., and O. K. De Foe.** Energy reappearing as characteristic X-rays when X-rays are absorbed in Cu, 381*A*.
- Jeffries, Zay.** Al and its alloys, 447*A*; report of Sub-Cttee. VI. of Cttee. E-4 of A.S.T.M. on X-ray metallography, 510*A*.
- Jeffries, Zay, and P. Tarsov.** Tungsten and thoria, 411*A*.
- Jellinek, J.** See Jirsa, F.
- Jellinek, K.** Equilibria in fused salts (Reactions between alloys of alkali and alk. earth metals and their chlorides), 479*A*.
- Jenckes, Edwin K.** Pure oxides and salts of W and Mo, 413*A*.
- Jenge, W.** See Schulz, E. H.
- Jenkin, C. Frewin.** Rubber in the lab., 591*A*.
- Jenkin, J. W.** Discussion on "Note on the Magnesium-Rich Magnesium-Copper Alloys," 100.
- Jette, Eric R.** Mobility of ions in soln., with particular reference to separation of isotopes, 524*A*; see Kendall, James.
- Jewell, Lewis E.** Illuminator for use in metallographic microscopy, 515*A*.
- Jewett, F. B.** Motive and obligation, 754*A*.
- Jez, Piotr.** Thermionic emission of incandescent Pt in vapours of I, 402*A*.
- Jilek, Ant.** See Lukas, J.
- Jilek, Ant., and Jan Lukas.** Electrolytic sepn. of Cu in presence of Cd, 573*A*.
- Jirsa, F., and J. Jellinek.** Anodic oxidation of Au.—III., 387*A*.
- Joel, E.** See Zaigmondy, R.
- Johlin, J. M.** Ring method for surface tension measurement, 592*A*.
- Johnson, F.** Correspondence on "Brittleness in Arsenical Copper," 67; Correspondence on "Investigation of the Effects of Impurities on Copper," 165, 180.
- Johnson, Martin C.** Cumulative ionization in stellar atmospheres, 525*A*;

- scattering and absorption in atmospheres of emission line stars, 551A.
- Jones, C. O.**, and E. C. Frost. Detn. of small amts. of Bi in Cu, 577A.
- Jones, E. O.**, and E. Whitehead. Cracking of nickel-silvers in course of annealing, 465A.
- Jones, L. T.** Variable mass of the electron, 527A.
- Jones, W. R. D.** Mg and its alloys, 468A.
- Jönsson, Axel.** Exception to intensity rule relating to Röntgen spectra, 548A.; intensities in *L*-Röntgen series, 548A.
- Jordan, Louis, L. H. Grenall, and H. K. Herschman.** Tarnish resistance and some phys. properties of Ag alloys, 491A.
- Jordan, Louis, A. A. Peterson, and L. H. Phelps.** Refractories for melting pure metals: Fe, Ni, Pt, 736A., 737A.
- Jordan, P.** Theory of atomic structure, 530A.
- Jouaust, —.** Photoelect. cells, 673A.
- Jouniaux, A.** Extension of Trouton's rule to fusion of metals, 431A.; variation of mol. wt. of Pb with temp., 390A.; variation of mol. wt. of Sn with temp., 410A.
- Jrmer, W.** Hardening of metals, 420A.
- Jubitz, W.** Influence of working on coeff. of thermal expansion of metals, 433A.
- Jumau, L.** Theory of Pb accumulator, 633A.
- Jung, H.** Röntgenographic investigation of Cu, Ag, and Au, 522A.
- Junker, O.** Water-cooled metal moulds, 707A.
- Kahlenberg, Louis.** American Electrochemical Society, 756A.
- Kahlenberg, Louis, and Sidney J. French.** Potential of Al in aqueous solns., 373A.
- Kaiser, Clifford F.** Elected student member, 330.
- Kaiser, Joseph G.** Conflicting foundry methods, 716A.
- Kalpers, H.** Alloys of Cr, 653A.
- Kameyama, Naoto.** Elected member, 330.
- Kamiński, Bogdan.** Nature of absorption of H by Na and Ca, 408A.
- Kändler, Hermann, and E. H. Schulz.** New way to reduce risk of continuous fracture, 603A.
- Kapusiński, W.** Fluorescence of Cd vapour, 535A.; line fluorescence of Cd vapour, 535A.
- Karnop, R.** See v. Göler, Frhr.
- Karnop, R., and G. Sachs.** Behaviour of Al crystals under tension. II.—Experimental, 372A.
- Karns, George M.** Test for Cd in presence of Cu, 569A.
- Karrer, Enoch.** Thermoscope for liquid-air baths, 615A.
- Karssen, A.** See Smits, A.
- Kaufmann, Albert.** Elected member, 15; pressure die-casting, pressure die-casting machines, 716A.
- Kautny, Theo.** Book: "Handbuch der autogenen Metallbearbeitung unter Berücksichtigung der elektrischen Schweißung," 762A., (review) 773A.; use of acetylene for autogenous metal working, 697A.; use of benzol for autogenous welding and cutting, 695A.
- Kautter, Theo.** See Gutbier, A.
- Kawakami, Masuo.** Sp. heat of Fe-Ni alloys, 473A.
- Kaye, G. W. C.** Book: "High Vacua," 762A., (review) 774A.
- Kaye, G. W. C. and T. H. Laby.** Book: "Physical and Chemical Constants and Some Mathematical Functions," 762A., (review) 781A.
- Kazarnovskij, I. A.** Photosensibility of Se, 405A.
- Kean, R. H.** See Adams, F. W.
- Keel, —.** Know your blowpipe, 694A.
- Keesom, W. H.** H. Kammerlingh Onnes, 745A.
- Keesom, W. H., F. P. G. A. J. van Agt, and A. F. J. Jansen.** Thermal expansion of Cu between + 101° C. and - 253° C., 379A.
- Keinath, Georg.** Measurement of resistance, 611A.
- Keith, W. D.** See Dix, E. H., jun.
- v. Keler, Theodore R.** Cr plating patent muddle, 642A.
- Keller, J. O.** Auxiliary equipment for elect. furnaces, 725A.
- Kellström, Gunnar.** Precision measurements in *K*-series of Pd and Ag, 542A.
- Kemmerer, Geo., and Helmuth H. Schrenk.** Mercuric bromide paper for Gutzeit method for As, 569A.
- Kempf, L. W.** See Archer, Robert S.
- Kendall, James, and William West.**

- Attempted sepn. of Hf and Zr by ionic migration method, 573*A*.
- Kendall, James**, Eric R. Jette, and William West. Sepn. of Ra and of mesothorium I. from Ba by ionic migration method, 575*A*.
- Kennedy, John Carroll**. Elected member, 15.
- Kennedy, Walter**. Elect. resistance materials, 672*A*.
- Kern, E. F.** See Colcord, F. F.
- Kerr, William**. Failure of metals by creep, 423*A*.
- Kerridge, Phyllis M. Tookey**. Use of glass electrodes, 623*A*.
- Kerschbaum, Friedrich P.** Elected member, 330.
- Kettinger, Charles F.** Research—a mental attitude, 754*A*.; research and progress, 755*A*.
- Keugean, G. H.** Statical hysteresis in flexure of bars, 602*A*.
- Keys, D. B.** Review of research work on manuf. of Mg, 635*A*.
- Khastgir, S. R.** See Barkla, C. G.
- Kichlu, Pratap Kischen**. Arc spectrum of Cu, 536*A*.
- Kiddle, Richard H.** Shrinking a cylinder on brass liner, 662*A*.
- Kienle, H.** Stationary Ca line in O- and B-type stars, 536*A*.
- Killeffer, D. H.** Industry finds a new tool—X-rays, 613*A*.; \$300,000,000 annually consumed by rust, 498*A*.
- Killian, Thomas J.** Thermionic phenomena caused by vapours of Rb and K, 543*A*.
- Kindscher, E.** See Rodt, V.
- King, Haroll S.** See Richards, Theodore W.
- King, J. F.**, and R. N. Washburne. Electrometric detn. of small amts. of ferric iron, 581*A*.
- King, J. T.** Effect of air on cupellation losses, 564*A*.
- King, W. G., jun.** See Mantell, C. L.
- Kinkad, R. E.** Research in welding industry, 685*A*.
- Kirschfeld, L.** See Huber, H.
- Kistiakowsky, George B.** Ionization potentials of N and H on Fe and other metals, 437*A*.
- Kling, A.**, A. Lassieur, and (Mme.) A. Lassieur. Sepn. of Zn and Ni by means of H₂S, 575*A*.
- Kling, K.** See Strache, H.
- Klingaman, Foster E.** Selective dispersion of Hg vapour at $\lambda 2536$ absorption line, 541*A*.
- Klinkhardt, H.** New method for detn. of sp. heat at high temps., 430*A*.
- Klopsteg, Paul E.** Surface tension measurement by ring method, 592*A*.
- Klug, J.** Renaming of Seger cones, 619*A*.
- Knauer, F.**, and O. Stern. Evidence of small magnetic moments of molecules, 393*A*.
- Knein, M.** Theory of compression tests, 610*A*.
- Knerr, H. C.** Report to A.S.T.M. on testing of thin sheet metals, 600*A*.
- Knoblauch, Osc.**, and K. Hencky. Book: "Anleitung zu genauen technischen Temperaturmessung," 762*A*.
- Knox, John D.** Six-roll, cluster type cold mill, 701*A*.
- Koch, —.** Detn. of Sn and Pb in solder and of W in ferro-tungsten by calculation on Archimedean principle, 587*A*.
- Koch, Lisel.** See Masing, Georg.
- Koenigsberger, J.** Modulus of torsion and tenacity of single- and multi-crystal wires, 418*A*.
- Koets, P.** See Arkel, A. E. van.
- Kohlrausch, K. W. F.** Contradictory results of experiments with RaC γ radiation, 543*A*.
- Kohn, Hedwig**, and Hans Jakob. Intensity relations in doublets of principal series of alkali metals, 448*A*., 547*A*.
- Kolhörster, Werner**. Reply to paper by Behönek on origin of penetrating radiation of atmosphere, 390*A*.
- Kollmann, K.** See Tammann, Georg.
- Kolthoff, I. M.** Book: "Die Massanalyse," 762*A*.; specific reagent for Na, 570*A*.
- Kolthoff, I. M.**, and N. Howell Furman. Book: "Potentiometric Titrations," 762*A*., (review) 781*A*.
- Komatsu, Shigeru**. Catalytic action. IV.—New function of reduced Cu, 384*A*.
- Komatsu, Shigeru**, and Masao Kurata. Catalytic action. VI.—Catalytic action of reduced Cu on acid amide, 384*A*. XI.—Catalytic activity of reduced Cu.—I., 385*A*.
- Komatsu, Shigeru**, and Shozo Yamaguchi. Camphor series. III.—Catalytic action of reduced Cu on dextro-camphoroxime, 384*A*.
- Komatsu, Shigeru**, and Takehiko Yukitomo. Camphor series. V.—Cata-

- lytic action of reduced Cu and reduced Ni on *l*-menthol, 384*A*.
- Komatsubara, Hisaji.** See Hirata, Hideki.
- Konen, H.** Position of quant. spectral analysis, 560*A*.
- Konschak, Martin.** See Ruff, Otto.
- Kopenskii, B. I.** See Izmailskii, B. A.
- Koppel, Ivan.** Book: "Der Bau der Atome und das periodische System," 762*A*.
- Körber, Friedrich.** Deformation and recrystn., 421*A*.; present position of investigation of metallic materials, 747*A*.
- Kordes, E.** Change of entropy on melting. I.—Variation of entropy change of elements with atomic no., 432*A*.; eutectic lowering of freezing point in binary systems, 483*A*.
- Koref, F.** Influence of crystal structure on stability of form of tungsten illuminating bodies, 412*A*.
- Korn, A.** Forces of attraction and repulsion in atoms, 529*A*.
- Kossek, L.** See Moser, Ludwig.
- Köster, W.** Technologic behaviour of drawn brass rods, 464*A*.
- Köster, W., and F. Müller.** Soly. of Si in Al, 453*A*.
- Koszegi, D.** Vol. method for quant. detn. of Cu, 580*A*.
- Kraus, Edward H.** Calculating Jolly balance, 591*A*.
- Kraus, E. J.** Scheme of logarithmic tables for vol. analysis, 558*A*.
- Krause, E.** Cr plating in factory practice, 643*A*.
- Krauskopf, Francis F., and Carl E. Swartz.** Molybdenum thiocyanate and qual. detection of Mo, 570*A*.
- Krebs, Gustav.** Prodn. of bronze cylinder liners, 706*A*.
- Kremann, Robert.** Electrolytic conduction in molten metallic alloys. XVIII.—Summary of preceding papers, 479*A*.
- Kremann, Robert, and Andreas Tröster.** Electrolytic conduction in molten metallic alloys. XVII.—Electrolysis of alloys of Zn with Pb, Bi, and Cd, of Sb with Bi and Cd, and of Cd with Pb and Bi, 478*A*.
- Kremers, H. C.** See Thompson, A. P.
- Kreutzberg, E. C.** Pulverizing coal at furnace, 732*A*.
- Krivobok, Vsevolod Nicholas.** Elected member, 15.
- Kriz, Antonin.** Elected member, 16.
- Kroll, W.** Al-Ag alloys showing ageing phenomena, 454*A*.; Al alloys showing ageing phenomena. Replacement of Si by Be in alloys of Duralumin, Lualal and Aludur type, 447*A*.; Al alloys showing ageing phenomena. Replacement of Si with Ge, 451*A*.; diagr. Al-Ge, 451*A*.; mech. properties of binary Al-Be alloys, 447*A*.; prepn. of Be, 375*A*.
- Krumme, P.** Galvanizing and tinning of iron and steel wire, 502*A*.
- Kühnel, R. and W. Marzahn.** New red brass R5 in railway work, 466*A*.
- Kühnel, R. (with W. Marzahn, — Mohrmann, and E. Neemann).** Constitution and properties of red brass, 465*A*.
- Kuhnen, H.** Light metals in transport, 652*A*.
- Kunsman, C. H.** Thermionic properties of some mixtures used as catalysts in synthesis of ammonia, 676*A*.
- Kuntze, W.** Tensile tests with notched test-pieces, 609*A*.
- Kunz, Jacob, John B. Taylor, and Worth H. Rodebush.** Magnetic properties of atoms, 429*A*.
- Kurata, Masao.** See Komatsu, Shigeru.
- Kurnakow, N. S.** General properties of chem. diagrams, 485*A*.
- Kurnakow, N. S., and G. G. Urzov.** Thermal analysis of clays and bauxites, 739*A*.
- Kürschner, K., and K. Scharrer.** Use of powdered Cu in analytical chemistry, 562*A*.
- Kurtchatov, T., and K. Sinelnikov.** Transmission of low velocity electrons through thin metallic foils, 442*A*.
- Kuyama, Tamio.** See Fukuda, Mitsuharu.
- Kypopoulos, S.** Preparation, refractive index and dielectric const. of red crystalline Se, 405*A*.
- Ladenburg, R.** Anomalous dispersion by electrically excited H, He, Ne, and Hg, 394*A*.
- Laffray, J.** Spark spectrum of Hg in extreme red, 538*A*.
- Lafitte, P.** Ag-Mg alloys, 476*A*.
- Lafortune, F.** See Bruylants, P.
- Lai, Emil.** Cu and its treatment, 382*A*., 656*A*.
- La Mer, Victor K.** See Gronwall, T. H.

- Lamoreux, Ivan.** Core supports in large castings, 706*A*.
- Lampe, B.** Influence of Ni mash tubs on acidity, H-ion concn. and colour of wort, 665*A*.
- Lancaster, Roy.** Elected member, 330.
- Lancing, William D.** Electronic theory of passivity, 630*A*.
- Landau, L.** Theory of spectra of diatomic molecules, 556*A*.
- Landolt, P. E.** Progress in art of elect. pptn. since 1900, 756*A*.
- Lange, Heinz.** Colouring of metals, 672*A*.; Cr plating, 505*A*.; metal precipitations and separations, 635*A*.
- Langenberg, Frederick C.** Elected member, 330.
- Laporte, Otto.** Fundamental terms of spectra of first and second large groups, 554*A*.; *see* Meggers, W. F.
- Laporte, Otto, and A. Sommerfeld.** Spectroscopic explanation of magneton numbers in Iron Group, 547*A*.
- Lasarev, P.** Theory of solid solutions, 484*A*.
- Lasausse, E.** American and English work on corrosion, 493*A*.
- Laschkarew, W.** *See* Linnik, W.
- Lassieur, Arnold.** Electrolytic separations by graded potentials, 572*A*.; rapid electro-analysis. Separations by graded potentials, 557*A*.; *see* Kling, A.
- Lassieur, (Mme.) A.** *See* Kling, A.
- László, Franz.** Construction and material, 601*A*.; value of notch-bar impact test, 603*A*.
- Lattès, (Mme.) J. S.** Absorption measurements of radiation of Ra and of its secondary radiation, 542*A*.
- Laubengayer, A. W., and R. B. Corey.** Ge. XIII. — Modified form of vacuum apparatus for purification and study of volatile compds. of Ge, 592*A*.
- v. Laue, M.** Influence of temp. on interferences of X-rays, 521*A*.
- v. Laue, M., and Nikhitranjan Sen.** Calculation of fall of potential in ion and electron gases emitted by glowing metals, 441*A*.
- Lawrence, Ernest O.** Method of high precision for detn. of crit. potentials and ionization potential of Hg vapour, 394*A*.; principle of correspondence, 555*A*.
- Lawson, Robert W.** *See* Holmes, Arthur.
- Leber, A.** *See* Manchot, W.
- Le Chatelier, Henry.** Theory of heating, 727*A*.
- Lecoq, Raoul.** Simple analyt. apparatus, 593*A*.
- Lee, Thomas L.** Elected member, 15.
- Lefèvre, Albert.** Book: "Pour le soudeur-brasseur," 762*A*.
- Leffmann, Henry.** Quotation of scientific references, 755*A*.
- Le Guyon, Robert F.** Titration of Ba ions, 578*A*.
- Leide, Arvid.** K-series Röntgen spectra, 549*A*.
- Leighton, Alan.** Interrupter for use with Hg thermo-regulator, 590*A*.
- Leighton, Philip Albert.** *See* Forbes, George Shannon.
- Leiss, Carl.** New porcelain-metal Röntgen tube designed by Manne Siegbahn, 595*A*.; opt. instruments for investigations in ultra-red and ultra-violet, 594*A*.
- Leist, M.** Oligodynamic action of metals employed in dentistry, 440*A*.
- Leiter, Susan B.** Annealing of commercial Cu to prevent embrittlement by reducing gases, 383*A*.
- Leitner, F.** Influence of wall thickness of moulds on casting, 707*A*.; primary crystn. in Cr-Ni-steel, its influence and importance in faults, 712*A*.
- Lemoine, R.** Practical use of apparatus for measuring permeability and cohesion of moulding sands, 709*A*.
- Lenard, Philipp, and August Becker.** Book: "Kathodenstrahlen," 762*A*.
- Lenher, Victor.** Quant. detn. of Se and Te, 584*A*.
- Leonhardt, Johannes.** Meaning of Laue diagrams from deformed crystals, 519*A*.
- Le Rolland, P.** Measurement of hardness by pendulum, 607*A*.
- Leroux, Johann Anton Armand.** Elected member, 16.
- Leroux, Lucien.** Metals of Pt ores, 665*A*.
- Lessels, M., and R. Striebeck.** Endurance limit of iron and steel in alternating bending compared with results given by tensile tests, 602*A*.
- Lessheim, Hans, and Rudolf Samuel.** Synthesis of electronic groups in atom, 527*A*.
- Leu, Alfred.** Deflection of molecular rays in magnetic field, 533*A*.
- Leun, A. V.** Effect of mulling on phys. properties of foundry sands, 709*A*.

- Levasseur, Albert.** Use of elect. furnaces in alloy and non-ferrous metal foundries, 721A.
- Levi, G. R., and R. Haardt.** Catalytic action considered as surface action, 437A.; crystalline structure of Ru and Os, 523A.
- Levy, S.** *See* v. Trautenberg, Heinrich Rausch.
- Lewis, Dartrey.** *Discussion on* "Penetration of Brass by Tin and Solder," "The Attack of Molten Metals on Certain Non-Ferrous Metals and Alloys," and "The Penetration of Mild Steel by Brazing Solder and Other Metals," 228.
- Lewis, E. W.** Indust. radiology, 613A.
- Lewis, W. C. M.** *See* Garner, Maud.
- Lichtenecker, Karl.** Theory of mixtures and logarithmic mixture rule, 484A.
- Liebreich, E.** Theory of electrolytic deposition of Cr from aqueous chromic acid solns., 641A.
- Liempt, J. A. M. van.** Colour of Cu-Ni alloys, 460A.; resistance limits of W-Mo solid solns.—II., 477A.; *see* Geiss, W.
- Liesegang, Wilhelm.** *See* Schmidt, Hermann.
- Lincoln, J. F.** Welded pressure vessels, 684A.
- Lindemuth, L. B.** Theory of cause of blisters on galvanized sheets, 502A.
- Linder, Ernest G.** Thermoelect. effect in single crystal Zn, 414A.
- Lindh, Axel E.** Development of Röntgen spectroscopy during 1921-1925, 548A.
- Lindridge, Frederick George.** Elected member, 329.
- Lindsay, Geo. A., and Geo. D. Van Dyke.** K X-ray absorption of Ca in calcite, gypsum, and fluorite, 536A.
- Lindt, V.** Metallographic studies on corrosion in pulp and paper industry and wood grinders, 496A.
- Linnik, W., and W. Laschkarew.** Detn. of refractive index of Röntgen rays, employing phenomenon of total reflection, 595A.
- Lissner, Anton.** Elected member, 329.
- List, J. H.** Making a special pipe connection, 704A.
- Litinsky, L.** Standardization suggestions for refractory industry, 734A.
- Little, Arthur D.** Research, 754A.; romance of carbon, 743A.
- Livens, G. H.** *See* Davies, E. L.
- Lloyd, F. E., and G. W. Scarth.** Surface tensiometer and osmometer for class work, 502A.
- Lloyd, William V.** *See* Sand, Henry J. S.
- Lobley, A. G.** *Discussion on* "Electric Furnaces in Non-Ferrous Metallurgy," 304.
- Lobry de Bruyn, C. A.** Elected member, 330.
- Lockyer, William J. S.** Apparatus for broadening spectra, 554A.
- Logan, Arthur.** Non-ferrous foundry practice, 703A.
- Lohse, U.** America's foundry conditions, 703A.
- Loisy, E. de.** Theory of elect. arc furnaces, 725A.
- Lomakin, B. A.** New apparatus for producing spark spectrum of solns., 594A.
- Longden, E.** Analysis of defective castings, 712A.
- Longenecker, L. S.** Refractory research, 734A.
- Loomis, A. G., and J. E. Walters.** Calibration of resistance thermometers at oxygen b.p. and CO₂ sublimation point, 614A.
- Lord, James.** *See* Blake, F. C.
- Lorenz, H. A.** Book: "Lectures on Theoretical Physics," 763A.
- Lorenz, Richard, W. Fraenkel, and Marianne Ganz.** Equilib. of Sn and Pb with stannous chloride and lead chloride, 410A.
- Losana, L.** *See* Montemartini, C.
- Lott, Edward William.** Elected member, 330.
- Lotz, A.** *See* Duhme, E.
- Love, A. E. H.** Book: "A Treatise on the Mathematical Theory of Elasticity," 763A.
- Lowenstein, E.** Elect. high temp. furnaces up to 3300° C., 721A.
- Loyarte, Ramón G.** Excitation potentials of Hg atoms, 540A.
- Lucas, Francis F.** Appn. of microtome methods to prepn. of soft metals for micro-examination, 514A.; ultra-violet metallography, 512A.
- Lucasse, Walter W.** Transference numbers of HCl in glycerol-water mixtures, 632A.
- Lücke, F.** *See* Hanemann, H.
- Lüder, E.** *See* Rostosky, L.
- Ludwik, P.** Crystal lattice and hardening, 420A.; yield-point, cold- and hot-brittleness, 422A.

- Lueg, P.** Ultra-red absorption spectrum of didymium in glasses and solns., 537*A*.
- Luisi, Elio De.** Detn. of Mn in rich alloys, 581*A*.
- Lukas, Jan.** *See* Jilek, Ant.
- Lukas, Jan, and A. Jilek.** Electrodeposition of Sb from acid and alk. solns., 566*A*.; rapid electrolytic detn. of Te by means of reduced potential, 585*A*.; sepn. of Sb from acid and alk. solns. by electrolysis, 572*A*.
- Lukens, Hiram S.** Use of Hg as cathode in electro-analysis, 557*A*.
- Lunde, Gulbrand.** Occurrence of Pt in Norwegian rocks and minerals. Geochemistry of Pt metals, 583*A*.
- Lupan, Andrei.** Elected member, 16.
- Lux, H.** Electronic structure of elements based on chem. properties, 527*A*.
- McAdam, D. J., jun.** Corrosion-fatigue, 424*A*.; stress-strain-cycle relationship and corrosion-fatigue of metals, 423*A*.
- McAulay, A. L., and F. P. Bowden.** H over-potential at Hg cathode, 628*A*.
- McBain, James W.** *See* Britton, George T.
- McCaffery, Richard.** Elected member, 330.
- McCaughey, W. J., and H. C. Harrison.** Equilib. considerations of cyanite-clay refractories.—II., 739*A*.
- McClelland, J. J.** Wasters, 712*A*.
- McCord, C. P., and Alfred Friedlander.** Occupational syndrome among workers in zinc, 753*A*.
- McCulloch, Leon.** Rapid corrosion of metals by acid within capillaries. Reply by U. R. Evans, 493*A*.
- McDonnell, M. E.** Rust-proofing of materials, 501*A*.
- McDowell, J. Spotts.** Rational analysis of clay.—II., 739*A*.
- MacGee, A. Ernest.** Role of sp. heat in selection of refractories, 734*A*.
- McHutchison, John P.** Electrodeposition of Ra-*D* and Ra-*E*, 404*A*.; electrolysis of Ra-*D* and Ra-*E*, 405*A*.
- McIntosh, Donald H.** Detn. of metallic Pb in metallurgical products and pigments, 581*A*.
- McKail, David.** Prophylaxis in industrial lead poisoning, 752*A*.
- McKay, Hugh Victor.** Obituary notice, 351.
- McKay, Robert J.** Practical uses of pure Ni, 664*A*.; still plugs for unusual pressures, 674*A*.
- McKeehan, L. W.** Glossary of terms relating to X-ray metallography, 511*A*.
- McKenna, James J.** Elected member, 15.
- Mackenzie, E. A.** *See* Bulmer, Frederick M. R.
- Mackenzie, Gladys I.** *See* Barkla, C. G.
- McLachlan, J.** Fitting irregular pattern shapes, 705*A*.
- Maclean, Neil John.** Elected member, 329.
- McLennan, J. C., I. Wallerstein, and H. Grayson Smith.** Fluorescence spectra of sulphur group, 545*A*.
- MacMahon, A. M.** Light sensitiveness of crystalline Se, 406*A*.
- McManus, J. D.** *See* Faden, J. L.
- MacNair, Walter A.** Fine structure of certain lines and energy levels of Cd, 534*A*.
- MacQuigg, C. E.** Cr alloys in chem. plant equipment, 501*A*.; resistant Cr alloys, 653*A*.
- McVetty, P. G., and N. L. Mochel.** Tensile properties of stainless iron and other alloys at elevated temps., 479*A*.
- Maddison, R. E. W.** *See* Cunliffe, P. W.
- Maedje, C. W.** Modern tungsten lamp making, 668*A*.
- Magnus, A., and H. Danz.** Sp. heat of W, B, boron nitride, and beryllium oxide, 411*A*.
- Magnus, A., and A. Hodler.** Sp. heat of Ag and diamonds in higher temp. ranges, 406*A*.
- Maier, Charles G.** Adjusted vapour pressures of Zn and Cd, 415*A*.
- Maier, Charles G., George S. Parks, and C. Travis Anderson.** Free energy of formation of zinc oxide, 415*A*.
- Maihs, P.** *See* Rupp, E.
- Mallander, R.** Hot-brittleness of brass, 463*A*.
- Maity, Girindra Nath.** Elected student member, 330.
- Majewski, Witold.** Luminescence of Hg vapour in electrodeless discharge, 540*A*.
- Majumdar, Kanakendu.** Absorption spectrum of Ni, 542*A*.

- Mallock, A.** Stresses involved in tests of hardness and a table of comparative hardness of certain metallic elements, 604*A*.
- Malone, E. L.** High temp. oxidation in roasting furnace, 501*A*.
- Manchot, W., and A. Leber.** Compds. and alloys of Ti with Al, 454*A*.
- Mandi, J.** *See* Strebing, R.
- Manley, J. J.** Use of Invar steel for precision balances, 591*A*.
- Manning, Fred.** Elected member, 17.
- Manning, John.** Prepn. of Ni membranes for ultra-filtration, 665*A*.
- Mantell, C. L.** Scrap detinning affords big outlet for Cl, 667*A*; utilization of Cl in recovery of Sn and Sn salts from tinplate scrap, 668*A*.
- Mantell, C. L., and W. G. King, jun.** Reversed potentials in corrosion of tinplate, 491*A*.
- Manthey, E., and W. Conzelmann.** Anode effect in electrolysis of molten salts, 624*A*.
- Mappin, Harry.** Mercury gilding, 664*A*.
- Maracineau, (Mlle.) St.** Special effects of sunlight on radio-activity of polonium and lead, 403*A*.
- Marchal, (Mlle.) G.** *See* Matignon, C.
- Marchant, E. W., and J. L. Miller.** Method of observing flaws in metal surfaces and of comparing conductivities of metal plates, 611*A*.
- Markwald, M., and H. Gebhardt.** Gravimetric detn. of Zn by cyanamide, 588*A*.
- Mardles, E. W. J.** *See* Sims, C. J.
- Marie, C., and J. Berthelot.** Two causes of error in electrolytic detn. of Ni in presence of Fe, 583*A*.
- Mark, Hermann.** Book: "Röntgenstrahlen in Chemie und Physik," 763*A*.
- Mark, J. van der.** *See* Goudsmit, S.
- Markland, T. W.** Making of thin section patterns, 705*A*.
- Markovetskii, A. E.** Structure of molecules, 532*A*.
- Marks, George Harold.** Elected member, 15.
- Marle, Martin van.** Elected member, 330.
- Marsh, Kirtland.** Temp. control in Al foundries, 615*A*.
- Marshall, Abraham Lincoln.** Electrodeposition of Zn from sulphate solns., 645*A*; mechanism of reactions photo-sensitized by Hg vapour, 393*A*; synthetic formaldehyde from Co + H₂. Mechanism of sensitized photo-chemical reaction, 664*A*.
- Marshall, L. H.** *See* Grubb, A. A.
- Martell, P.** New rust-preventing media, 509*A*.
- Martin, H. E.** *Correspondence on* "Electric Furnaces in Non-Ferrous Metallurgy," 316.
- Marzahn, W.** *See* Kuhnelt, R.
- Mashiyama, Yoshio.** *See* Shōji, Hikoroku.
- Masing, Georg.** Elected member, 16; corrosion of brass in water meters, 489*A*; thermoelect. power of metallic aggregates, 481*A*.
- Masing, Georg, and O. Dahl.** Expansion on solidn. of Al contg. Fe, 451*A*; solidification of Al contg. Fe, 451*A*.
- Masing, Georg, and Carl Haase.** Elect. conductivity of commercial Al, 372*A*; magnitude and distribution of internal strain in cold-worked brass, 464*A*.
- Masing, Georg, and Lisel Koch.** De-oxidation of Ni, 395*A*.
- Masing, Georg, and Wilhelm Mauksch.** Behaviour of cold-rolled brass in tension and compression, 464*A*.
- Masing, G., and M. Póányi.** Tensile strength of Zn and cold-working, 414*A*.
- Maslin, Ernest Seba.** Elected member, 15.
- Masumoto, Bunkichi.** Camphor series. X.—Synthesis of camphor. I.—Catalytic action of reduced Cu on borneols, 384*A*.
- Masumoto, Hakar.** Co-Ni and Co-Fe equilib. diagram, 457*A*; new allotropic of Co, 377*A*; new transformation of Co and equilib. diagr. of Ni-Co and Fe-Co, 458*A*.
- Mathevet, J.** Use of filter pulp in vacuum filtration, 561*A*.
- Mathewson, C. H., and Albert J. Phillips.** Plastic deformation of coarse-grained Zn, 414*A*.
- Mathias, E. Heike Kammerlingh Onnes,** 745*A*.
- Matignon, C.** Electrolytic production of Be, 634*A*.
- Matignon, C., and (Mlle.) G. Marchal.** Thermochem. of Be, 375*A*.
- Matsuyama, Yoshiji.** Elect. resistance of molten metals and alloys, 480*A*; elect. resistance of pure metals in molten state, 426*A*.

- Maugin, Ch.** Reciprocal lattices and X-ray diffraction patterns, 520A.
- Mauksch, Wilhelm.** See Masing, Georg.
- Maxymowicz, Wladimir.** See Moser, Ludwig.
- May, Walter J.** Appn. of fluxes, &c., in foundry, 710A.; conveyance of air-blast to cupolas and forced draught furnaces, 710A.; foundry fuel economics, 730A.; utilizing waste heat from crucible furnaces, &c., 718A.
- Mayer, Max.** Elected member, 17.
- Mayers, May R.** Lead anemia, 752A.
- Maynz, Theodore.** Indust. power plant piping, 675A.
- Mayr, C.** Variability of titre of thio-sulphate solns., 562A.
- Mazumdar, K.** See Saha, M. N.
- Mazzucchelli, A.,** and A. Vercillo. Preparation of intermetallic compds. by wet method, 484A.
- Meadowcroft, J. W.** Efficiency from welding machines, 692A.
- Medicus, Ludwig.** Book: "Kurse Anleitung zur qualitativen Analyse," 763A.
- Meggers, W. F.** Multiplets in spectrum of ionized V.—II., 546A.
- Meggers, W. F.,** and Otto Laporte. Arc spectrum regularities for Ru, 543A.
- Meier, Herm.** See Füchtbauer, Chr.
- Meigen, W.,** and K. Stock-Schröber. Detn. of S in metallic alloys and its influence on their properties, 585A.
- Meigh, Charles Harold.** Elected member, 16.
- Meikle, George.** Elected member, 329.
- Meissner, K. L.** Al-Si alloys in year 1926, 453A.; microstructure of Al, 513A.; new Al alloys, 445A.; new developments in process for improving Al casting alloys, 447A.; process of improvement in modified Al alloys, 446A.; see Sander, W.
- Meissner, K. W.** Series of argon spectrum, 534A.; series relating to arc spectrum of A.—I., 534A.
- Meissner, Walther.** Measurements employing liquid He. II.—Resistance of Au, Zn, Cd, Pt, Ni, Fe, and Ag, down to 1.3° abs., 387A.
- Meitner, L.** See Hahn, O.
- Melchior, P.** German material standards of non-ferrous metals, 671A.
- Mellet, R.** Vol. detn. of Ca in mineral substances contg. phosphoric acid, Mg, Fe, and Al, 579A.
- Mellor, J. W.** Book, "A Comprehensive Treatise on Inorganic and Theoretical Chemistry," 763A., (review) 768A.; work of British Refractories Research Assn., 734A.
- Mensing, Lucy.** Intensities of Zeeman components in partial Paschen-Back effect, 553A.
- Menzen, —.** Al works in Germany, 749A. •
- Menzies, Alan W. C.,** and C. A. Sloat. Millikan rays and acceleration of radioactive change, 526A.
- Merck, F.** See Ryschkewitsch, E.
- Merica, Paul D.** Ni and metal industries, 664A.; Ni industry, 664A.
- Merrett, W. H.** Correspondence on "An Etching Reagent for Copper," 69.
- Merriss, M. H.** Improvements in series system of electrolytic Cu refining recently developed by Nichols Copper Co., 636A.
- Merritt, Ernest.** Contact rectification by metallic Ge, 386A.
- Merritt, George E.** Thermal expansion of some fused oxides used as refractories, 743A.
- Mertens, A.** Corrosion of Al by conc. NaCl soln., 487A.
- Merton, T. R.** Measurement of intensity of spectral lines, 555A.
- Mertz, Pierre.** Direct measurement of X-ray mass scattering coeff., 443A.
- Messe, Wilhelm.** See Müller, Erich.
- Messenger, George Paul.** Elected member, 15.
- Messenger, Helen A.** Significance of certain crit. potentials of Hg in terms of metastable atoms and radiation, 394A.
- Metzger, T.** Elect. furnace in metal industry, 720A.
- Meulen, H. ter.** Simple heating apparatus, 590A.
- Meunier, F.** Electrolytic overvoltage, 627A.
- Meurer, —.** Present position of metal-spraying process and Meurer powder-spraying process, 504A.
- Meurer, H. L.** Deterioration and conservation of materials, 503A.
- Meyer, G.,** and F. E. C. Scheffer. Carbide of Ni, 397A.
- Meyer, H. H.** See Tammann, G.
- Meyer, Julius,** and Anton Pawletta. Detection of vanadic acid by means of hydrogen peroxide, 571A.
- Meyer, R. J.** See Bodenstein, M.

- Michel, F.** Book: "Metallnieder-schläge und Metallfärbungen," 763A., (review) 776A.
- Michels, A., and P. Geels.** Influence of pressure on elect. conductivity of Pt, 399A.
- Micks, Reg.** Al casting output and its difficulties, 713A.; casting a 35-ton lead keel, 713A.; controlling quality in brass foundry, 703A.; increasing output with moulding machines, 706A.
- Micksch, Karl.** Elect. welding, 688A.
- Middleton, A. R.** Reaction of "aluminon" with hydroxides of Be, rare earths, Zr and Th, 568A.
- Mierdel, G.** Welding with atomic hydrogen, 690A.
- Miers, (Sir) Henry A.** *May Lecture on* "The Growth of Crystals in Super-saturated Liquids," 331.
- Miethe, A., and H. Stammreich.** Formation of Au from Hg, 440A.
- Miething, H.** Siemen's incandescent filament pyrometer, 619A.
- Millar, Russell W.** Vapour pressures of some liquid and solid metals, 432A.
- Miller, Albert Basil.** Elected member, 15; metal aeroplane construction, 651A.
- Miller, Dwight D.** *Correspondence on* "Electric Furnaces in Non-Ferrous Metallurgy," 318.
- Miller, H. J.** *Paper on* "Penetration of Brass by Tin and Solder, with a Few Notes on the Copper-Tin Equilibrium Diagram," 183.—*Discussion*, Sir G. A. Muntz, 223; H. J. Hartley, 224; U. R. Evans, 224; D. Lewis, 228; A. Pinkerton, 228; H. W. Brownsdon, 230; W. H. J. Vernon, 230; T. Turner, 230.—*Reply to Discussion*, 233.—*Correspondence*: J. L. Haughton, 234; W. Hume-Rothery, 236, 237.—*Reply to Correspondence*, 239.
- Miller, J. L.** *See* Marchant, E. W.
- Miller, Roy H.** *See* Bardwell, E. S.
- Miller, S. W.** Oxy-acetylene welding of Cu, 682A.
- Milliau, E.** Action of gelatin on electrolysis of Cd, 641A.
- Millikan, R. A.** High-frequency rays of cosmic origin, 525A.; *see* Bowen, I. S.
- Millington, W. E. W., and F. C. Thompson.** Practical significance of inner structure of metals, 511A.
- Millis, C. T.** Book: "Technical Education," 763A., (review) 782A.
- Mills, Adelbert P.** Book: "Materials of Construction," 763A., (review) 776A.
- Mills, George P.** Elect. annealing and heat-treating furnaces, 723A.
- Milne, E. A.** Absorption coeff. and pressure of radiation in photospheric layers of star, 552A.; astrophys. detn. of average life of excited Ca atom, 526A.; equilib. of Ca chromosphere, 536A.; Rosseland's integral for stellar absorption coeff., 552A.; stellar absorption coeff., 551A.; width of Fraunhofer lines, 555A.; *see* Fowler, R. H.
- Mishima, Tadao.** *See* Nagaoka, Hantaro.
- Mitchell, Allan Monroe.** Elected member, 330.
- Mitchell, Patrick.** Transmutation of elements, 440A.
- Mitchell, R. C.** Economical design in the plating shops, 641A.
- Mitiaev, W. K.** Effect of constant magnetic field upon magnetic spectra, 554A.
- Miyagi, Otogoro.** Failure of bars due to impact, 603A.
- Miyake, M.** *See* Stoughton, Bradley.
- Miyanishi, Michika.** Excitation of enhanced lines of Sn in arcs and Zeeman effect of certain enhanced lines of Sn, 545A.
- Mochel, N. L.** *See* McVetty, P. G.
- Moeller, Max.** Placing of apparatus for elect. temp. measurement, 615A.
- Mohler, F. L., Paul D. Foote, and R. L. Chenault.** Photo-ionization and relative absorption probabilities of Cs vapour, 535A.
- Mohr, F.** Box-measures and spring manometers for testing machines, 611A.
- Mohrmann, —.** *See* Kuhnel, R.
- Moldenke, Richard.** Permanent and long life moulds, 715A.
- Moll, W. J. H.** Reliable thermo-converter, 597A.; vacuum thermo-element, 617A.
- Molthan, Wilhelm.** Dependence of degree of vacuum attainable by means of diffusion air pump upon purity of Hg vapour used, 593A.
- Mond, Ludwig.** Life and work of, 745A.
- Mondiez, Adrien.** Book: "Cours de physique industrielle," 764A.
- Monroe, C. J., and W. D. Turner.** New periodic table of elements, 444A.

- Montemartini, C., and L. Losana. Action of mixtures of O and N on a few elements, 434A.
- Monval, P. M. Colorimetric researches on S and Se, 405A.
- Moore, Burrows, and F. S. Sinnatt. Ignition of solid fuels, 730A.
- Moore, E. Le R. New method for teaching atoms and molecules, 532A.
- Moore, Edward T. Elect. furnaces for castings and ingots, 722A.
- Moore, H. Elected member of Council, 13.
- Moore, H., and S. Beckinsale. Paper on "Notes on the Manufacture and Properties of Hairsprings," 111.—Discussion: G. Sachs, 119.—Reply to Discussion, 120.
- Moore, H. F. Fatigue of non-ferrous metals, 422A.; mechanism of fatigue failure of metals, 423A.; report of Cttee. E-9 of A.S.T.M. on correlation of research, 755A.
- Moore, H. F., and T. M. Jasper. Evidence and detn. of a fatigue limit in metals, 603A.
- Moore, R. R. Effect of grooves, threads, and corrosion upon fatigue of metals, 424A.
- Moressée, G. Heat of fusion of metals, 431A.; heating and cooling of metals by radiation, 718A.
- Morgan, S. F. See Hartman, M. L.
- Mortimer, George. Al casting alloys: B.E.S.A. specifications reviewed, 649A.; light alloy castings in marine engineering, 652A.
- Moscicki, I., and J. Broder. Spheroidal state of liquid in presence of heated metal surfaces, 434A.
- Mosends, L. New modification of Mohr's pinchcock for burettes, 589A.
- Moser, Ludwig. Sepn. of Zr from Ti, 575A.
- Moser, Ludwig, and Alfred Brukl (with L. Kossek). Sepn. and detn. of rare metals from other metals. VIII.—Detn. of Tl as thallous chromate and its sepn. from other elements, 586A.
- Moser, Ludwig, and Wladimir Maxymowicz. Use of porcelain filtering crucibles in analysis, 561A.
- Moser, Ludwig, and Erich Ritschel. Quant. analysis of Rb and Cs, 566A.
- Moser, Ludwig, and Karl Schmidt. Sepn. and detn. of rare metals from other metals. VII.—Detn. of W and its compds. by distn. in current of air and carbon tetrachloride vapour, 586A.
- Moser, Ludwig, and Wilhelm Schöninger. Simple method of standardizing potassium permanganate solns. with electrolytic iron, 563A.
- Moser, M. Brinell ball tests, 605A.; testing of working materials in practice, 601A.
- Mountfort, Haworth Hillary. Elected member, 15.
- Muench, Reinhold Karl. Elected member, 329.
- Muhlert, F. Krupp radiant brick furnace, 718A.
- Muir, George Wallace. Elected member, 330.
- Mukerji, D. M. See Bhatnagar, S. S.
- Müller, Carl. Prodn. of very thin metallic films, 638A.
- Müller, E. Theory of electrolytic deposition of Cr from aqueous chromic acid solns., 642A.
- Müller, Erich, and Wilhelm Messe. Vol. detn. of Cr, 579A.
- Müller, Erich, and Fritz Weisbrod. Potentiometric detn. of Au, 581A.
- Müller, F. See Köster, W.
- Müller, Friedrich. Potentiometric detn. of Pt metals, 584A.
- Müller, John Hughes, Edwin Frederic Pike, and A. Kenneth Graham. Preparation of metallic Ge and volatility of metal in H and *in vacuo*, 386A.
- Müller, M. See Wenger, P.
- Müller, Robert, Alfons Schimke, and N. M. Farmakides. Pptn. reactions of metals in anhydrous solns.—I., 559A.
- Müller, Robert, and Franz Thoiss. Pptn. reactions of Ni and Co chlorides with Zn or Cd in anhydrous ethyl alcohol. Pptn. reactions of metals in anhydrous solns.—II., 559A.
- Mulligan, J. J. See Colcord, F. F.
- Mulliken, Robert S. Electronic states and band spectrum structure of diatomic molecules. I.—Statement of postulates. Interpretation of CuH, CH, and CO band types, 556A.; II.—Spectra involving terms essentially of the form $B(j^2-\sigma^2)$, 556A.
- Mund, W. Ionization by radon in spherical vessels, 405A.
- Munday, A. H. Metallurgist in industry, 745A., 746A.; seconds adoption of Report of Council, 13.

- Münter, H.** Casting loco. bearings with Ca-Pb alloys and Lurgi hardened by addn. of alk. earth metals, 713*A*.
- Muntz, (Sir) Gerard A.** *Discussion on* "Penetration of Brass by Tin and Solder," 223.
- Münzing, Ernst.** *See* Tubandt, C.
- Murakami, Takejiro,** and Kinichi Someya. Durability of alk. soln. of potassium ferricyanide as etching reagent, 514*A*.
- Murphy, A. J.** *See* Rosenhain, W.
- Murti, Malvalli Gundappa Krishna.** Elected member, 15.
- Mylius, F.** Thermal HCl test and reaction classes of Al, 488*A*; thermal test-tube tests for Al foil, 488*A*.
- Nagano, Masataka.** *See* Fuseya, Giichiro.
- Nagaoka, Hantaro.** Number of electrons and α -particles in atomic nuclei, 524*A*.
- Nagaoka, Hantaro,** and Tetsugoro Futagami. Coincidence of some spectral lines of Au and Th, 537*A*; explosion spectra of Hg, 539*A*; He lines in spectra of U and Th, 546*A*; instantaneous photographs of electrically exploded wires, 554*A*; lines of transformation products of U and Th in spectra of these elements, 546*A*; occurrence of harmonics in spectral lines, 554*A*.
- Nagaoka, Hantaro,** Tetsugoro Futagami, and Toshio Machida. Elect. explosion of wires and threads, 553*A*.
- Nagaoka, Hantaro,** Tetsugoro Futagami, and Hikoichi Obata. Spectra of metals excited by means of high tension and heavy current, 554*A*.
- Nagaoka, Hantaro,** and Tadao Mishima. Anomalous Zeeman effect of Hg line 5791 and its satellite -0.124 , 541*A*; fine structure of Bi lines, 534*A*; fine structure of Cd lines, 534*A*; magnetic sepn. of Hg line 5770 into nonet of special type, 541*A*.
- Nakamura, Gisaburo.** Bands at $\lambda 2536$ and $\lambda 2540$ of Hg, 539*A*.
- Nash, William G.** Effect of He on intensity of Hg spectrum, 541*A*.
- Nasledow, D.,** and P. Scharawsky. Dependence of intensity of Röntgen spectral lines on number of cathode electrons, 548*A*.
- Nass, C. V.** *See* Grubb, A. A.
- Nathusius, Hans.** Detroit electric rock-ing furnace, 725*A*.
- Needham, W. Roland.** Engineer and study of metals.—I.—II., 746*A*.
- Neef, Th.** Examination of metals by X-rays, 613*A*.
- Nelson, T. Holland.** Recent developments in use and fabrication of corrosion-resistant alloys, 499*A*.
- Nelson, W.** Duralumin welding, 682*A*.
- Nemilov, V.** *See* Shemtschushni, S.
- Nesemann, E.** *See* Kuhnelt, R.
- Neuhauss, H.** *See* Wever, Franz.
- Neumann, E.** Surface treatment of metals with Al, 505*A*.
- Newbery, Edgar.** Anodic overvoltage measurements with cathodic ray oscillograph, 628*A*.
- Newman, F. H.** Flash arc spectrum of K, 542*A*; flash arc spectrum of Na, 544*A*; "flash" arc spectrum of Rb, 543*A*.
- Newton, H. S.** Scabs, 712*A*.
- Nicholas, Warren W.** X-ray spectrometer with which wave-lengths are read directly on ordinary micrometer screws, 594*A*.
- Nicholls, Noel Albert.** Elected member, 329.
- Nicholson, J. D.** Small work moulding in green and dry sand, 707*A*.
- Nicol, A. E.** Conductivity of plating solns., 638*A*.
- Nicollet, —.** Measurement of hardness by Rockwell machine, 606*A*.
- Nielsen, Walter M.** Formation of negative ions in Hg vapour, 394*A*.
- Niewodniczanski, Henryk.** Fluorescence of superheated Hg vapour, 539*A*.
- Nikitin, N.** Absorption of H and CO₂ by phosphoric iron, Ni, and Co., 396*A*.
- Nishimura, Hideo.** Elected member, 330.
- Nishimura, Kojiro.** Elected member, 15.
- Nix, Foster C.** *See* Dean, R. S.; *see* Schumacher, Earle E.
- Noddack, Ida.** *See* Noddack, Walter. *See also* Tacke, Ida.
- Noddack, Walter,** and Ida Noddack. Masurium and rhenium, 386*A*; eka-manganese. I.—Chemical part, 385*A*; rhenium and masurium, 385*A*.
- Norbury, A. L.** Thermoelect. properties of certain metallic solid solns., 481*A*.

- Norris, James F.** Second census (in U.S.A.) of graduate research students in chemistry, 755A.
- Northrup, E. F.** High-speed H-F. inductive heating, 725A.
- Norton, F. H.** Mechanism of spalling, 744A.
- Norton, J. T., and B. E. Warren.** Plastic deformation of metals, 421A.
- Notman, Arthur.** Profits in Cu wire and brass industry, 749A.; profits in fabricating copper, 749A.
- Nottingham, W. B.** Normal arc characteristic curves: dependence on abs. temp. of anode, 625A.
- Nowack, Leo.** Influence of small additions of Pb to Au, 466A.
- Nugent, R. L.** See Estill, H. W.
- Nys, J.** Feeding plates with current rectified by means of electrolytic cells, 634A.
- Obata, Hikoichi.** See Nagaoka, Hantaro.
- Obata, Jûichi.** Relation between temp. and Hall effect in some alloys, 480A.
- Oberhoffer, Paul.** See Esser, Hans.
- Oberhoffer, Paul, and L. E. Daweke.** Improved differential dilatometer, 591A.
- Obrutscheva, A.** See Hevesy, G.
- Obst, W.** Action of cement on metals, 497A.
- O'Connor, W. J.** Lead—its demand and future, 662A.
- Oddo, Giuseppe.** My periodic classification of elements and elect. constitution of atoms and of valence, 443A.
- Odén, Per Gustaf.** Elected member, 16.
- v. Oettingen, W. F.** Automatic thermo-regulator depending on flow of warmed liquid, 590A.
- Ogburn, S. C., jun.** Qual. sepn. of Pt metals, 574A.; some new analytical reactions of Pt metals, 574A.
- Ogden, A. N.** See Anderson, D. G.
- Ohya, Masakichi.** Electrolysis of metals of Ce family and prepn. of pyrophoric alloy, 634A.
- Oldenberg, Otto.** Continuous spectrum of H, 537A.
- Ollard, E. A.** Advances in electro-deposition, 638A.; Ni depositing solns., 644A.; Ni plating, 644A.
- Onnes, Heike Kammerlingh.** Obituary notices, 745A.; see Tuijn, W.
- Onoda, Tadashi.** Overvoltage. I.—Hydrogen overvoltage, 628A.
- Oppenheimer, J. R.** Quantum theory of continuous spectra, 550A.
- Orcel, J.** Crystals of Pt, 402A.
- Orlich, Ernst.** Book: "Anleitungen zum Arbeiten im elektrotechnischen Laboratorium," 764A.
- Ormont, B.** Formation of cobalt mercurithiocyanate in HNO₃ soln. as qual. reaction for Hg, 570A.
- Osawa, Atomi.** Relation between lattice const. and density in Fe-C-Ni alloys, 474A.; relation between lattice const. and density of Fe-Ni alloys, 474A.
- Ossenowa, Z. A.** See Schilow, Eugen.
- O'Sullivan, Jasper B.** Appn. of quinhydrone electrode to measurement of pH values in solns. contg. Cu ions and other bivalent ions, 622A.; behaviour of quinhydrone electrode in solns. of neutral copper sulphate, 623A.
- Ôtani, Buntarô.** Silumin and its structure, 453A.
- Ott, C. N.** See Pearce, J. N.
- Ott, H.** New metal Röntgen ray tube, 595A.
- Otterbacher, T. J.** See Hollingshead, T. E.
- Otto, Carl.** Improvement of cobalt aluminate test for Al, 568A.; sepn. of Mg from alkali metals, 574A.
- Owen, E. A., and G. D. Preston.** Atomic structure of AgMg and AuZn, 531A.
- Pages, R.** See Cournot, Jean.
- Painton, Edgar T.** Book: "The Working of Aluminium," 764A.
- Palmaer, Knut Wilhelm.** Elected member, 329.
- Palmer, Edgar.** Another use for Zn, 670A.
- Pan, Li Chi.** See Fink, Colin G.
- Pannek, H.** See Diepschlag, E.
- Paoloni, C.** See Treadwell, W. D.
- Park, Bart.** Bismuthate method for Mn, 582A.
- Parker, Henry C., and Willard N. Greer.** H-ion control of Ni-plating baths with quinhydrone electrode, 644A.
- Parker, W. B.** Correspondence on "The Penetration of Mild Steel by Brazing Solder and Other Metals," 239.

- Parkinson, J. L.** Accurate adjustable contact breaker, 599*A*.
- Parks, George S.** *See* Maier, Charles G.
- Parks, R. A.** Theory and practice of metal spraying process, 504*A*.
- Parnall, Walter Rudolph.** Elected member, 330.
- Parsons, A. L.** Preservation of minerals, 507*A*.
- Parsons, (the Hon. Sir) Charles A.** Elected member of Council, 13.
- Partington, J. R., and N. L. Anfilogoff.** Improved form of elect. vacuum furnace, 590*A*.
- Pasley, Arthur.** Elected member, 329.
- Pasley, Charles Reginald.** Elected member, 330.
- Patalong, H.** *See* Sauerwald, F.
- Patch, N. K. B.** Heat-treatment improves bronzes, 678*A*.
- Pauli, Wo.** *See* Fuchs, Leopold.
- Pauli, Wo. and F. Perlak.** General colloid chemistry. XXI.—Stability and constitution of Bredig's Ag sols, 407*A*.
- Pauling, Linus.** Screening consts. of relativistic or magnetic Röntgen ray doublet, 549*A*.
- Pavelka, F.** Drop reactions for detection of Ti, Zr, and Th, 571*A*.
- Pavloff, Ig.** Accumulation of admixtures by repeated meltings, 711*A*.
- Pawletta, Anton.** *See* Meyer, Julius.
- Payne, H. J.** Saving in foundry handling with elect. industrial truck, 704*A*.
- Payne, R. J. M.** Potentiometer improvement, 598*A*.
- Peacock, H. B.** Hall effect in evaporated films of Fe, Co, Ni, Pd, and Pt, 378*A*.
- Pearce, J. G.** Modulus of rupture in various sizes of test-bar, 602*A*.
- Pearce, J. N., and C. N. Ott.** Mechanism of catalytic decompn. of esters by Ni, 398*A*.
- Pechal, Frank.** Elected member, 15.
- Pêcheux, H.** Working and characteristics of tungsten arc lamp, 668*A*.
- Pelterie, R. Esnault.** *See* Esnault-Pelterie, R.
- Pendergast, W. L.** *See* Geller, R. F.
- Pérard, Albert.** Study of monochromatic radiations of Cd in Michelson and Hamy lamps from standpoint of their appns. to metrology, 535*A*.
- Perkins, H. F.** Corrosion in oil refinery, 496*A*.
- Perlak, F.** *See* Pauli, W.
- Perlitz, Harold.** Apparent relation between rate of change of elect. resistance at fusion and crystal lattice of metallic elements, 427*A*.
- Perot, Eugène.** *See* Cournot, J.
- Perrin, Michael Willcox.** *See* Humby, Spencer Robert.
- Person, Fred. G.** *See* Durrell, L. W.
- Peschard, Marcel.** Magnetization of ferro-nickels (paramagnetic properties), 473*A*.; magnetization of ferro-nickels (thermomagnetic properties), 473*A*.; magnetization of ferro-nickels (saturation and atomic moments), 473*A*.
- Peter, A.** Normalized parts from pressed brass for German State Rlys., 700*A*.
- Peters, M. F.** *See* Fairchild, C. O.
- Petersen, Alfred.** Elected member, 16; modern research in sphere of non-ferrous metals, especially of light metals, 649*A*.
- Peterson, A. A.** *See* Jordan, Louis.
- Petrenko, S. N.** Relationships between Rockwell and Brinell numbers, 606*A*.
- Pettersson, H.** Detection of products of atomic disintegration in transmutation of elements, 567*A*.
- Petty, D. M.** Converting existing rolling mills from steam-engine to elect. motor drive, 701*A*.
- Peyrot, Maurice.** Manuf. of elect. wires, 699*A*.
- Pfeiffer, W. H.** *See* Westman, A. E. R.
- Pfeistorf, Gerhard.** Detn. of opt. consts. of metals in visible and ultra-violet part of spectrum, 429*A*.
- Pfundt, O.** *See* Jander, G.
- Phelps, L. H.** *See* Jordan, Louis.
- Phelps, S. M.** Shrinkage of diaspore clays.—I., 739*A*.
- Philipp, Oscar Isaac.** Elected member, 16.
- Philippi, Heinrich.** Elected member, 17.
- Phillips, Albert J.** *Correspondence on* "The Mechanism of Inverse Segregation in Alloys," 283; *see* Mathewson, C. H.; *see* Price, W. B.
- Phillips, S. H.** Properties of Duralumin, 449*A*.
- Phillips, W.** Temp. compensation of precision dynamometer instruments, 599*A*.
- Phillips, W. N.** Cr plating and automobiles, 642*A*.
- Philpot, A. J.** Radiation pyrometers, 618*A*.
- Phragmén, Gösta.** *See* Westgren, Arne.

- Picazo, Gabriel. Elected member, 15.
 Piccardo, Georgio. *See* Rolla, Luigi.
 Pichler, A. Benedetti-. *See* Benedetti-Pichler.
 Pierce, H. C. Cd plating, 641A.
 Pierce, W. M. Good Zn roofing methods, 670A.
 Pike, Edwin Frederic. *See* Müller, John Hughes.
 Pilling, Norman B., and George P. Halliwell. Effect of Pb and Sn with O on conductivity and ductility of Cu, 380A.
 Pinck, H. *See* Hackspill, L.
 Pinkerton, Andrew. Discussion on "Penetration of Brass by Tin and Solder," and "The Attack of Molten Metals on Certain Non-Ferrous Metals and Alloys," 228.
 Pinkus, Georg. Contradiction of Alfred Stock's statements on danger of Hg vapour and amalgams, 753A.; danger of Hg vapour, 752A.
 Piron, G. Prepn. of foundry sand, 708A.
 Pitzer, L. E. Na_2O_2 fusions in Ni crucibles, 562A.
 Piutti, Arnaldo, and Enrico Boggiora. Transmutation of Hg into Au, 439A.
 Piwowsky, Eugen. Elected member, 16.
 Place, W. I. Optical multiplier, 596A.
 Plaskett, J. S. H and K lines of Ca in O-type stars, 536A.
 Pockels, Agnes. Measurement of surface tension with balance, 592A.
 Pogorzelska, Jadwiga Rakowicz-. *See* Rakowicz-Pogorzelska, Jadwiga.
 Pohland, Erich. *See* Stock, Alfred.
 Poirot, G. Detection of Cu, 569A.
 Pokorný, Ernst. Book: "Molybden," 764A., (review) 779A.
 Póányi, M. Extensometer for threads and wires, 609A.; *see* v. Bogandy, St.; *see* Hasche, R. L.; *see* Masing, Georg.
 Pollak, J. *See* Feigl, F.; *see* Strebing, R.
 Polvani, G. Eventual retardation of Hall effect in magnetic field, 430A.; new experiment on the Hall effect, 430A.
 Pomeroy, William C. Quantum analysis of band spectrum of AlO ($\lambda 5200\text{--}\lambda 4650$), 534A.
 Pomp, A. Fixing the price of a job and calculating for prime costs in cold-rolling mills, 701A.
 Pool, G. E. Correspondence on "The Penetration of Mild Steel by Brazing Solder and Other Metals," 237.
 Pool, H. G. *See* Taylor, W. W.
 Poole, W. H. Examination of metals, 704A.
 Popesco, J.-G. Capillary and photo-elect. properties of Hg, 392A.
 Popoff, A. Specifications for manuf. of refractory materials, 734A.
 Poppleton, G. G. Elected Auditor, 17.
 Portevin, Albert M. *See* Guillet, Léon.
 Portevin, Albert M., and P. Chevenard. Principles and chief appns. of dilatometric analysis of materials, 485A.
 Portevin, Albert M., and R. de Fleury. Ultra-light alloys and their utilization on aircraft, 663A.
 Posepal, V. Resonance absorption in region of X-rays, 526A.
 Poste, E. P. Enamelling industry in the South, 507A.
 Poth, E. J. *See* Rollefson, G. K.
 Potter, H. H. Proportionality of mass and wt., 532A.; *see* Sucksmith, W.
 Powell, J. H. Flowmeter, 593A.
 Pownall, J. F. Book: "Organized Publication," 764A.
 Prandtl, Wilhelm. Sepn. of rare earths by basic pptn. VIII.—Prepn. of pure yttrium oxide, 575A.
 Prandtl, Wilhelm, and Albert Grimm. Search for element 61.—II., 416A.
 Pratt, Roydon S. *See* Webster, Wm. Reuben.
 Pressler, E. E. Porosity and sp. gr. of refractory materials, 735A.; *see* Geller, R. F.
 Preston, F. W. Spalling of bricks, 744A.
 Preston, G. D. *See* Owen, E. A.
 Price, W. B., and A. J. Phillips. Exudations on brass and bronze, 464A.
 Prichard, Charles Ross. *See* Hinshelwood, Cyril Norman.
 Prichard, Charles Ross, and Cyril Norman Hinshelwood. Interaction of H and CO_2 on surface of Pt, 400A.
 Prideaux, E. B. R. *See* Taylor, W. W.
 Priestley, P. W. Industrial appn. of X-rays, 613A.
 Primrose, H. S. Gun-metal castings, 678A.
 Primrose, J. M. Conveyance of material in foundry, 705A.
 Prince, D. C. Mercury arc rectifiers, 664A.

- Pringsheim, Peter.** *See* Gaviola, E.
Prins, J. A. Diffraction of X-rays by Hg, 523*A*.
Prochaska, George L. Elected member, 16.
Proctor, Charles H. Can glass moulds be coated with Cr?, 643*A*.
Prasad, Mata. *See* Bhatnagar, S. S.
Puig, Ignacio. Phys. discontinuity of matter, 532*A*.
Pullin, V. E., and W. J. Willshire. Book: "X-Rays Past and Present," 764*A*.
Pulsifer, H. B. Microstructure of Cu, 513*A*.
Purdy, C. H. Electro-sherardizing large parts, 503*A*.
Putte, — van der. Progress in metallurgy of non-ferrous metals in 1924, 745*A*.
Quadrat, Otokar. Elected member, 330.
Quarder, B. Polarization by impact illumination.—I., 540*A*.
Quick, G. W. Lab. tests on non-ferrous screen wire cloth, 612*A*.
Rabald, Erich. Influence of proportion of gelatin in electrolyte on still- and deposition-potential of Zn in ZnSO₄ soln., 645*A*.
Raby, M. Zn metallurgy in Tonkin, China, 751*A*.
Rackwitz, Erich, and Erich K. O. Schmidt. Appn. of oxidizing salt test of Mylius to various light metal alloys, 488*A*.
Radenwitz, F. G. Danger of Hg vapour, 752*A*.
Rainer, L. Sterner-. *See* Sterner-Rainer, L.
Rakowicz-Pogorzelska, Jadwiga. Resonance lines of Te vapour, 545*A*.
Rakusin, M. A. *See* Zelinski, N. D.
Ralston, Oliver C. 25 years' progress in electrolytic Zn, 635*A*.
Ramb, E. *See* Feussner, O.
Randles, W. Brough. *See* Hind, H. Lloyd.
Rankin, James S. Elastic range of friction, 601*A*.
Raper, Alan Richardson. Elected student member, 16.
Raquet, D. Sensitivity of certain reagents for Sr and Ca, 571*A*.
v. Raschevsky, N. Theory of heats of fusion, 432*A*.; theory of thermionic effect, 429*A*.
Rassow, B. Friedrich Wöhler, 745*A*.
Rassow, E. *See* Czochralski, J.
Rathke, H. *See* Sauerwald, F.
Rauch, August. Quant. estn. of K by electrometric titration, 584*A*.; *see* Zintl, E.
Rawdon, Henry S. Protection of Fe by Cd, 505*A*.; report of Sub-Cttee. V. of Cttee. E-4 of A.S.T.M. on micro-hardness, 604*A*.; report of Sub-Cttee. VII. of Cttee. A-5 of A.S.T.M. on accelerated tests, 493*A*.; *see* Blum, W.
Ray, Satyendra. Ag deposit in fringes on parallel glass plates, 515*A*.; transformation of line spectrum into continuous spectrum by passage through absorbing soln. of certain crit. density, 553*A*.
Rayleigh, Lord. Continuous spectrum of Hg, 539*A*.
Read, Charles Little. Elected member, 15.
Read, H. S. Effect of temp. on X-ray absorption, 552*A*.
Rebbeck, Leopold Edward. Elected member, 330.
Redlich, O. *See* Abel, E.
Rees, W. J. *See* Hugill, W.
Reeve, L. *See* Cunliffe, P. W.
Reeves, Bernard George. Elected member, 329.
Regener, Erich. Sub-electron, 527*A*.
Reihlen, H. Danger of Hg vapour, 752*A*.
Reiner, St. Comparative corrosion tests with spray-galvanized and fire-galvanized iron plates, 502*A*.
Reininger, H. Improvement of light metal cast alloys with aid of de-oxidizing additions to molten alloy, 446*A*.
Reinoso, E. A. *See* Skowronski, S.
Reis, A. Quant. spectral analysis, 560*A*.
Reiss, Max. Existence of sub-electrons, 528*A*.; velocity of fall of solid spheres of radii down to 1×10^{-5} cm. and their elect. charges, 527*A*.
Reissaus, Georg Günther. Detn. of Zn by electrometric titration, 588*A*.; vol. method of detg. Bi and rapid method for detn. of Bi in ores, 577*A*.
Reitmeister, W. Prevention of porosity and improvement in phys. properties of gun-metal, 713*A*.

- Rekshinskii, V.** Iridosmine and prepn. of metals of Pt group from it, 402*A*.
- Remy, Heinrich.** Chemistry of Ru, 570*A*.; comparative tests on activity of contact substances.—IV., 439*A*.
- Reyerson, L. H., O. E. Harder, and L. E. Swearingen.** Nature of metal films reduced on surfaces of silica gel, 437*A*.
- Rheinboldt, —.** 100 years—Al, 647*A*.
- Rhodes, P. N.** *See* Beams, J. W.
- Ribaud, G.** Elect. H.-F. induction furnaces for very high temps., 726*A*.
- Ribbeck, Fritz.** Dependence of elect. resistance of nickel steels upon composition, temp., and heat-treatment, 474*A*, 475*A*.
- Ricard, G.** Manuf. of filaments of incandescent lamps, 699*A*.
- Rice, Frank E.** [Copper condensing pans.] Sweetened condensed milk. VI.—Tallowiness, 657*A*.
- Richard, Eugène.** Colorimetric detn. of H-ion concn. of solns., 623*A*.
- Richards, C. E.** Detn. of Pb, 581*A*.
- Richards, Evan Sims.** Elected member, 330.
- Richards, Theodore W., and Lawrence P. Hall.** Atomic wt. of uranium lead, 390*A*.
- Richards, Theodore W., Harold S. King, and Lawrence P. Hall.** Attempts to fractionate mixed isotopes of Pb, and atomic wt. of Pb, 390*A*.
- Richardson, D., and E. W. Birch.** Welding facts and figures.—I.—VIII., 686*A*.
- Richardson, E. G.** Hot wire anemometers, 594*A*.
- Richardson, H. H.** *See* Dix, E. H., jun.
- Richter, C. F.** Spinning electron in hydrogen-like spectra, 528*A*.
- Richter, Hermann.** Autogenous welding of Cu used in construction of apparatus and of tubes, 683*A*.
- Rideal, Eric K., and Hugh S. Taylor.** Book: "Catalysis in Theory and Practice," 765*A*.
- Ridsdale, C. H.** Applying science in foundry, 703*A*.
- Rienäcker, G.** *See* Zintl, E.
- Ries, H.** Present status of lab. investigation of sands, 708*A*.; use of standard tests of moulding sands, 709*A*.
- Riesenfeld, E. H., and W. Haase.** Prepn. of Au-free Hg, 392*A*.
- Riley, Harry Lister, and Herbert Brereton Baker.** Detn. of atomic wt. of Ag by direct ratio of Ag to O in silver oxide, 407*A*.
- Rimbach, Richard.** Research in metallurgical literature, 747*A*.
- Rinne, F.** Fine structure and X-ray methods with regard to opt. anomalies of crystals, 519*A*.
- Ripan, R.** New method for detn. and for sepn. of Cd, 578*A*.; new microchem. method for sepn. of Zn and Cu, 575*A*.
- Ripley, P. C.** Solder paste, 680*A*.
- Ritschel, Erich.** *See* Moser, Ludwig.
- Roberds, W. M.** Resistance of Cu wires at very high frequencies, 383*A*.
- Roberts, P. L.** Arc welding aided by hydrogen, 690*A*.; electrode efficiency, 691*A*.
- Roberts, R. W.** Modification of design of Shearer X-ray tube, 595*A*.
- Roberts, William John Stuart.** Elected student member, 16.
- Robertson, Andrew.** Need for testing materials, 601*A*.
- Robertson, John K.** Merton's method of measuring half-width of spectral source, 555*A*.
- Robinson, Almon.** Pb storage battery in 1902, 634*A*.
- Robinson, H. R., and A. M. Cassie.** Secondary and tertiary cathode rays produced by external and internal absorption of homogeneous X-rays, 525*A*.
- Robinson, P. B.** Use of silica refractories, 741*A*.
- Robinson, Percy Lucock.** *See* Briscoe, Henry Vincent Aird.
- Robson, Stanley.** Elected member, 330.
- Rodebush, W. H.** Compact arrangement of periodic table, 444*A*.; *see* Kunz, Jacob.
- Rodt, V., and E. Kindscher.** Sepn. of small quantities of Ca from large amts. of Mg, 573*A*.
- Roe, A. C., and D. H. Braymer.** Cu wire that is used in motor repair work, 656*A*.
- Rogers, Austin F.** Addition and subtraction rule in geometrical crystallography, 520*A*.; math. study of crystal symmetry, 519*A*.
- Rogers, Charles F.** *See* Durrell, L. W.
- Rogers, R. A.** *M* series X-ray absorption spectra of Os, Ir, and Pt, 542*A*.
- Rohmann, Hermann.** Passage of electricity between Pt electrodes in *vacuo*, 399*A*.

- Rohn, W.** Acid-resisting alloys with Ni base, 498*A.*; metals and alloys for thermocouples for high-temp. measurement, 616*A.*; small elect. smelting furnace for white metal, Al, Mg, and their alloys, 722*A.*
- Röhrig, H.** Brinell hardness of Lantal between 20° and 500° C., 450*A.*
- Roll, Franz.** Heat transference of moulding sands, 709*A.*
- Rolla, Luigi.** Elected member, 329.
- Rolla, Luigi, and Lorenzo Fernandes.** Element of at. no. 61, 417*A.*
- Rolla, Luigi, and Giorgio Piccardi.** Chem. properties and ionization potentials, 437*A.*
- Rollefson, G. K., and E. J. Poth.** New method for study of soft X-rays, 524*A.*
- Romanoff, V. I.** Prod'n. of high vacuum by means of Langmuir's pumps and its appn. to distillation of Hg, 593*A.*
- Romig, Orlando E.** Prepn. of metallic single crystals and twinning in Zn and Zn single crystals, 417*A.*
- Ronceray, E.** Elected member, 17; pattern plates, 705*A.*
- Rondelli, Tito.** Removal of Sn from tin-plated scrap, 667*A.*
- Ros, M., and A. Eichinger.** Tests to clear up question of danger of rupture, 609*A.*
- Rose, H.** Book: "Das Hafnium," 765*A.*, (review) 772*A.*
- Rosecrans, C. Z.** See Bradley, M. J.
- Rosenberg, P.** See Granjon, R.
- Rosenberg, Jacob Ellis, and Gebhard Stegeman.** Adsorption of ions by metallic Hg, 394*A.*
- Rosenhain, W.** Advances in prodn. of pure metals, 417*A.*; *discussion on* "Electric Furnaces in Non-Ferrous Metallurgy," 309; *discussion on* "Investigation of the Effects of Impurities on Copper," 164, 179; elected Vice-President, 13; wrought light alloys, 446*A.*
- Rosenhain, W., and A. J. Murphy.** Metallography of solid Hg and amalgams, 513*A.*
- Rosin, Joseph.** See Collins, W. D.
- Ross, C. Howard.** Upgrading of foundry apprentices, 716*A.*
- Ross, Evan J.** Foundry planning for economical prodn., 703*A.*
- Ross, P. A.** X-rays scattered by Mo, 395*A.*
- Rosseland, S.** Absorption of radiation within star, 551*A.*
- Rostosky, L.** Process of joining Al with Al and other metals, 681*A.*; welding and soldering of Al, 680*A.*
- Rostosky, L., and E. Lüder.** Al solders, 680*A.*
- Roth, W. A.** Krupp steel V2A as Pt substitute in lab., 589*A.*
- Rother, Franz.** Emission of electrons from cold metals, 442*A.*
- Rother, Willard H.** Elected member, 15.
- Rothert, C., and G. Dern.** "German silver" alloys, 465*A.*
- Rouse, Edwin W., and Paul K. Aubel.** Analyses of Cu-refining cell voltages, 637*A.*
- Rousseau, Ed.** Estn. of small quantities of Al in ferro-chrome, 577*A.*; separation of Ni and Fe from Cr by electrolysis, 574*A.*
- Rowe, Francis W.** Appn. of metallography in bronze founding, 513*A.*; modern problems and developments in engineering bronze founding, 713*A.*
- Rowe, H.** Vapour pressures of alkali metals, 416*A.*
- Rowell, Sydney William.** See Russell, Alexander Smith.
- Roy, S. C.** Total photo-elect. emission of electrons from metals as function of temp. of exciting radiation, 428*A.*
- Rožansky, D.** Ferro-magnetism of Ni and quantum state of its atoms, 396*A.*
- Rubies, S. Pifia de.** New lines, between wave-lengths 3500 I.Å. and 3100 I.Å. in arc spectrum of Eu under normal pressure, 537*A.*
- Rubio, E.** Existence of native Pt in several quartz veins at Cabo du Gata, 398*A.*
- Rudeloff, M.** Hole shearing tests with cast iron, 610*A.*
- Ruer, Rudolf, and Kurt Bode.** Copper oxide and at. wt. of Cu, 380*A.*; magnetic transformation of ferro-magnetic metals, 429*A.*
- Ruff, Otto, and Bruno Hirsch.** Topo-chemical influence, an example of sepn. of Mn and Zn with Na₂S, 574*A.*
- Ruff, Otto, and Martin Korschak.** Work in high-temp. ranges, 433*A.*
- Ruff, Otto, and Erich Thomas.** Behaviour of Cb and Ta₂O₅ in presence of CCl₄, as well as a process for detg. Cb and Ta, 583*A.*
- Ruff, Otto, and Ernst Vidic.** Ruthenium pentafluoride and a method for sepn. of Pt and Ru, 575*A.*

- Ruotolo, D.** Wt. of brass stock for screw machine parts, 662A.
- Rupe, H.,** and Alfons Heckendorn. Catalytic hydrogenation of cyanogen compds., 398A.
- Rupp, E.** Time of illumination of atoms, resonance in alkalis and in magnetic field, 443A.
- Rupp, E.,** W. Wegner, and P. Maihs. Titration of Hg with KCN and K. Jellinek's "titration" of weak dissociated salts, 582A.
- Russell, Alexander Smith,** and Sydney William Rowell. Positions of W and Mo in normal potential series, 632A.
- Russell, Alexander Smith,** Derek Curtis Evans, and Sydney William Rowell. Order of removal of Mn, Cr, Fe, Co, and Ni from amalgams, 632A.
- Russell, Robert Price.** Elected member, 329.
- Russell, S. H.** Impressions of American foundries, 703A.
- Rybár, St.** Modulus of torsion and tensile strength of single- and multi-crystal wires, 418A.
- Ryschkewitsch, E.,** and F. Merck. Detn. of m.p. of graphitic carbon, 742A.
- Sabatier, Paul.** Direct hydrogenation method by metallic catalysts, 439A.
- Sachs, G.** Ageing of Al alloys, 446A.; development of research on metals after world-war, 745A.; *discussion on* "Notes on the Manufacture and Properties of Hairsprings," 119; hardness problem, 604A.; *see* v. Göler, Frhn.; *see* Karnop, R.; *see* Schiebold, E.
- Sadtler, C. B.,** and J. L. Gregg. Deformation of Al alloy by const. load, 445A.
- Saha, Megh Nad.** Ionization in stellar atmospheres and steric factor, 555A.
- Saha, Megh Nad.,** N. K. Sur, and K. Mazumdar. Experimental proof of thermal ionization of elements, 437A.
- St. John, Ancel.** X-ray studies of coal and coke, 731A.
- St. John, H. M.** Temp. control in brass foundry, 615A.
- Saint Paul de Sincay, Gaston.** Elected member, 330.
- Samuel, —.** Action of solns. on Al and its alloys and on some rust-protecting agents, 488A.
- Samuel, Rudolf.** *See* Lessheim, Hans.
- Sand, Henry J. S.,** and William V. Lloyd. Arrangement for a.c. electrolysis, 622A.
- Sander, W.** Constructal, 445A.
- Sander, W.** (with K. L. Meissner). Influence of compd. MgZn on ageing capacity of aluminium alloys, 452A.
- Šandera, K.** Influence of colloidal solns. upon electro-capillarity of Hg, 626A.
- Sanderson, R. W. W.** *See* Bruyne, N. A. de.
- Sandlund, Sten.** Addn. of chromium oxide to silica bricks, 741A.
- Sandved, Karl.** Potentiometric titration of Sn with KBrO₃, 587A.
- Sanford, Raymond L.** Magnetic reluctance relationship, 756A.
- Sanzenbacher, Richard.** Measurement of elect. charge carried by vaporized mist particles, 527A.
- Sasaki, Kazuo.** *See* Uchida, Shun-ichi.
- Sauerwald, F.** Density measurements at high temps. VII.—Densities of liquid alloys Pd-Cd, Cd-Sn, Zn-Sn, and of liquid Cd, 467A.
- Sauerwald, F.,** and G. Drath. Surface tension of molten metals and alloys. I.—Max. bubble-pressure test and surface tension of Hg and Bi, 392A.
- Sauerwald, F.,** H. Patalong, and H. Rathke. Effect of cold-working on rate of evaporation, with note on melting and transition points of cold-worked metals, 422A.
- Sauerwald, F.,** and K. Töpler. Internal friction of molten metals and alloys. II.—Further information on methods of measuring and on internal friction of Bi-Sn alloys and alloy Cu₃Sn, 455A.
- Sauri, A. J.** Recovery of Sn from tinned iron scrap, 637A.
- Sawamura, Hiroshi.** Elected member, 330.
- Sawyer, Ralph A.,** and Norman C. Beese. New terms in spectra of Zn and Hg, 547A.
- Sayles, Bertram J.** Elected member, 15.
- Sayre, M. F.** New type of mirror extensometer, 609A.
- Sborgi, U.** Electronic theory of anodic behaviour of metals, especially those exhibiting passivity phenomena.—I.-II., 441A.

- Scarth, G. W.** See Lloyd, F. E.
- Schack, A.** Gas radiation from phys. and tech. standpoint, 619A.
- Schalkau, Artur F. W.** Elected member, 330.
- Schalnikoff, A.** See Semenoff, N.
- Schaphorst, W. F.** Successful expansion joint, 675A.
- Scharawsky, P.** See Nasledow, D.
- Scharrer, K.** See Kürschner, K.
- Scheel, Karl.** Thermal expansion of some substances.—I., 433A.
- Scheel, Karl, and Friedr. Blankenstein.** Sp. gr. of Hg, 392A.
- Scheffer, F. E. C.** See Meyer, G.
- Schenck, Friedrich Rudolf.** Elected member, 330.
- Schermerhorn, T. R.** See Hoyt, Samuel L.
- Scheuer, E.** Scleron and Aeron, 454A.; world's prodn. of Al since its discovery, 749A.
- Schiebold, Albin Ernst.** Elected member, 330.
- Schiebold, E.** See Seidl, E.
- Schiebold, E., and G. Sachs.** Graphic detn. of lattice orientation of crystals by means of Laue process. Regular growth of Al crystals during recrystn., 521A.
- Schilow, Eugen.** Rapid method for calibration of micro-burettes, 589A.
- Schilow, Eugen, and Z. A. Ossenowa.** Micro-titration methods, 576A.
- Schimke, Alfons.** See Müller, Robert.
- Schischkin, V.** Character of discharge in anode effect, 624A.
- Schleede, Arthur.** See Tiede, Erich.
- Schleicher, A.** Change of properties of tin-bronze by pressing and forging, 461A.
- Schleicher, A., and L. Toussaint.** Estn. and sepn. of As, Sb, and Sn by electrolysis, 577A.; V2A steel in electro-analytical pptns., 561A.
- Schleicher, A., with L. Toussaint and P. H. Troquay.** Detn. of Sb by electrolysis in HCl soln., 577A.
- Schluttig, Willi.** Titrating Sn with ferric chloride, using indigocarmin, 587A.
- Schmid, E.** Tenacity of single crystals as affected by plastic deformation, 418A.
- Schmid, E., and G. Wassermann.** Recrystallization of Cu wire, 521A.; Röntgenographic experiments on the Duralumin problem, 521A.; texture of hard-drawn wires, 517A.
- Schmidt, A.** Danger of Hg vapour, 752A.
- Schmidt, Erich K. O.** See Rackwitz, Erich.
- Schmidt, Hermann.** Gas pyrometer, 619A.; process for measuring gas temps., 619A.; spectral pyrometry of glowing bodies, 619A.
- Schmidt, Hermann, and Ernest Furthmann.** Influence of lens absorption when measuring with total radiation pyrometers, 619A.
- Schmidt, Hermann, and Wilhelm Liesegang.** Curve diagr. for visible spectrum of Wien's dispersion equation, 619A.
- Schmidt, Karl.** Elected member, 16; see Moser, Ludwig.
- Schmierer, J. M.** Estimation of internal resistance in dry batteries, 634A.
- Schmitt, Karl Otto.** Precision vol. analysis. I.—Description and accuracy of methods, 558A.
- Schmitz, Conrad.** Comparative tests of power required and rolling output on ingots, 700A.
- Schneider, Wm. G.** An alloy often rediscovered, 662A.; brass and copper pipe for water services and plumbing, 662A.
- Schoeller, W. R.** Detn. of Cd in spelter and alloys, 578A.
- Schoeller, W. R., and C. Jahn.** Analyt. chem. of Ta, Nb, and their mineral associates. VI.—Pptn. of earth acids by Na compds., 566A.
- Schöninger, Wilhelm.** See Moser, Ludwig.
- Schonland, B. F. J.** Scattering of cathode rays, 442A.
- Schoop, M. U.** New metallizing process, 504A.
- Schrenk, Helmuth H.** See Kemmerer, Geo.
- Schrenk, W. T., and B. L. Browning.** Detn. of Se and Te by means of KMnO_4 , 584A.; electrometric detn. of Te in presence of ferric iron, Se, and Cu, 586A.
- Schröber, K. Stock.** See Stock-Schröber, K.
- Schrödinger, E.** Undulatory theory of mechanics of atoms and molecules, 530A.
- Schueler, J. L.** Coating wire with Zn, 645A.
- Schulte, F.** Process of combustion in firing of pulverized coal, 732A.

- Schulthess, Martin C. de. Elected member, 329.
- Schulz, —. Tests with Al in seawater, 487A.
- Schulz, Bruno. Refractory bricks, 744A.
- Schulz, E. H. Fireproof materials for iron and metal manufg. industry, 737A.; investigation and testing of fireproof building material for metallurgical industry in Germany, 737A.; see Kändler, Hermann.
- Schulz, E. H., and W. Jenge. Chemical resisting alloys and their properties, 498A.
- Schulze, A. Book: "Die Thermische Ausdehnung," 761A.
- Schulze, Alfred. Behaviour of Cd amalgams in relation to Weston normal element, 633A.; relation between thermal and elect. conductivities in alloys, 480A.; thermal conductivity and conductivity-relation of alloys in relation to their constitution, 480A.
- Schulze, A. Günther-. See Günther-Schulze, A.
- Schulze, E. See Wenzel, M.
- Schumacher, Earle E., and Foster C. Nix. Solidus line in Pb-Sb system, 467A.
- Schurmann, E., and W. Böhm. Detn. of Ca, Na, and Li in new Pb alloys, 578A.
- Schütz, Wilhelm. Optical evidence for orientation of atoms in magnetic field, 530A.; phenomena accompanying Zeeman effect observed in weak magnetic fields and their variation due to presence of foreign gases, 552A.
- Schwartz, H. A. Permanent mould process, 715A.
- Schwartz, L. Medico-hygenic observations on prevention of indust. diseases, especially lead poisoning, 752A.
- v. Schwartz, M. Strength of pure Al at high temps., 372A.; tech. hardness measurement, 604A.; tensile strength of pure Al at elevated temps., 372A.
- Scott, Arthur F. Relationship between atomic no. and properties of ions in crystal lattice. III.—Metallic state, 531A.
- Scutt, Walter. Ge in a British mineral, 749A.
- Searle, Alfred B. Selection of refractory materials used in industrial chemistry, 736A.
- Searle, V. L. H. Oscillographic study of anodic polarization, 626A.
- Sears, Geo. W. Crit. studies on fusion of rare metal ores. II.—Sepn. of Ta and Cb, 575A.
- Sederholm, Per. See Benedicks, Carl.
- Seede, J. A. Elect. absorbing furnaces, 721A.
- Segerblom, Wilhelm. Book: "Properties of Inorganic Substances," 765A.
- Seguin, (Mlle.) Laure. See François, Maurice.
- Seidl, Erich. Elected member, 17.
- Seidl, Erich, and E. Schiebold. Behaviour of industrial Cu; illustrated by cold-treatment, 382A.
- Seigle, J. Effect of combined tension (or compression) and torsion on bars, 607A.
- Selényi, P. Detection of Th in incandescent filaments, 571A.
- Semenoff, N., and A. Schalnikoff. Investigation of chem. reactions in solid phase, 436A.
- Sen, Nikhitrnanjan. See v. Laue, M.
- Sen, N. R. Elect. field near surface of atoms of certain elements as deduced from doublet separations of their spectra, 527A.
- Seuthe, Adolf. Titration of Sn in white metal with KBr, 586A.
- Sextl, Th. Effect of absorbed gas film on elect. resistance of wire, 427A.
- Seymour, Hartland. Corrosion in pumps, 498A.
- Shaw, Ben, and James Edgar. Loam moulding, 706A.
- Shaw, L. I. See Deussen, H. N. van.
- Shaw, R. J. Present state of foundry industry, 703A.
- Shchukarev, S. Periodic classification of elements from point of view of study of isotopes, 443A.
- Sheerer, Leonard Francis. Effect of atm. conditions on load test for refractories, 735A.
- Sheldon, Ellsworth. Maintenance of motive power on New England Rys., 675A.
- Shemtschushny, S. F. Phys. and chem. investigation of native Au, 386A.; structure of native Pt, 398A.
- Shemtschushny, S. F., and V. Nemilov. Sp. resistance and temp. coeffs. of alloys of Manganin series, 460A.
- Shenstone, A. G. Quartet and doublet terms in Cu spectrum, 536A.; spectrum of CuII, 536A.

- Shepherd, H. H.** Analysis of Al alloys, 565A.
- Sheppard, S. E.** Apparently anomalous protection against oxidation, 381A.
- Sherwood, Richard Luke.** Elected member, 15.
- Shoda, Masaru.** See Arakatsu, Bunsaku.
- Shōji, Hikoroku.** Plasticity of metals.—I., 421A., 422A.
- Shōji, Hikoroku, and Yoshio Mashiyama.** Plasticity of metals at high temps.—II., 422A.
- Sholes, C. E.** Corrosion-resistive metals, 499A.
- Shrum, G. M., N. M. Carter, and H. W. Fowler.** 1s-md series of Cs and other alkali metals, 535A.
- Shute, Alfred J.** Development of Cu wire annealing, 678A.
- Sidney, L. P.** Pulverized fuel in metallurgical furnace practice, 732A.
- Siebe, P.** Detn. of Brinell hardness of thin Al sheets, 605A.; metallographic observations on Cu_2O in Cu, 383A.; straining apparatus for breaking normal spiral wire, 601A.
- Siebel, Erich.** Power expended and flow of material during plastic deformation, 700A.
- Siebel, G.** See Tammann, Georg.
- Sieenthal, C. E.** Metallurgical recovery of Zn, 670A., 751A.
- Sieverts, A.** See Huber, H.
- Sigot, A.** See Hackspill, L.
- Sillers, Frederick, jun.** Crystal structure of electro-deposited Cr, 521A.
- Simon, Franz.** New and simple method for attaining very low temps., 590A.
- Sims, C. J., and E. W. J. Mardles.** Effect of metallic sols in delaying detonation in internal combustion engines, 437A.
- Sinelnikov, K.** See Kwitchatov, T.
- Singleton, W.** Detection and estn. of Pt metals, 584A.; detection and estn. of small amts. of W, Mo, and Th, 587A.
- Sinnatt, F. S.** See Moore, Burrows.
- Sivertz, Victorian.** See Davies, Earl C. H.
- Sizoo, G. J.** Super-conducting state in metals, 426A.
- Skerl, J. G. A.** Permeability of moulding sands, 709A.
- Sklowsky, Max.** Burning fuel oil efficiently, 729A.
- Skowronski, S.** 25 years' progress in electrolytic refining of Cu, 636A.
- Skowronski, S., and E. A. Reinoso.** Sp. resistivity of Cu-refining electrolytes and methods of calculation, 637A.
- Slack, C. M.** Refraction of X-rays in prisms of various materials, 443A.
- Slater, Ian Griffith.** Elected member, 16.
- Slater, J. C.** Dynamical model for complex atoms, 529A.
- Slepian, J.** Temp. of a contact, 615A.
- Sloat, C. A.** See Menzies, Alan W. C.
- Smalley, Oliver.** Special Ni-brasses, 465A.
- Smekal, A.** Molecular theory of strength and strain-hardening, 420A.
- Smith, C. Coulson.** Zn and electrolytic recovery, 635A.
- Smith, C. F.** Appns. of spectroscopy in chem. and metallurgical testing, 613A.
- Smith, D. M.** Spectrum of Zn, 546A.
- Smith, Donald P.** See Halstead, Thomas.
- Smith, Ernest A.** *Correspondence on* "Note on the Silver Contents of Roman Lead from Folkestone and Richboro Castle," 74.
- Smith, E. W.** Fuel economy and metallurgical industry, 728A.
- Smith, F. A.** Securing perfectly conditioned sand, 708A.
- Smith, Hugh E.** Influence of strain on Thomson effect, 430A.; report of Sub-Cttee. VI. of Cttee. A-5 of A.S.T.M. on specifications for zinc-coated products, 502A.
- Smith, H. Grayson.** See McLennan, J. C.
- Smith, Henry Heron.** Elected member, 15.
- Smith, Howard Moorman.** Elected student member, 16.
- Smith, H. M. R.** Finishing tools for brass pressing, 700A.
- Smith, J. Hammond.** New twist meter for torsion tests, 602A.; some aspects of corrosion, 494A.
- Smith, Robert Low.** Elected member, 15.
- Smith, S. G.** Foundry progress, 703A.
- Smith, S. W.** *Discussion on* "The Mechanism of Inverse Segregation in Alloys," 271; vote of thanks to Council, 13.
- Smithells, C. J.** Manuf. of tungsten filaments, 668A.; see Avery, J. W.
- Smits, A.** On paper by Haber, Jaenicke, and Matthias on alleged

- prodn. of Au from Hg, 440*A.*; transformation of elements, 432*A.*
- Smits, A.,** and A. Karssen. Disintegration of Pb atom, 440*A.*
- Smout, A. J. G.** Elected Member of Council, 13.
- Smrč, J.** Researches with Hg dropping cathode. IX.—Sn, 626*A.*
- Snyder, Monroe B.** Universal atomic volcanism and Millikan cosmic rays, 526*A.*; universal atomic volcanism and ultimate atom, 526*A.*
- Soddy, Frederick,** Origins and conceptions of isotopes, 524*A.*
- Soltan, Andrzej.** Conditions of formation of bands in mixture of H and Hg vapour, 540*A.*
- Someya, Kin'ichi.** Use of liquid amalgams in vol. analysis. II.—Oxidimetric detn. of W, &c., by using Pb and Bi amalgams, 563*A.*; IV.—Reducing action of Bi amalgam, reduction of U, and appn. of dichromate titration, 563*A.*; V.—Estn. of H_3PO_4 by uranyl salt, 563*A.*; VI.—Estn. of chromic acid, ferric iron, and ferrieyanide by titanous salt, 563*A.*; VII.—Oxidimetric estn. of Cr, 564*A.*; VIII.—Oxidimetric estn. of Cu and Sn by means of Bi amalgam, 564*A.*; *see* Murakami, Takejiro.
- Sommer, L. A.** Arc spectrum of Rh, 543*A.*; Zeeman effect and structure of arc spectrum of Cu, 536*A.*; *see* Bechert, K.
- Sommerfeld, A.** *See* Laporte, O.
- Sonoda, S.** Properties of electrolytic copper sheets, 382*A.*
- Sowder, S.** Use of Ni in heat-treating high-speed wire drills, 665*A.*
- Soyenkov, Basil C.** Galvanoplastic plating with Ni, 644*A.*; quick methods of Cu plating, 643*A.*
- Spacu, G.** Two very delicate reactions for Cu, 569*A.*
- Spanner, J.** *See* Fraenkel, W.
- Sparagan, W.** *See* Hobart, H. M.
- Specketer, Heinrich.** Elected member, 330.
- Spencer, G. C.** *See* Collins, W. D.
- Speller, F. N.** Steam boiler protection, 508*A.*
- Speter, Max.** Pptn. of Zr with picric acid, 588*A.*
- Spooner, Thomas.** Appns. of a.c. potentiometer, 598*A.*; current transformers with Ni-Fe cores, 665*A.*
- Stäblein, F.** Simple expansion apparatus for high temps.; expansion of carbon-steels at change period, 592*A.*
- Stacy, H. A.** Bend tests of galvanized sheet steel, 502*A.*
- Stahl, Erhardt.** Book: "Metallgiesserei," 765*A.*
- Stammreich, H.** *See* Miethe, A.
- Starck, B. V.** Heating phenomena in muffle furnaces, 718*A.*
- Stauffacher, E. R.** Copper sulphate being used around ground plates, 490*A.*
- Stegeman, Gebhard.** *See* Rosenberg, Jacob Ellis.
- Steger, W.** Resistance of refractory materials to change of temp., 735*A.*
- Steinhoff, Eduard.** Refractory bricks when burning coal dust, 736*A.*; silica bricks.—I., 740*A.*
- Steinhoff, Eduard,** and Fritz Hartmann. New process for testing refractory material by dyeing, 735*A.*
- Stender, W. W.** Electrolyt. treatment of brass waste in HCl soln., 637*A.*
- Stephenson, B. R.,** and J. M. Cork. *K*-series emission spectra for elements Ta (73) to Bi (83), 547*A.*
- Stephenson, George Edward.** *See* Briscoe, Henry Vincent Aird.
- Stern, O.** *See* Knauer, F.
- Sterner-Rainer, L.** Danger of amalgam fillings, 753*A.*; recrystn. and softening of noble metal alloys, 482*A.*
- Stettbacher, Alfred.** New methods of detg. Cu, As, and Hg, 580*A.*; prepn., properties and analysis of burnt magnesite, 743*A.*
- Stendel, H.** Inclusions in light metals and their effect on mech. properties, 447*A.*
- Stevenson, A. E.** Discoloration in canned food, 666*A.*
- Stevenson, J. A.** Modern pattern making, 705*A.*
- Stewart, A. W.** Classification of atoms, 444*A.*
- Stewart, John Q.** Width of Frannhofer lines, 555*A.*
- Stewart, Will.** Gas-welding alloy steels, 685*A.*
- Stintzing, Hugo.** Sources of error in quant. chem. analysis by means of Röntgen emission spectra, 560*A.*
- Stock, Alfred.** Danger of Hg vapour, 752*A.*
- Stock, Alfred,** and Richard Heller. Estn. of small quantities of Hg, 582*A.*

- Stock, Alfred, and Erich Pohland.** Colorimetric estn. of very small quantities of Hg, 582A.
- Stock-Schröber, K.** See Meigen, W.
- Stokes, H. E.** Reversing mill driving equipment, 701A.
- Stoner, Edmund C.** Book: "Magnetism and Atomic Structure," 765A., (review) 775A.; magnetism and molecular structure, 532A.
- Storm, R. A.** Structural welding, 687A.
- Stoughton, Bradley, and Allison Butts.** Book: "Engineering Metallurgy," 765A., (review) 773A.
- Stoughton, Bradley, and M. Miyake.** Mg-base alloys, 468A.
- Stout, Wm. B.** All-metal airplane, 652A.
- Strache, H., and K. Kling.** Pocket gas tester, 732A.
- Straumanis, M.** See Centnerszwer, M.
- Strebing, R., and E. Flaschner.** Microanalytical detn. of Bi, 578A.
- Strebing, R., and J. Mandl.** Microchem. detn. of Sr, 585A.
- Strebing, R., and J. Pollak.** Use of pyrophosphates in micro-analysis, 582A.
- Stribeck, R.** See Lessels, M.
- Struth, H. J.** Who uses fuel oil?, 729A.
- Stuart, J. M.** See Bengough, G. D.
- Subramaniam, M.** Al anode film dielectric, 632A.
- Suchanek, Hans.** Prepn. of Ce-Fe (pyrophoric) alloys, 456A.
- Sucksmith, W., and H. H. Potter.** Magnetic properties of single crystals of Ni, 397A.
- Sullivan, J. W. N.** Book: "Gallio: or the Tyranny of Science," 766A.
- Sur, Nalini Kanta.** Arc spectrum of Pb, 538A.; arc spectrum of Sn, 545A.; see Saha, M. N.
- Sutton, H.** Corrosion of Al alloys, 488A.; discussion on "The Influence of Calcium on Aluminium Containing Silicon," 89; see Bengough, G. D.
- Svéda, J.** Simple apparatus for distillation of Hg *in vacuo*, 592A.
- Svensson, Erik.** See Bengtsson, Ernest.
- Swartz, Carl E.** See Krauskopf, Francis F.
- Swearingen, L. E.** See Reyerson, L. H.
- Sweely, B. T.** Practical chem. control of pickling room solns. in enamel industry, 507A.
- Sweeney, W. T.** See Hidnert, Peter.
- Swift, W. C.** Bronze welding appns., 684A.
- Sykes, James Arthur.** Elected member, 16.
- Sykes, W. P.** Fe-Mo system, 470 A.; Fe-W system, 477A.
- Szebellédy, L.** Detn. of Ca, Sr, and Ba, 579A.
- Tacke, Ida.** See Berg, Otto; see Noddack, Walter.
- Tafel, Wilh.** Problems of mechanics, technology, and metallurgy, 609A.
- Tak, W. G. van der.** Elected member, 17.
- Takahasi, Kinnosuké.** See Honda, Kôtarô.
- Takemura, Kango, and Yahei Hosokawa.** Eye-shaped end of bar investigated by photo-elastic method, 602A.
- Talbot, William John.** Elected member, 15.
- Tammann, G.** Crystal orientation in metal pieces in relation to elastic properties, 419A.; temp. at beginning of inner diffusion in crystals, 419A.
- Tammann, G., and Otto Dahl.** Pb-Zn-Sb alloys, 467A.
- Tammann, G., and O. Heusler.** Transformations which take place in homogeneous phases without crystn. changes, 483A.
- Tammann, G., and K. Kollmann.** Soly. of metals of Fe group and of Cu in Hg, 470A.
- Tammann, G., and H. H. Meyer.** Detn. of orientation of crystals by prodn. of slip bands, 511A.; detection of small inclusions in crystals by prodn. of slip bands, 511A.; orientation of crystals of Cu in dependence on degree of rolling, 379A.
- Tammann, G., and G. Siebel.** Temper colours on Fe-C alloys and on Fe solid solns. Fe-Ni, Fe-V, and Fe-Al, 473A.
- Tamura, S.** See Carpenter, H. C. H.
- Tapsell, H. J., and J. C. Clenshaw.** Book: "Properties of Materials at High Temperatures.—I.," 766A.
- Tarsov, P.** See Jeffries, Zay.
- Taverner, L.** Discussion on "Investigation of the Effects of Impurities on Copper," 163, 179.
- Taylor, Cyril S.** See Edwards, Junius D.

- Taylor, Edgar Willmott.** Elected member, 15.
- Taylor, F. J.** Overhead transmission lines, 672A.
- Taylor, Hugh S.** Mechanism of activation at catalytic surfaces, 438A.; *see* Dew, Walter A.; *see* Rideal, Eric K.
- Taylor, James.** Measurement of currents by electronic emission from heated wires, 599A.; sparking potentials of discharge tubes contg. carefully purified electrodes, 412A.
- Taylor, John B.** Magnetic moments of alkali metal atoms, 531A.; *see* Kunz, Jacob.
- Taylor, Mark Herschel.** Elected member, 16.
- Taylor, N. O.** Corrosion and phys. properties of some alloys of Al, Zn, and Sn, 454A.
- Taylor, W. A.** Acidity control in Cu bath, 643A.; acidity control in Ni bath, 644A.
- Taylor, W. W., E. B. R. Prideaux, and H. G. Pool.** Reaction between selenium tetrachloride and Cu, 381A.
- Templin, R. L.** Effects of size and shape of test specimen on tensile properties of sheet metals, 607A.; methods for detg. tensile properties of thin sheet metals, 608A.
- Terpstra, P.** Crystal structure of Tl, 523A.; *see* Jaeger, F. M.
- Theis, E.** Equilib. between Zn vapour, CO and CO₂, 415A.
- Thews, Edmund R.** Fireclay bricks, 738A.
- Thews, Richard.** Manuf. of "mixed tin," 666A.
- Thibaud, Jean.** Spectrography of γ -rays: Secondary β -ray spectra and crystalline diffraction, 554A.
- Thierbach, Bruno.** Book: "Elektrowärmewirtschaft in der Industrie," 766A.
- Thois, Franz.** *See* Müller, Robert.
- Thomas, C. H.** *See* Compton, K. T.
- Thomas, C. T., and W. Blum.** Protective value of Ni plating.—II., 490A.
- Thomas, Erich.** *See* Ruff, Otto.
- Thompson, A. P., W. B. Holton, and H. C. Kremers.** Prepn. and properties of metallic Yt, 413A.
- Thompson, F. C.** Elected member of Council, 13; *discussion on* "The Attack of Molten Metals on Certain Non-Ferrous Metals and Alloys," 227; *discussion on* "The Influence of Calcium on Aluminium Containing Silicon," 90; *discussion on* "The Mechanism of Inverse Segregation in Alloys," 273; *see* Millington, W. E. W.
- Thompson, J. G.** Nitrogen fixation involves combination of high pressures and temps., 674A.; resistance of metals to nitric acid, 500A.
- Thompson, L. R.** *See* Turner, J. A.
- Thomson, Robert M.** *See* Batchelor, Roger P.
- Thorsen, Robert.** X-ray spectra of lower elements.—II., 549A.
- Thorne, P. C. L.** *See* Hatschek, E.
- Thorneycroft, W. E.** *See* Friend, J. Newton.
- Thorpe, (Sir) Edward.** Obituary notice, 745A.
- Thorsen, V.** Series representation of spectrum of Bi, 534A.
- Thuerk, H. C.** Elect. brass melting reduces costs, 722A.
- Thum, E. E.** Are welded pressure vessels safe?, 684A.
- Thurlby, Ernest George.** Elected student member, 16.
- Tiede, Erich, Arthur Schleede, and Frieda Goldschmidt.** Formation of Au from Hg, 440A.
- Timm, W. A.** Elect. annealing of magnetic materials for telephone apparatus, 677A.
- Timpanaro, Seb.** Quant. spectral analysis, 553A.
- Tod, John Alexander.** Elected member, 330.
- Toller, Hugh Bolton.** Elected member, 330.
- Tomicek, O. H.** Kammerlingh Onnes, 745A.
- Töpler, K.** *See* Sauerwald, F.
- Tosterud, Martin, and Junius David Edwards.** Discovery of Al, 371A.
- Tour, Sam.** Report of Cttee. B-3 of A.S.T.M. on corrosion, 493A.
- Toussaint, L.** *See* Schleicher, A.
- v. Trautenberg, Heinrich Rausch, and S. Levy.** Polariscope for detg. feeble polarization, 597A.
- Travers, —, and — de Goloubinoff.** Study of silica bricks. Dilatometric analysis. Tests of raw material.—I.—II., 740A.
- Travis, J. T.** Corrosion of Ni alloy single rolls, 490A.
- Treadwell, W. D., and C. Paoloni.** Appn. of 3-electrode valves in electro-metric titrations, 576A.

- Trebitsch, Heinrich.** Velocity of fall of solid spheres of radii down to 1×10^{-5} cm. and their elect. charges, 527A.
- Treciak, St.** See Bekier, E.
- Trillat, Jean-Jacques.** Appn. of X-rays in metallurgy, 516A.
- Trinks, W.** Fuels and furnaces in Europe, 717A.
- Troller, A.** Autogenous welding in atomic H, 690A.
- Troquay, P. H.** See Schleicher, A.
- Tröster, Andreas.** See Kremann, Robert.
- Trumpy, B.** Intensity and width of spectral lines, 541A.
- Truthe, W.** Behaviour of Pt metals to Ag and Au in cupelling heats from 1100° and 1200° C., 476A.
- Tschischewski, N.** Analysis of boron alloys, 565A.
- Tubandt, C.,** and Ernst Münzing. Equilib. between molten metals and salts, 434A.
- Tucker, N. P.** Alloys of Fe research. VII.—Prepn. of high purity Si, 750A.
- Tuijn, W.,** and H. Kammerlingh Onnes. Elect. resistance of In in temp. region of liquid He, 427A.
- Tulloch, T. G.** Radiant heat furnaces, 718A.
- Tupholme, C. H. S.** Magnetic separator pulleys in foundries, 710A.
- Turner, F. C.** Mech. autographic extensometer, 609A.
- Turner, J. A.,** and L. R. Thompson. Health hazard of brass foundries, 751A.
- Turner, T.** Discussion on "Investigation of the Effects of Impurities on Copper," 164; discussion on "Penetration of Brass by Tin and Solder," and "The Attack of Molten Metals on Certain Non-Ferrous Metals and Alloys," 230; discussion on "The Mechanism of Inverse Segregation in Alloys," 270.
- Turner, W. D.** See Monroe, C. J.
- Turowa-Pollak, M. B.** See Zelinski, N. D.
- Tuuk, J. H. van der.** Röntgen L-spectra of lighter elements, 549A.
- Twyman, Frank.** Elected member, 15.
- Tyler, Chaplin.** Book: "Chemical Engineering Economics," 766A.
- Uchida, Shun-ichi.** Reaction mechanism of catalytic oxidation of ammonia, 438A.
- Uchida, Shun-ichi,** and Kazuo Sasaki. Action of HNO_3 on Al, 373A.
- Uchida, Yashushi.** See Fukuda, Mitsuharu.
- Udale, Stanley Martin.** Elected member, 15.
- Umino, Saburô.** Heats of transformation and fusion in carbon steels, cast iron, and some other metals, 432A.; heat of transformation in Ni and Co, 396A.; latent heat of fusion of several metals and their sp. heats at high temps., 432A.
- Unger, M.** Refractories for induction furnaces, 736A.
- Urazov, G. G.** See Kurnakov, N. S.
- Usher, F. L.** Electrokinetic behaviour and electrode potential, 631A.
- Utzino, S.** Prepn. of differently coloured Au sols by means of biological fluids, 388A.
- Valeton, J. J. P.** Symmetry of sylvine and the nature of etching figures, 512A.
- Vallance, Reece H.,** and Arthur A. Eldridge. Book: "Chromium and its Congeners," 761A., (review) 771A.
- van Agt.** See Agt.
- van Arkel.** See Arkel.
- van Aubel.** See Aubel.
- van der Putte.** See Putte.
- van Deusen.** See Deusen.
- van der Harst.** See Harst.
- van der Mark.** See Mark.
- van der Tak, W. G.** See Tak.
- van der Tunk.** See Tuuk.
- Van Dyke, Geo. D.** See Lindsay, Geo. A.
- van Geel.** See Geel.
- Vanioukov, V. A.** Batch process for electrolytic sepn. of Au from Ag, 635A.
- van Liempt.** See Liempt.
- van Marle.** See Marle.
- Vardy, William Andrew Shakespeare.** Elected member, 330.
- Vegard, L.** Variations of intensity of lines of a Hg triplet, 541A.
- v. Vegesack, A.** Heterogeneous equilib. liquidus-solidus in ternary system Fe-Cr-C, 456A.
- Verbruggen, L.** See Bruylants, P.
- Vercillo, A.** See Mazzucchelli, A.
- Vernon, H. M.** See Collis, Edgar L.
- Vernon, W. H. J.** Discussion on "Penetration of Brass by Tin and Solder," "The Attack of Molten

- Metals on Certain Non-Ferrous Metals and Alloys," and "The Penetration of Mild Steel by Brazing Solder and other Metals," 230; formation of protective oxide films on Cu and brass by exposure to air at various temps., 507A.
- Verrill, F. D. Shipyard pneumatic plant and pneumatic riveting, 679A.
- Vidic, Ernst. *See* Ruff, Otto.
- Vieweg, R. *See* Vieweg, V.
- Vieweg, V., and R. Vieweg. Bearing tests, 610A.
- Villers, R. New labs. of École Central des Arts et Manufactures, Paris, 756A.
- Vinal, G. W. Electrochemistry and electrometallurgy, 621A.
- Vining, Ralph Edward. Elected member, 16.
- Vivian, Hugh. Elected member of Council, 13.
- Vogel, J. H. Acetylene explosions, 698A.
- Vogel, O. *See* Bauer, O.
- Vogel, Rudolf. Formation of twin deformations in eutectics, 483A.; structure of Fe-Ni meteorites, 474A.
- Vogt, E. *See* Hasche, R. L.
- Volkringer, H. Continuous spectrum of Hg, 539A.
- Vollenbruck, O. *See* Bauer, O.
- Volshtein, L. M. Electrode potential of Tl, 409A.
- von Bogandy. *See* Bogandy.
- von Bruggen. *See* Bruggen.
- von Göler. *See* Göler.
- von Hevesy. *See* Hevesy.
- von Hippel. *See* Hippel.
- von Keler. *See* Keler.
- von Laue. *See* Laue.
- von Oettingen. *See* Oettingen.
- von Raschevsky. *See* Raschevsky.
- von Schwartz. *See* Schwartz.
- von Traubenberg. *See* Traubenberg.
- von Vegesack. *See* Vegesack.
- von Weimarn. *See* Weimarn.
- von Welsbach. *See* Welsbach.
- von Wisniewski. *See* Wisniewski.
- Vosburgh, Warren C. Eppley unsatd. standard cells at high temps., 633A.
- Voss, William. Diseases of brass deposits, 641A.
- Vuilleumier, E. A. Correcting "unsatisfactory" electrolytes, 639A.
- Vürtheim, A. Detn. of K in K salts as perchlorate, 584A.
- Waard, S. de. Detn. of volatile matter in coal, 731A.
- Wada, Isaburo. *See* Ato, Sunao.
- Wade, James W. Future of lead supply, 662A.
- Wagner, Percy A. Ancient bronze from Transvaal, 462A.
- Wakefield, H. W., jun. *See* Dietert, H. W.
- Wakelee, Ronald. Finding diam. of blanks for flanged shells, 700A.
- Walcott, Albert J. Some factors influencing crystal habit, 519A.
- Walker, G. W. Relation of surface to volume in crystals as a determining factor in grain-growth of metals, 519A.
- Waller, Ivar. Stark effect of second order in case of H, and Rydberg correction referring to spectra of He and Li⁺, 538A.
- Wallerstein, I. *See* McLennan, J. C.
- Walmsley, H. P. Conductivity of clouds dispersed from an arc.—II., 426A.
- Walter, B. Attempt to vary artificially the rate of radiative disintegration, 525A.
- Walter, C. M. Industrial heating by town's gas, 729A.
- Walters, J. E. *See* Loomis, A. G.
- Wang, C. Compn. of Wu-chou coinage, and examination of ancient pewter, 461A.
- Wang, S. C. Configuration of Lorentz electron moving arbitrarily along a straight line, 528A.
- Ward, P. G. *See* Grogan, J. D.
- Warner, D. M. *See* Daniels, Samuel.
- Warren, B. E. *See* Norton, J. T.
- Washburne, R. N. *See* King, J. F.
- Wassermann, G. *See* Schmid, E.
- Watson, F. C. Electrification of International Nickel Co.'s works for Monel metal, 722A.
- Watson, Henry. Elected member, 330.
- Watson, W. H. *See* Barkla, C. G.
- Weber, Gustavus A. Book: "The Bureau of Standards," 767A., (review) 782A.
- Webster, G. R. Useful alloys of Al and their properties, 447A.
- Webster, W. L. Longitudinal magneto-resistance effect in single crystals of Fe, 419A.
- Webster, Wm. Reuben. Cu and brass manuf., 656A.
- Webster, Wm. Reuben, John L. Christie, and Roydon S. Pratt. Comparative

- properties of tough pitch and phosphorized copper, 382*A*.
- Weeks, H. B.** Vote of thanks to President for his Address, 18.
- Wegner, W.** *See* Rupp, E.
- Wegscheider, Rudolf.** Independent components and univariant systems, 485*A*.
- Weigel, W. M.** Prepn. and use of industrial special sands, 708*A*.
- Weigle, J. J.** Lattice energy, and work necessary to detach electrons from Ca, 527*A*.
- Weil, Walter.** Elected member, 330.
- Weiler, Georg.** *See* Hahn, Friedrich L.
- v. Weimarn, P. P.** Dispersoid synthesis of Au.—II., 388*A*.
- Weisbrod, Fritz.** *See* Müller, Erich.
- Weiss, H.** Appn. of X-ray spectroscopy to study of metals, 516*A*.
- Weiss, Pierre.** Equation of magnetic state and variation of atomic moment, 429*A*.; paramagnetism independent of temp., 429*A*.; sp. heat and magnetization of Ni, 397*A*.
- Weiss, Pierre, and R. Forrer.** Magnetization and magneto-thermal phenomena of Ni, 396*A*.
- Weissenberg, K.** *See* Herzog, R. O.
- v. Welsbach, C. Auer.** Researches to discover element No. 61, 416*A*.
- Welter, Georg.** Elected member, 15; repeated impact strength and dynamic elastic limit, 604*A*.
- Wendehorst, Erwin.** Colorimetric detn. of Mo, 582*A*.
- Wenger, P., and M. Müller.** Sepn. of Zr from Fe, 575*A*.
- Weinstock, Zelman.** *See* Gans, Ricardo.
- Wennerlöf, Ina.** Precision measurements in *L*-series of Ta, 545*A*.
- Wenzel, M., and E. Schulze.** Gas pyrometers, 619*A*.
- Werner, Eugen.** Etching of metals, 748*A*.; media for rust prevention, 509*A*.
- Werner, Max.** Rate of soly. of Al in HCl, 487*A*.
- Werner, S.** Spark spectrum of Li, 538*A*.
- Weryha, Aleksander.** Ag, Au, and Cu amalgams, 469*A*.
- West, William.** *See* Kendall, James.
- Westenbrink, H. G. K.** *See* Jaeger, F. M.
- Westgren, Arne, and Gösta Phragmén.** Structure of alloys, 516*A*.; X-ray analysis of systems W-C and Mo-C, 524*A*.
- Westlake, H. W. G.** Measurement of combustion chamber temps., 618*A*.
- Westman, A. E. R.** General method for calculating properties of 3-phase Y-connected arc systems, 724*A*.; mercury balance, 735*A*.
- Westman, A. E. R., and W. H. Pfeiffer.** Comparison of uniformity of strength and texture of fire-brick made by different processes, 738*A*.
- Westmont, O. B.** *See* Hartman, M. L.
- Westrip, George Meredyth.** Hydrogen overvoltage of Zn, 629*A*.
- Wever, Franz.** H.-F. induction furnace, 726*A*.
- Wever, Franz, and Wilhelm Fischer.** H.-F. induction furnace. I.—Theory and construction of iron-less induction furnace, 726*A*.
- Wever, Franz., and H. Neuhaus.** H.-F. induction furnace. II.—Metallurgy of iron-less induction furnace, 727*A*.
- Wever, Franz, and W. Reineken.** Alloys of Fe and Sn, 477*A*.
- Wheeler, R. V.** *See* Foxwell, G. E.
- White, A. E.** Research, 755*A*.
- White, Charles Lawson.** Elected student member, 16.
- Whitehead, E.** *See* Jones, E. O.
- Wichers, Edward.** *See* Collins, W. D.
- Wichmann, Arthur Paul.** Elected member, 16.
- Widemann, M.** Silica bricks, 741*A*.
- Widman, H.** *See* Glocker, R.
- Wiederholt, W.** Influence of thermal treatment of Al on its rate of soly. in HCl, 487*A*.
- Wigg, Edward William.** Elected member, 330.
- Wikul, Mykola.** Regulating device for pinchcocks of burettes, 589*A*.
- Wilckens, E.** *See* Hahnemann, W.
- Wilkinson, George D.** Gas produces better results (in enamelling) at less cost, 507*A*.
- Willard, Frederic W.** Problem of secondary metals in world affairs, 747*A*.
- Willett, G. H.** Pipework: its manuf. and lay-out, 674*A*.
- Williams, E. H.** Magnetic susceptibility of rare earth metals, 416*A*.
- Williams, E. J.** Compton effect and reflection of X-rays by crystals, 549*A*.
- Williams, Harry M.** Elected member, 16.

- Williams, S. V.** *Discussion on "The Penetration of Mild Steel by Brazing Solder and Other Metals,"* 226.
- Willis, William A.** Bracing up Cu and brass, 657*A*.
- Willners, H.** *See* Améen, E.
- Willstrop, John William Wesley.** Elected member, 330.
- Willtshire, W. J.** *See* Pullin, V. E.
- Wilmot, V. L. Eardley.** *See* Eardley-Wilmot, V. L.
- Wilson, Ernest.** Corrosion products and mech. properties of certain light Al alloys as affected by atm. exposure, 486*A*.
- Winans, J. G.** Radiation emitted by optically excited Zn vapour, 546*A*.
- Winship, William W.** Amorphous silica for severe service, 742*A*.
- Winter, R. M.** *See* Barratt, T.
- Wisniewski, Felix-Joachim.** Doublets of alkali metals, 547*A*; monatomic molecule of rare gases, 533*A*.
- Wiss, E.** Study of oxy-acetylene flame and yield of blowpipes, 693*A*.
- Wöhler, Friedrich.** Biographical sketch, 745*A*.
- Wolf, K.** Accuracy of electrometric method of detg. pH, 622*A*.
- Wolf, Ludwig.** Danger of Hg poisoning, 752*A*.
- Wolff, Georg.** Metal poisoning in industrial life, 751*A*.
- Wolstenholme, J.** Commercial aspect of foundry work, 703*A*.
- Woo, Y. H.** Disappearance of unmodified line in Compton effect, 549*A*.
- Wood, Joseph Kaye.** Materials used in elect. machine design, 672*A*.
- Wood, R. W.** Structure of Cd and Zn resonance lines, 535*A*.
- Woodson, James Clay.** Elected member, 330.
- Woodward, R. W.** Report of Cttee. D-14 of A.S.T.M. on screen wire cloth, 676*A*.
- Woog, Paul.** Hollowing of tungsten bars by central fusion, 411*A*.
- Wooster, W. A.** *See* Ellis, C. D.
- Worthing, A. G.** Deviation from Lambert's law and polarization of light emitted by incandescent W, Ta, and Mo, and changes in opt. const. of W with temp., 412*A*; spectral emissivities of Ta, Pt, Ni, and Au as function of temp., and m.p. of Ta, 408*A*.
- Woyno, Tadeusz Jerzy.** Crystallographic study of artificial amalgam Ag₃Hg₄, 523*A*.
- Wray, Robert I.** Al paint for industrial plants, 506*A*.
- Wróbel, A.** Polarimetric detn. of inactive substances: potassium, 584*A*.
- Wulf, Theodor.** Book: "Lehrbuch der Physik," 767*A*.
- Wunder, W.** Al in electrotechnics, 648*A*.
- Wuthrich, Gottlieb.** Elected member, 15.
- Wyman, Le Roy Linwood.** Elected member, 16.
- Yamaguchi, Shozo.** Catalytic action of reduced Cu on acetophenone oxime, 385*A*; catalytic action of reduced Cu on benzaldoximes, 385*A*; catalytic action of reduced Cu on oximes, 385*A*; catalytic action of reduced Cu on pinacones, 385*A*; *see* Komatsu, Shigeru.
- Yeh, Chi Sun.** Effect of hydrostatic pressure on magnetic permeability of Fe, Co, and Ni, 378*A*.
- Yentsch, S.** Estn. of metal surface protection by electrolytic Cr plating, 643*A*.
- Yntema, L. F.** *See* Harris, J. A.
- Yoder, C. P.** Elect. annealing, 677*A*.
- Young, H.** Welding Cu fireboxes, 683*A*.
- Young, H. W.** *See* Finney, W. R.
- Young, T. F.** *See* Harkins, William D.
- Yukitomo, Takehiko.** *See* Komatsu, Shigeru.
- Zablocki, W.** *See* Centnerszwer, M.
- Zakowski, Josef.** Growth of small Au particles in prepn. of Au sols from dilute alk. gold chloride solns., 388*A*.
- Zanetti, J. E.** List of research problems in chemistry, 755*A*.
- Zeher, G.** *See* Boer, J. H. de.
- Zeeman, P.** *See* Goudsmit, S.
- Zelinski, N. D., and M. A. Rakusin.** Adsorption of Hg vapour with activated wood charcoal, 394*A*.
- Zelinski, N. D., and M. B. Turowa-Pollak.** Noble metals as catalysts in hydrogenation and dehydrogenation, 438*A*.

- Zepf, K.** *See* Bauer, O.
Zickrick, Lyall. *See* Dean, R. S.
Zickrick, Lyall, and R. S. Dean. Distribution of energy in worked metals and effect of process annealing temp. on final annealing temp. of fine Cu wire, 379*A*.
Zintl, E. Work of Kolthoff, Tomicek, and Robinson: potentiometric standardization of titanous chloride solns., 562*A*.; *see* Hönigschmid, O.
Zintl, E., and A. Rauch. New potentiometric methods of titration, 576*A*.
Zintl, E., and G. Rienäcker. Potentiometric titration of Hg alone and in presence of other metals, 582*A*.
Zocher, H. *See* Berkmann, Sophie.
Zsigmondy, R., and E. Joel. Protection and pptn. of Au by proteins, 388*A*.
Zurlinden, H. Corrosion, 495*A*.
Zwicker, C. Modification changes of Zr and Hf, 415*A*.; phys. properties of W at high temps., 410*A*.; thermionic emission of W, Mo, Th, Zr, and Hf, 413*A*.