

METALLURGICAL ABSTRACTS

	PAGE
I. Properties of Metals	409
II. Properties of Alloys	410
III. Structure (Metallography; Macrography; Crystal Structure).	415
IV. Dental Metallurgy	—
V. Powder Metallurgy	416
VI. Corrosion and Related Phenomena	417
VII. Protection (Other than by Electrodeposition)	420
VIII. Electrodeposition	421
IX. Electrometallurgy and Electrochemistry (Other than Electrodeposition)	—
X. Refining	—
XI. Analysis	422
XII. Laboratory Apparatus, Instruments, &c.	428
XIII. Physical and Mechanical Testing, Inspection, and Radiology.	429
XIV. Temperature Measurement and Control	—
XV. Foundry Practice and Appliances	432
XVI. Secondary Metals: Scrap, Residues, &c.	—
XVII. Furnaces, Fuels, and Refractory Materials	435
XVIII. Heat-Treatment	436
XIX. Working	436
XX. Cleaning and Finishing	439
XXI. Joining	440
XXII. Industrial Uses and Applications	445
XXIII. Miscellaneous	449
XXIV. Bibliography	452
XXV. Book Reviews	456

AUTHOR INDEX TO ABSTRACTS

AFANAS'EV, N. N., 410.	Bergsman, E. R., 429.	Carlson, A. B., 446.	Dowdell, R. L., 440.
Ahrens, G., 446.	Bever, M. B., 450.	Carrington, E., 432.	Dubovitskaya, E. I.,
Aitchison, L., 450.	Bijvoet, —, 416.	Cassen, B., 431.	427.
Akimov, G. V., 419.	Bischoff, J. C., 432.	Chase, H., 421, 435, 437.	Dumas, A., 449.
Allen, N. P., 449.	Blackmon, T. M., 429.	Chipizhenko, A. I., 409.	Dunlop, A., 434.
Andrade, E. N. da C.,	Boak, A. C., 435.	Churchill, H. V., 427.	
452.	Bobalek, E. G., 426.	Churchill, J. R., 427.	Eastwood, L. W., 453.
Appleton, (Str) E., 449.	Bobylev, A. A., 409.	Chute, G. M., 453.	Elchinger, A., 414.
Aref'eva, T. V., 427.	Bochvar, A. A., 413,	Clark, D. S., 431.	Endell, K., 434.
Armfield, F. A., 418.	434, 448.	Clauser, H. R., 431.	Evans, R. C., 416.
Ashburn, G., 423.	Bohner, H., 436.	Close, G. C., 439.	
Ashcraft, D. J., 442.	Bouton, G. M., 440.	Collacott, R. A., 449.	Farkas, L., 410.
Averbach, B. L., 442.	Bowker, J. W., 452.	Collins, H. L., 428.	Felske, F. G., 435.
	Boyd, T. F., 426.	Conley, W. J., 441.	Ferko, A. J., 418.
	Bragg, (Str) L., 416.	Convey, J., 451.	Fiek, G., 451.
Bablik, H., 420.	Breger, A. Kh., 409.	Coons, K. W., 456.	Fine, M. R., 440.
Badaeva, T. A., 411.	Brewer, A. K., 428.	Cox, J. K. E., 431.	Fischer, F., 451.
Badger, F. H. M., 436.	Brillouin, L., 452.		Fischer, H., 421.
Bailey, J. C., 446.	Brockway, —, 416.	Daniel-Bek, V. S., 419.	Fitzgerald-Lee, G., 409,
Bainbridge, C. G., 444.	Brosky, S., 428.	Dankov, P. D., 420.	417.
Baker, W. A., 434.	Brouk, B. O., 447.	Davidenkov, N. N.,	Floe, C. F., 450.
Ball, L. W., 431.	Brown, E. A., 424.	409, 429.	Fournier, H., 453.
Barber, J. H., 438.	Brown, H., 432.	Deichman, E. N., 423.	Fridman, Ya. B., 429.
Barkley, D. P., 430.	Brown, W. F., Jr., 430.	Della-Vedova, R., 413.	Friend, W. Z., 418.
Bärmann, H., 421.	Budaev, A. A., 433.	Dermanova, I. G., 425.	Fry, S. L., 432.
Bankloh, W., 417.	Bunin, K., 415.	Devereux, W. C., 432.	Fullman, B., 451.
Beatson, E. V., 441.		Dixon, H. E., 443.	Funk, E. J., Jr., 436.
Beaumont, R. A., 430.	Cady, E. L., 446.	Dobatkín, V. I., 411.	Funke, F., 417.
Begovich, N. A., 442.	Calder, R. F. O., 420.	Dolance, A., 427.	
Belcher, R., 452.	Cameron, T. B., 442.	Donaldson, J. W., 412.	Gabor, D., 454.
Belyankin, F. P., 429.			

Author Index to Abstracts

- Gaynor, J. W., 418.
 Gerstenmaier, J. H., 445.
 Geschelin, J., 448.
 Ghaswala, S. K., 435.
 Gillett, H. W., 450.
 Goddard, G., 454.
 Goffman, C., 451.
 Golby, F. P., 436.
 Golubev, A. I., 419.
 Goodman, D., 431.
 Greenwald, H. P., 417.
 Grenot, L. D., 418.
 Grigor'eva, N. K., 418.
 Grillot, G. F., 422.
 Grindley, J., 451.
 Gubbins, C. E., 425.
 Guerard, J. P., 447.
 Gullert, L., 414.
 Guynier, —, 416.
 Gwynne, G. R., 438.
 Hall, W. L., 449.
 Halls, E. E., 421.
 Halm, F., 443.
 Hancock, R. W., 438.
 Harker, —, 416.
 Harkins, L. B., 438.
 Harms, K., 433.
 Hartford, W. H., 423.
 Hartmann, I., 417.
 Hassell, —, 416.
 Hauser, R. F., 412.
 De Haven, J. O., 450.
 Haynes, H., 434.
 Healy, P. W., 427.
 Heath, (Sir) H. F., 454.
 Heibling, F., 441.
 Hemsley, S. H., 454.
 Hered, G. R., 424.
 Hered, W., 424.
 Heron, A. A., 437.
 Herres, O., 447.
 Herrmann, H., 443.
 Hess, W. F., 442, 443.
 Hetherington, A. L., 454.
 Hickson, E. F., 420.
 Higgins, B. G., 445.
 Hinchcliffe, R., 435.
 Hirst, H., 454.
 Hooking, H., 432.
 Hodge, E. S., 454.
 Hogg, I. H., 445.
 Hoke, C. M., 454.
 Holligan, P. T., 413.
 Homes, —, 416.
 Hone, A., 416.
 Hoeselitz, K., 413.
 Houlf, F. H., 434.
 Hug, H., 415.
 Hulme, F. M., 432.
 Hultgren, R., 450.
 Hume-Rothery, W., 454.
 Hutcheson, J. A., 451.
 Hutt, G. M., 450.
 Hüttig, G. F., 417.
 Hyde, A. E., 429.
 Isermann, A. W., 436.
 Jackson, H. H., 439.
 Jaquet, P.-A., 454.
 Jarzynka, F. J., 451.
 Jevons, J. D., 441.
 Joffe, A. F., 410.
 Joffe, B. S., 429.
 Jones, M. H., 430.
 Jones, T. D., 433.
 Jones, W. D., 417.
 Keck, P. H., 428.
 Keller, A. V., 433.
 Keller, F., 445.
 Kelley, J. B., 422.
 Kikoin, I. K., 410.
 Klinke, H. O., 444.
 Kochanovska, —, 416.
 Kokorin, A. I., 423, 425.
 Koltthoff, I. M., 425.
 Körber, F., 414.
 Krakat, J., 445.
 Krasnikov, A. I., 410.
 Kremers, H. E., 423.
 Krishnan, —, 416.
 Kröll, W. J., 448.
 Kudryavtsev, I. V., 429.
 Kuznetsov, V. D., 429.
 Lalner, V. I., 415.
 Laissus, J., 455.
 Lamoureux, P. E., 450.
 Lapin, N. N., 424.
 Lardge, H. E., 444.
 Larsen, R. G., 418.
 Ledlingwell, G., 439.
 Leonov, V. A., 433.
 Lesser, M. A., 439.
 Letort, Y., 455.
 Levin, J., 420.
 Levitsky, M. P., 438.
 L'Hermite, R., 455.
 Liddard, E. A. G., 434.
 Lidde, W., 452.
 Lightfoot, G., 455.
 Lindstrand, F., 422.
 Lingane, J. J., 424.
 Lipson, S., 433.
 Loane, C. M., 418.
 Lokhov, P. F., 428.
 Lonsdale, K., 416.
 Losana, L., 455.
 Loux, J. H., 435.
 Ludicke, H., 410.
 Ludewig, D. L., 436.
 McLachlan, —, 416.
 McMaster, R. O., 442.
 Mahn, F., 412.
 Mann, W. B., 455.
 Manuele, J., 451.
 Marinisco, N., 431.
 Markus, H., 433.
 Mase, W. J., 428.
 Mason, J. P., 439.
 Matsuyama, G., 425.
 Mears, R. B., 430.
 Mendeleev, I. A., 412.
 Meyers, F. W., Jr., 444.
 Millker, M. A., 410.
 Mills, R. A., 419.
 Moeller, T., 423.
 Molroun, —, 416.
 Möller, H., 414.
 Monday, C., 438.
 Moore, K. H., 442.
 Moore, R. L., 446.
 Morgan, J., 432.
 Morgen, R. A., 452.
 Morral, F. A., 451.
 Morrison, J. L. M., 449.
 Müller-Börner, R., 437.
 Nathorst, H., 413.
 Newmark, M., 455.
 Norwitz, G., 426.
 Notkin, E. M., 434.
 Nourse, P. R., 429.
 O'Connor, T. F., 422.
 Oding, I. A., 429.
 Oldt, L. M., 417.
 Page, V., 439.
 Palmer, A. R., 435.
 Palmer, T., 446.
 Parker, E. R., 450.
 Paschkis, V., 436.
 Patridge, R. F., 425.
 Peach, A. L., 421.
 Pearson, E., 416.
 Pell-Walpole, W. T., 433.
 Pendred, L. St. L., 455.
 Perrault, R., 455.
 Petrak, F., 448.
 Petrov, D. A., 411.
 Phipps, G. S., 440.
 Pitrk, G. W., 449.
 Plessert, E. H., 429.
 Pletnev, S. A., 427.
 Plucknett, H., 434.
 Pochapsky, T. E., 428.
 Poehlman, Wm. J., 428.
 Polyak, I. Ya., 426.
 Pomerantz, M. A., 410.
 Portevin, A. M., 414, 449.
 Pray, H. A., 420.
 Preiswerk, E., 444.
 Prot, M., 455.
 Pugsley, A. G., 430.
 Ravner, H., 426.
 Raw, O. S. M., 449.
 Razumov, I. M., 451.
 Reedy, J. H., 423.
 Reid, W. C., 439.
 Reinberg, T., 455.
 Richardson, J. A., 421.
 Richmond, W. W., 438.
 Rigbey, J. V., 431.
 Rogel'berg, I. L., 412, 440.
 Rosenthal, H., 433.
 Rudnevsky, N. K., 427.
 Ryalls, E., 444.
 Sadchikova, N. M., 434.
 Sanderson, I., 434.
 Sawyer, D. W., 430.
 Schmid, A., 445.
 Schmidt, W. H., 414.
 Schofield, M., 447.
 Schumacher, E. E., 440.
 Scott, W. J., 440.
 Séférian, D., 455.
 Seifing, F. G., 434.
 Selissky, Ya. P., 415.
 Serensen, S. V., 429.
 Shamray, F. I., 411.
 Shebyn, H., 428.
 Sheshunoff, V., 443.
 Shevandin, E. M., 429.
 Shpichinctsky, E. S., 412, 440.
 Shrader, S. A., 426.
 Siebel, E., 429, 451.
 Siemen, S. E., 429.
 Sillen, —, 416.
 Simons, E. N., 455, 456.
 Simpson, N. H., 437.
 Slunder, C. J., 420.
 Smith, G. G., 445.
 Smith, G. S., 414.
 Snyder, L. J., 423.
 Sokolov, L. D., 409.
 Southgate, B. A., 451.
 Spektorova, S. I., 434.
 Sproull, W. T., 431, 455.
 Stanfield, J. R., 439.
 Stanley, J. K., 424.
 Stanley, T. R., 435.
 Staton, S., 449.
 Steiner, J., 422.
 Stepanoff, A. H., 409.
 Strasmann, W., 434.
 Strauss, K., 432.
 Strong, R. K., 456.
 Taganov, K. I., 427.
 Tal, E. M., 427.
 Tananayev, I. V., 423.
 Tarayan, V. M., 423.
 Taylor, T. A., 448.
 Teeple, H. O., 418.
 Thomas, L. G., 436.
 Timofeeva, M. I., 409.
 Townsend, C. D., 439.
 Townsend, J. R., 448.
 Trillat, —, 416.
 Tylecote, R. F., 444.
 Urazov, G. G., 411.
 Vetoshkin, V. F., 427.
 Vitman, F. F., 429.
 Voronov, S. M., 411.
 Voysey, R. G., 448.
 Vyakbirev, D. A., 426.
 Waddington, R. H., 432.
 Walker, P. H., 420.
 Walker, R. O., 456.
 Waller, —, 416.
 Ward, R. E., 432.
 Wasart'ernia, —, 416.
 Wassart, F. A., 444.
 Webber, H. M., 441.
 Weil, L. A., 446.
 Weinberg, S., 426.
 Weisler, A., 427.
 West, E. G., 445, 446.
 Wheeler, J. W., 435.
 Whitfield, M. G., 413.
 Williams, W. S., 436.
 Wilson, C., 446.
 Wilson, C. L., 452.
 Wilson, W., 456.
 Winheim, A. H., 410.
 Winsor, F. J., 413.
 Woldman, N. E., 413.
 Wood, A., 456.
 Wood, D. B., 446.
 Wood, E., 413.
 Woollen, A. H., 443.
 Wyant, R. A., 442.
 Wyart, —, 416.
 Wyckhoff, —, 416.
 Yensen, T. D., 424.
 Young, O. B. F., 456.
 Zachariasen, —, 416.
 Zachariasen, R. H., 428.
 v. Zeeleder, A., 444.
 Zeiss, N. W., 414.
 Zentler-Gordon, H. E., 445.
 Zholobov, V. V., 437.
 Zhukovitsky, A. A., 409.

METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

Volume 13

DECEMBER 1946

Part 12

I.—PROPERTIES OF METALS

*The Mechanical Properties of Copper at High Temperatures. A. A. Bobylev and A. I. Chipizhenko (*Tsvet. Metally*, 1945, (3), 62-65).—[In Russian]. Annealed wires, 6 mm. in dia., were tested at three rates of extension (1, 20, and 300 mm./min.) at temp. from 20° to 900° C. With increase in the rate of extension, the strength and plasticity of copper become greater. The deleterious effect of the ambient atmosphere is connected with its action on the grain boundaries, which results in the formation of intercrystalline cracks and leads to a sharp decrease in plasticity.—N. A.

*The Influence of Small Iron Contents on the Properties of Copper and Alpha Brasses. (Shpichinetsky and Rogel'berg). See p. 412.

Lithium, the Lightest Known Metal. G. Fitzgerald-Lee (*Aircraft Eng.*, 1946, 18, (203), 32).—A brief note on the properties, applications, and economics of lithium.—H. S.

Cavitation in Centrifugal Pumps. A. H. Stepanoff (*Trans. Amer. Soc. Mech. Eng.*, 1945, 67, (7), 539-552; *Corr. Abs.*, 1946, 2, (3), 45).—The present state of information on cavitation of centrifugal pumps is presented, with a method for determining cavitation conditions from velocity considerations. The model-test laws as applied to cavitation are deduced, with their limitations. The presence of gases in liquids does not affect the cavitation of pumps, except that vaporization starts at a higher absolute pressure, due to the law of partial pressures. Drop in head capacity may appear earlier because of liberation of gases under reduced pressure, and the water-hammer effect of collapsing vapour bubbles is cushioned. Penetration of metals by water under repeated stresses furnishes a logical explanation for the origin of local destructive high pressures found during cavitation, and also for the cases of metal failure from fatigue in presence of liquids. 32 references are given.

*The Influence of Rate on the Resistance of Metals to Plastic Deformation. L. D. Sokolov (*Zhur. Tekhn. Fiziki*, 1946, 16, (4), 437-442).—[In Russian]. Static compression tests (at rates of 0.01 and 1.0 mm./sec.) and dynamic tests (at an average rate of 2000 mm./sec.) were carried out in the cold and at elevated temp. on 20-mm.-high cylinders of lead, copper, and steels of various carbon contents. True-stress curves were constructed from the results. The rate coeff. (*i.e.*, the ratio of the change in true stress to change in rate) increases with rise in temp. and with diminution of the m.p. of the metal, and has a single-order value for an increase in rate in the ranges indicated above.—N. A.

*Examination of the Wood and Smith Effect [in Aluminium]. N. N. Davidenkov and M. I. Timofeeva (*Zhur. Tekhn. Fiziki*, 1946, 16, (3), 283-290).—[In Russian]. Experiments were made to measure the residual stresses of the first order in the outer layers of stretched aluminium specimens. Negative results were obtained in all cases, and no residual stresses were found.—N. A.

The Surface Strain of Metals. A. Kh. Breger and A. A. Zhukovitsky (*Zhur. Fiz. Khim.*, 1946, 20, (4/5), 355-362).—[In Russian]. On the basis of Sommerfeld's model, it is shown that the dispersion of a metal leads to an increase in the kinetic energy of the electrons, and this is the fundamental physical cause of the large surface strain of metals. A formula is deduced

* Denotes a paper describing the results of original research.

† Denotes a first-class critical review.

for calculating surface strain, which gives accurately its order of magnitude and its relation to the density of the electron gas. In the case of a linear model it is shown that surface strain may also be determined by the method of molecular orbits.—N. A.

The Theory of Fatigue Strength Under Complex Stresses. N. N. Afanas'ev (*Zhur. Tekhn. Fiziki*, 1946, 16, (4), 443-454).—[In Russian]. A theory has been worked out for real polycrystalline metals, based on the probability of finding the crystals most favourably orientated in relation to the max. shear stresses acting in the metal.—N. A.

***Hydrogen and Proton Gas in a Metal.** A. I. Krasnikov (*Izvest. Akad. Nauk S.S.S.R.*, 1946, [Tekhn.], (1), 133-140).—[In Russian]. An experimental spectrographic study was made of the state of hydrogen in a metal, the action of X-rays, and the structure of the lines of the $K\alpha_1\alpha_2$ doublet. It is shown that hydrogen in the form of protons is a factor determining the structure of the doublet and also the properties of the material. The linkage of the atoms of the material is determined by the energy state of its proton gas. The state of the electron gas is a function of the state of the proton gas. The reaction oxidation-reduction can be described in terms of the redistribution of protons.—N. A.

***The Gyromagnetic Effect in Supraconductors [Lead].** I. K. Kikoin (*Zhur. Tekhn. Fiziki*, 1946, 16, (2), 129-154).—[In Russian]. The existence of the Einstein-de Haas effect in supraconductors was demonstrated by experiments on supraconducting lead. The numerical value of the Lande factor was found to be 1 ± 0.03 , indicating that the gyromagnetic effect is due to short-circuit currents.—N. A.

Semi-Conductors and Their Application. A. F. Joffe (*Izvest. Akad. Nauk S.S.S.R.*, 1946, [Fiz.], 10, (1), 3-14).—[In Russian]. Delivered at a session of the Physico-Mathematical Division of the Academy of Sciences of the U.S.S.R., during the celebration of the 220th anniversary of the founding of the Academy. A review is given of the work at the Physico-Technical Institute relating to these questions: the determination of the number and mobility of conductivity electrons; electrical conductivity in strong fields; the mechanism of electrical conductivity; boundary layers; photo-electric phenomena; and the application of semi-conductors.—N. A.

***Secondary Electron Emission from Oxide-Coated Cathodes.—II.** Martin A. Pomerantz (*J. Franklin Inst.*, 1946, 242, (1), 41-61).—Apparatus and experimental procedure are described for an investigation of electron emission from oxide-coated cathodes. It is concluded that the high secondary electron yields may not be attributed to some modification of the Matter effect.

—H. J. A.

II.—PROPERTIES OF ALLOYS

***Report of the Automobile Research Committee on Contraction of Aluminium Alloy Bearings.** L. Farkas and H. Ludicke (*J. Inst. Automobile Eng.*, 1946, 14, (9), 205-228).—The nature and causes of the contraction of aluminium alloy bearings in steel housings were investigated, earlier (unpublished) work having indicated that contraction was due to plastic straining of the bearing metal. Tests were carried out in a machine in which the conditions existing in a connecting-rod big end were simulated, and the following factors were investigated: (a) strength of the bearing material, (b) interference fit, (c) bearing wall thickness, (d) bearing size, and (e) connecting-rod wall thickness. The effect of temp. on bearing clearance was also considered. The results show that, owing to the interference fit in the housing and the differential expansion between the bearing and the connecting rod, a compressive hoop stress exists which may exceed the elastic limit of the aluminium alloy and so lead to plastic

strain and contraction of the bearing across internal and external dia. Contraction can be prevented, however, by suitable choice of alloy and proper design of the bearing. The alloy should have a high limit of proportionality in compression at temp. usually encountered in bearings, and should not soften on exposure to such temp. for long periods. Fully heat-treated, high-strength aluminium alloys appear to satisfy these conditions; a satisfactory alloy is one containing copper 2.12, nickel 1.13, silicon 0.65, zinc 0.06, magnesium 0.93, manganese 0.07, titanium 0.07, iron 1.2, and tin 0.2%. As regards design, it is essential to make the interference fit as small as possible in order to keep the max. stress in the bearing low. The max. stress can be calculated by simple equations, and if the strength properties of the alloy are known, the highest temp. to which the bearing can be subjected without contraction can be estimated. Provided that contraction is prevented, bearing clearance remains practically const. at all operating temp.—N. B. V.

***Investigation of the Equilibrium Diagram of the System Aluminium-Copper-Magnesium.** G. G. Urazov and D. A. Petrov (*Zhur. Fiz. Khim.*, 1946, 20, (4/5), 387-398).—[In Russian]. The aluminium corner of the system was studied by the thermal and microstructural analysis of alloys on five sections: 80, 70, and 60% aluminium, part of the 20% copper section, and the section from aluminium to the newly discovered ternary compound *S*. Three invariant reactions were established in the region investigated: (a) a ternary eutectic liq. \rightleftharpoons Al + CuAl₂ + *S* at aluminium 63.1, magnesium 7.2, copper 29.7%, 500° C.; (b) a peritectic reaction liq. + *S* \rightleftharpoons Al + *T* at aluminium 64.4, magnesium 25.6, copper 10%, 465° C.; (c) a ternary eutectic liq. \rightleftharpoons Al + *T* + Al₃Mg₂ at aluminium 65.5, magnesium 33.0, copper 1.5%, 445° C. There is also a peritectic reaction liq. + *U* + *S* \rightleftharpoons *T* at aluminium 51.1, magnesium 34.0, copper 15%, 520° C. Approx. compositions of the compounds found in the region investigated are as follows: *U*: aluminium 13.7, copper 66.0, magnesium 20.3%; *S*: aluminium 38, copper 44.8, magnesium 17.2%. In conformity with these compositions the formulæ Al₂Cu₃Mg₃ and Al₂CuMg may be provisionally ascribed to the compounds *U* and *S* respectively. Vogel's formula Al₃CuMg₄ can be retained for the phase *T* (*Z. anorg. Chem.*, 1919, 107, 265; *J. Inst. Metals*, 1919, 22, 354). The phase *U* differs in composition from Bastien's phase with the formula Al₂Cu₃Mg₂ (*Publ. sci. et tech. Ministère de l'Air*, No. 20, 1933, 1-9; *J. Inst. Metals*, 1933, 53, 623), but doubtless the two are the same. The composition of *S* differs from the phase designated Al₂Cu₃Mg₂ by Laves and Witte (*Metallwirtschaft*, 1936, 15, (1), 15-22; *Met. Abs.*, 1936, 3, 353) and also from Al₁₃Cu₇Mg₈ (Nishimura (*Nippon Kinzoku Gakkai-Si*, 1937, 1, 8-18; *Met. Abs.*, 1938, 5, 208)). The max. solubility of magnesium in CuAl₂ probably does not exceed 1-1.5%. The phase *S* was mistaken by Vogel for the solid solution of Al₃Mg₁ in CuAl₂.

—N. A.

***On the Structure and Properties of Commercial Aluminium Alloys of High Iron and Manganese Content.** S. M. Voronov and V. I. Dobatkin (*Tsvet. Metall.*, 1945, (5), 63-67).—[In Russian]. Ternary aluminium-iron-manganese solid solutions in slowly cooled commercial aluminium alloys tend to give rise to brittle crystals. Primary crystals of an iron-manganese phase begin to appear in alloys containing 0.7% manganese and 0.8% iron. The brittle particles of this phase decrease the plasticity of the alloy in hot working under pressure, and reduce the static and dynamic mechanical properties. With a high iron content (0.6-0.8%) in the alloy "D6" (copper 4.8-5.2, magnesium 0.75-1.0, manganese 0.8-1.2, silicon 0.7%), the manganese content should be close to the lower limit.—N. A.

***The Mechanical Properties of Aluminium-Magnesium-Zinc Alloys in the Region of the Aluminium-Rich Solid Solution.** T. A. Badaeva and F. I. Shamray (*Izvest. Akad. Nauk S.S.S.R.*, 1946, [Tekhn.], (4), 611-618).—[In

Russian]. It is established that the greatest strength is possessed by alloys lying on sections in the region of increasing relative magnesium content between the section Al-MgZn₂, and that corresponding to the ratio Mg : Zn = 1 : 1. This shows that the increased strength of the alloys is due not only to the MgZn₂ phase but also to the ternary phase Al₂Mg₃Zn₃, which exists in regions corresponding to Mg : Zn ratios of 1 : 3 to 1 : 1, and imparts max. strength to them. Aluminium-magnesium-zinc alloys have a high resistance to corrosion by sea water, but are susceptible to stress-corrosion. Suitable choice of composition and heat-treatment can minimize this deficiency however.—N. A.

Aluminium Foundry Alloys. Their Selection and Preparation. (Carrington). See p. 432.

***The Action of Small Quantities of Magnesium on the Allotropic Modification of Metallic Cerium.** (Mlle.) Françoise Mahn (*Compt. rend.*, 1946, 223, (2), 78-79).—The coeff. of magnetization and the elongation of various cerium-magnesium alloys containing 0-4% magnesium were determined at ascending and descending temp. from 78° to 290° abs. The object was to find out if the free cerium phase, as indicated by Vogel (*Z. anorg. Chem.*, 1915, 91, 277; *J. Inst. Metals*, 1915, 13, 326) and Guertler ("Metallographie," Band I, Teil 2, Berlin: 1921; *J. Inst. Metals*, 1921, 26, 682 (review)) could assume the allotropic states that characterize the pure metal. Both quenched and slowly cooled alloys were studied. The limits of existence of the allotropic state of cerium were greatly modified by the presence of small quantities of magnesium, and the γ -phase becomes unstable. Although the cycle of dilatation, $\gamma \rightleftharpoons \alpha$, diminishes at from 0 to 1% magnesium, the corresponding magnetic cycle reaches a very marked max. at about 0.2% magnesium.—J. H. W.

†**Copper and Copper-Base Alloys. Review of American Research During 1945-46.** J. W. Donaldson (*Metal Ind.*, 1946, 69, (8), 157-160; (9), 171-173; (10), 195-198).—A comprehensive review of researches, carried out in the U.S.A. in 1945-46, on the melting and casting, working, brazing and welding, testing, structure, powder metallurgy, stress-corrosion cracking, and damping of copper and copper-base alloys. A bibliography of 54 references is given.—J. H. W.

***The Influence of Small Iron Contents on the Properties of Copper and Alpha Brasses.** E. S. Shpichinetsky and I. L. Rogel'berg (*Tsvet. Metall.*, 1946, (1), 54-60).—[In Russian]. S. and R. studied the effect of small quantities of iron (0.005-0.5%) on the mechanical properties after deformation and annealing, the grain-size, and the corrosion-resistance of copper and of brasses containing 5, 10, 15, 20, and 28% zinc. The effect of iron on the mechanical properties of the alloys "L80," "L68," and "L62" at elevated temp. was also examined. Iron in copper and copper-zinc alloys increases the hardness and strength, decreases the elongation, and inhibits grain growth. Iron markedly affects the plasticity of brasses at elevated temp. Up to 0.3% iron in copper and α -brasses does not appear to be a harmful impurity. After annealing at 600°-650° C., alloys containing up to 0.15% iron have properties practically identical with those of iron-free alloys.—N. A.

***Study of the Anisotropy of Melchior [Nickel Brass] in Relation to Its Mechanical Properties.** I. A. Mendelev (*Tsvet. Metall.*, 1945, (6), 56-61).—[In Russian]. The temp. of the preliminary anneal appears to be the most important factor determining the degree of anisotropy of nickel-brass strip in relation to the mechanical properties for a given reduction. Anisotropy is least when preliminary annealing is carried out at 700°-800° C. and final annealing at 700°-900° C.—N. A.

New Magnesium Die-Casting Alloy [Eclipsaloy]. R. F. Hauser (*Modern Metals*, 1946, 2, (2), 8-10).—The need for a magnesium-base die-casting alloy having a small tendency to hot-cracking led to the development of Eclipsaloy

130, which contains aluminium 1.0–1.5, manganese 0.5–1.5, iron 0.005 max., nickel 0.005 max., copper 0.05 max., silicon 0.3 max., total other elements 0.3% max., remainder magnesium. After a special heat-treatment (the details of which are not disclosed), the alloy has the following properties: tensile strength 32,000, yield strength 21,000 lb./sq.in., elongation on 2 in. 9%, Charpy impact value 10 ft.lb., hardness 56 (Rockwell E). Corrosion-resistance is comparable with that of the best magnesium die-casting alloys at present in use. The use of Eclipsaloy 130 is said to permit the die-casting of articles which would not otherwise be possible on account of hot-cracking. The alloy has the disadvantages, compared with the usual alloys, of decreased apparent fluidity, greater tendency towards apparent internal shrinkage porosity, and greater tendency to form flow marks on the surface of the castings. Measures can, however, be taken to minimize these shortcomings.

—N. B. V.

*The Cause and Control of Microporosity in Magnesium Alloys. (Liddiard and Baker). See p. 434.

Modern Permanent-Magnet Materials. Helmer Nathorst (*Jernkontorets Ann.*, 1942, 126, (10), 471–525).—[In Swedish]. A detailed review of the development of alloys for permanent magnets, with particular reference to progress made in the 1930–1940 decade. N. discusses the theory of ferromagnetism and considers the properties of materials used for permanent magnets, from the early martensitic steels to the later aluminium-nickel-cobalt-titanium high-alloy steels, and such non-ferrous alloys as Alconit 5.2. The manufacture, treatment, properties, and applications of these alloys are discussed, and the Zumbusch system of classification explained. A list of Swedish patents and a bibliography are appended.—M. A. V.

†Modern Hard Magnetic Materials. K. Hoselitz (*Metal Treatment*, 1946, 13, (47), 213–222).—See *Met. Abs.*, this vol., p. 289.

Selecting Non-Ferrous Bearing Material. Norman E. Woldman (*Iron Age*, 1946, 158, (10), 54–57; (11), 60–64).—The structure, physical properties, and proper applications of non-ferrous bearing alloys are discussed, including the characteristics of babbitts, the copper-lead group, single-phase metals such as pure lead, tin, cadmium, and bismuth, and the recently developed aluminium-base alloys. A comparison is made with other standard-type bearing materials, and the advantages and disadvantages of the various aluminium alloys for specific purposes are described. A bibliography is appended.—J. H. W.

Bearing Metals. Mechanism and Fundamentals of Performance. E. Wood (*Metal Ind.*, 1946, 69, (14), 277–280).—Describes the manner in which bearing metals work and, in particular, the fundamental advantages of soft metals for bearings. These alloys depend principally on their ability to cope with breakdowns in the oil film and periods of boundary lubrication. Tin-base alloys offer the best all-round combination of properties for bearing metals. For very high-duty applications, silver-lead-indium bearings may be better.—J. H. W.

Bearing Developments. P. T. Holligan (*Proc. Inst. Brit. Found.*, 1944–45, 38, B26–B31; discussion, B31–B36).—See *Met. Abs.*, 1945, 12, 248.

On the Dependence of the Mechanical Properties of Alloys on Composition and Structure. A. A. Bochvar (*Izvest. Akad. Nauk S.S.S.R.*, 1946, [Tekhn.], (5), 743–752).—[In Russian]. B. points out the inadequacy of determining the properties of alloys from composition-property diagrams, without taking into account other factors which influence the properties of alloys. Data are given regarding the change of hardness in the aluminium-silicon alloys; values calculated from the law of additivity are distinctly higher than the experimental values. The enhanced plasticity of the alloy of zinc with 20% alu-

minium at 100°–300° C. is also pointed out. (Cf. *ibid.*, 1945, [Tekhn.], (9), 821; *Met. Abs.*, this vol., p. 318).—N. A.

*The Behaviour Under Tensile Stress of Metals Deformed by Compression.—II. Friedrich Körber, Anton Eichinger, and Hermann Möller (*Mitt. K.-W. Inst. Eisenforschung*, 1943, 28, (6), 71–89).—Cf. *Met. Abs.*, 1943, 10, 67. Continuing their researches on embrittlement, the authors investigated the effect of temp. up to 700° C. Embrittlement generally increased with upsetting temp., but disappeared in specimens upset at 700° C.—M. A. V.

*Internal Friction of Metallic Alloys. Albert Portevin and Léon Guillet (*Compt. rend.*, 1946, 223, (6), 261–263).—The internal friction of alloys was compared by Chevenard's torsion micropendulum, precautions being taken to obviate errors caused by the very different grain-sizes, heterogeneity of the solutions, and the residual strain in the specimen after working. This test gives damping curves of the specimen, which functions as an oscillator. The conclusions of previous investigators, that the decrement of solid solutions is much smaller than that of pure metals, and that it diminishes rapidly at first and then slowly as the concentration increases, were confirmed. In the case of order-disorder transformations, gold-copper alloys afford two examples: (a) On quenching the alloy of equi-atomic composition from 650° C. in cold water, a disordered cubic solid solution results; on slow cooling and reheating for 100 hr. at 380° C., an ordered structure with a tetragonal lattice results. The decrement of the ordered alloy is 50 times greater than that of the disordered alloy. (b) On the other hand, the order-disorder transformation without change of lattice of Au₃Cu shows no change of decrement. Due to experimental difficulties, the results for intermediate solid solutions are meagre. For Cu₃₁Sn₈ the decrement is very small and corresponds to a min. on the decrement-composition curve for an electronic concentration of 21:13. In the case of CuZn, however, the decrement is appreciable and corresponds to a max. at an electronic concentration of 3:2. A general conclusion and an explanation of the practical points are advanced.—J. H. W.

*Catalytic Effect of Metals and Light on Fats and Oils. N. W. Zeils and W. H. Schmidt (*Oil and Soap*, 1945, 22, (12), 327–330; *Corr. Abs.*, 1946, 2, (3), 32).—Presented to a conference on problems related to fat deterioration in foods, held by the Committee on Food Research of the U.S. Office of the Quartermaster-General. Aluminium and nickel were the only metals among those tested found absolutely free of any pro-oxidant effect on hydrogenated vegetable oils during the de-odorizing process. Inconel and Rezistal were the best of the alloys tested, while Monel was the poorest, probably because of its high copper content. As a rule the metal effect became more noticeable with increasing temp. Metals used were lathe turnings or 10-mesh granules; in no case was powder employed.

Russian Metallography. Kurnakov's "Daltonides" and "Berthollides." G. Stanley Smith (*Metal Ind.*, 1946, 68, (23), 451–454; (24), 471–474; (25), 495–498; (26), 516–518).—A full description of the basic principles of Russian work on metallic systems, with particular reference to the investigations embodying a combination of geometry and physics with chemistry, carried out by Kurnakov and his school. These involve the introduction of the conception of "daltonides" and "berthollides." Briefly, the former is a phase with singular points on the property-composition curves; the latter is a phase of variable composition with an "irrational" max. m.p. The application of these conceptions to the transformations that take place in the copper-gold and other solid solutions is discussed, and order and disorder transformations generally are examined and illustrated. The ability of berthollides to change their properties as equilibrium conditions alter is of importance in dispersion-hardening. The study assists in the choice of suitable age-hardening alloys, such as occur in the aluminium-magnesium, aluminium-copper, and alumin-

ium-magnesium-zinc systems. S. correlates these Russian theories with the electron-atom ratios and characteristics formulated by Hume-Rothery and others. 21 references are appended.—J. H. W.

III.—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

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

Nature-Printing Aluminium Alloy Forgings. — (*Metallurgia*, 1946, 34, (204), 335).—Cf. *Met. Abs.*, this vol., p. 49. In the light of further experience, the etching procedure previously described has been considerably altered. The etchant finally evolved is composed of ferric chloride 40 and cupric ammonium chloride 13 g. in 1 l. of water. This etchant is used at 80^o–95^o C., the section being immersed for two-minute periods; after which it is washed, immersed in 45% nitric acid until the adherent brown deposit has dissolved, and rewashed.—J. W. D.

***The Structure of Aluminium [and Aluminium Alloy] Spot Welds.** H. Hug (*Schweiz. Arch. angew. Wiss. Techn.*, 1946, 12, (8), 250–257).—[In German]. Metallographic examination of spot welds, made under carefully controlled conditions in pure aluminium, Anticorodal, Avional, and Aluman, revealed the existence of four principal zones in the welded sheet: (1) unchanged structure, with crystals oriented in the direction of rolling; (2) a similar structure in which some of the constituents had melted; (3) cast structure containing very fine constituents which had separated from the melt and were oriented at right angles to the lens-shaped edge of the spot weld; and (4) randomly-oriented cast structure. 16 photomicrographs of welds are reproduced and described in detail.—N. B. V.

***On the Structure and Properties of Commercial Aluminium Alloys of High Iron and Manganese Content.** (Voronov and Dobatkin). See p. 411.

***The Electrolytic Polishing and Etching of Copper and Copper Alloys.** V. I. Lainer (*Tsvet. Metall.*, 1946, (3), 54–66).—[In Russian]. Copper and its alloys were successfully polished by the electrolytic method in phosphoric acid solutions. The addition of other constituents to the solutions did not lead to any improvement. The decisive factor in the electropolishing was the concentration of phosphoric acid, to which was related the degree of anodic polarization. On strengthening the acid concentration the optimum c.d. decreased, and the duration of the process increased; on increasing the temp. and stirring the electrolyte, the time was shortened and the c.d. increased.—N. A.

***Crystal Lattice Constants of the Iron-Rich Solid Solutions of Iron, Silicon, and Aluminium.** Ya. P. Selisky (*Zhur. Fiz. Khim.*, 1946, 20, (7), 597–604).—[In Russian]. The lattice const. of alloys containing up to 13 wt.-% aluminium and 18 wt.-% silicon were determined by Preston's method, using Fe radiation. Curves showing the change of lattice const. with composition exhibit inflections, the presence of which is explained by the formation of superstructures of the type Fe₃(Si,Al). The boundary of the superstructure field extends from the straight line joining the compositions of the binary alloys Fe₃Si and Fe₃Al with the alloy containing aluminium 10, silicon 5 wt.-%.—N. A.

***On the Question of the Structure of Eutectic Alloys.** K. Bunin (*Izvest. Akad. Nauk S.S.S.R.*, 1946, [Tekhn.], (2), 305–310).—[In Russian]. The behaviour of liquid eutectic alloys when centrifuged was studied. Specimens of eutectic bismuth-tin alloy were placed in a crucible, heated to 200^o±5^o C., and rotated at 3000 r.p.m. for 10–30 min. The crucible was then quenched

in water and broken, and the cylindrical specimens (1-8 mm. dia. \times 50 mm. long) were subjected to chemical analysis at three points. The results showed that the bismuth content in the regions farthest from the axis of rotation differed on an average by 10 at.-% from the regions nearest to it. In specimens which were not rotated, no gravity segregation was observed. From his results, B. draws conclusions regarding the absence of molecular mixing in alloys of the eutectic type.—D. A.

Recent Publications on Electrolytic Polishing and Its Applications. — (*Métaux et Corrosion*, 1946, 21, (245), 18; (246), 27, 32).—Extension to the bibliography of P.-A. Jacquet, *Métaux, Corrosion—Usure*, 1943, 18, 1-21.—W. G. A.

The Structure and Growth of Passivated Films. (Dankov). See p. 420.

X-Ray Analysis. Developments During the War Years. — (*Metal Ind.*, 1946, 69, (5), 87-90; (6), 119-120).—A report of papers read at the international conference on X-ray analysis organized by the Institute of Physics. *Wyckhoff* surveyed the development of the electron microscope, and the technique developed in America for specimen preparation since 1946. (Mrs.) *K. Lonsdale* discussed thermal and other perturbations of crystal structure. *Wyart* reviewed the work done at the Sorbonne, and indicated that the present tendency was to develop monochromatic rays and to increase the actual power of X-ray tubes to give greater definition to the radiograms. *Zachariassen* gave an account of the crystalline character of the rare-earth elements and of thorium, uranium, neptunium, and plutonium; *L. Bragg* described the method of illustrating plane, close-packed crystal structures by using a layer of bubbles on the surface of a liquid to represent individual atoms; and *Bijvoet* dealt with X-ray researches in Holland. *Homes* outlined the work done in Belgium, and *R. C. Evans* reviewed X-ray crystallography in Germany. *McLachlan* described a Fourier-series machine in which sand is made to fall in a sinusoidal manner; *Trillat* gave a description of French designs of the electron microscope, and (with (Mlle.) *Moiroud*) discussed electronic radiography and micro-radiography. *Guinier* surveyed new and improved methods of X-ray analysis, while *Harker* reviewed American developments in the study of the crystallography of metals. *Brockway* referred to the types of equipment and apparatus at present in use in America; *Hassell* gave an account of electron diffraction in Norway; *Waller* and *Sillen* outlined optical methods of Fourier summation; *Wasartjerna* briefly summarized the work being done in Finland; and *Krishnan* discussed the diffuse scattering of electrons in metals and alloys in relation to their resistivities. *Kochanowska* gave an account of an investigation of different types of tungsten and tungsten-titanium cemented carbide by the Debye-Scherrer method.—J. H. W.

Quality Control. III.—Metallography. A. Hone and E. Pearson (*Canad. Metals*, 1945, 8, (8), 24-28, 45).—Cf. *Met. Abs.*, 1945, 12, 405; this vol., pp. 428, 429, 431. An elementary introduction to the results obtained by microscopic metallography.—H. J. A.

V.—POWDER METALLURGY

Spectrographic Analysis of Powdered [Aluminium] Alloys. (Rudnevsky). See p. 427.

Two New Methods of Using Powdered Metal. — (*Ironmongers' Weekly*, 1946, (1745), 572-573).—Two powdered-metal products are described: (a) A copper-base bearing alloy containing nickel 2.4, silicon 0.8, and phosphorus 0.3%. The powders are sintered in hydrogen or cracked-ammonia atmospheres at pressures of 25-40 tons/sq.in. (b) A sintered mass of pulverized steel impregnated with a molten copper alloy containing 15% tin in addition to silicon, chromium, and other constituents. The compacted steel is heated in

contact with the copper alloy to just above the m.p. of the latter. The product has good bearing qualities and can be brazed directly to other metals.—P. R.

Alloys of the Heavy Metals. G. Fitzgerald-Lee (*Aircraft Eng.*, 1946, 18, (209), 239–241).—The preparation of aggregates by powder metallurgy is described briefly, and some particulars of G.E.C. Heavy Alloy are given.

—H. S.

***The Theoretical Basis of the Fritting Process in Powders.** G. F. Hüttig (*Metallwirtschaft*, 1944, 23, (40/43), 367–372).—Describes the changes that a homogeneous, powdered chemical substance undergoes when the temp. is gradually increased. A thermodynamic approach to the subject is made on the basis of the theories of Maxwell, Planck, and van Liempt; the results are applied to the changes taking place on heating single crystals and two or more single crystals in contact with each other. From this a theory of fritting of metal powders is developed. Fritting takes place in successive stages, and there is a direct relationship between the absolute m.p. T_F and the temp. at which these changes occur T_Z , represented by $T_Z = \alpha T_F$. The process of fritting runs, in general, thus: period (a), below $\alpha = 0.23$, progressive uncovering of the surface layers, viz., reduction of surface activity by adhesive forces. Period (b), $\alpha = 0.23-0.36$, mainly activation as a result of surface diffusion and a loosening or escape of gases in the superficial layers. Period (c), $\alpha = 0.33-0.45$, de-activation due to completion of molecular re-arrangements in the surface layers, and the resultant conditional stabilization as increased adhesion takes place. Period (d), $\alpha = 0.37-0.53$, activation as new atomic groupings occur inside the crystals. Period (e), $\alpha = 0.48-0.8$ and above, de-activation due to lattice diffusion as well as surface contraction caused by collective recrystallization. Period (f), $\alpha > 0.8$, a new activation which, although not fully investigated, appears to be a preliminary to melting and may be fusion of the surface layers. Generally, the formation and orientation of new crystals begins at $\alpha = 0.33$ for metals, 0.52 for metal oxides, 0.54 for metal salts, and 0.90 for carbonaceous materials. The results are given of measuring many physical and chemical properties of the powders at various temp., and it is shown that all values decrease sharply at $\alpha = 0.8-0.9$. The powders examined included most of the common metals and metal oxides.—E. N.

The Explosibility of Metal-Powder Dust Clouds. Irving Hartmann and H. P. Greenwald (*Min. and Met.*, 1945, 26, (463), 331–335).—The greatly extended use of metals in powder form in recent years has necessitated investigations into the explosibility of powders. H. and G. summarize work carried out by the U.S. Bureau of Mines (cf. *U.S. Bur. Mines Rep. Invest. No. 3751*) and discuss preventive measures for reducing the explosion hazard. The hazard is greatest for zirconium, magnesium, aluminium, titanium, and some of their alloys.—N. B. V.

British Powder Metallurgy. Its History, Development, and Commercial Future. W. D. Jones (*Metal Ind.*, 1946, 68, (22), 431–434).—A lecture to the Stevens Institute of Technology, New York. The past, present, and future of powder metallurgy are discussed.—J. H. W.

VI.—CORROSION AND RELATED PHENOMENA

***Scaling of Some Metals in Pure Steam [Copper, Iron, Nickel, Zinc].** W. Baukloh and F. Funke (*Korrosion u. Metallschutz*, 1942, 18, (4), 126–130; *Corr. Abs.*, 1946, 2, (3), 26).—Experimental data are presented on scaling resistance of iron, nickel, copper, zinc, and cast iron (grey and white) in steam and in dry air. In contrast with the behaviour of iron, the scaling resistance of nickel is greater in steam than it is in air. When exposed to steam, copper

shows only minute signs of scaling up to a temp. of 1000° C. Pure zinc offers about the same resistance in air as it does in steam; the surface of the pure metal undergoes marked passivation.

Corrosion-Resistant Materials [Brasses and Bronzes] in the Atmosphere of Acid Vapours of Sulphite-Alcoholic. N. K. Grigor'eva (*Korroziya i Bor'ba s Ney*, 1941, 7, (1), 40-43).—[In Russian]. For parts exposed to the atmosphere of acid vapours of sulphite-alcoholic, various types of brasses and bronzes may be used, especially those containing aluminium or aluminium, iron, and manganese.—N. A.

Corrosion of Inserts. Results of Tests on a Magnesium Casting Alloy. A. J. Ferko (*Metal Ind.*, 1946, 68, (24), 467-468).—Owing to its extremely negative galvanic properties, magnesium is very susceptible to corrosion by dissimilar-metal contact. F. describes an investigation to determine the best coating to apply to a magnesium casting alloy in order to suppress galvanic corrosion between the alloy and a number of different metals in the form of screwed inserts.—J. H. W.

Processing with Magnesium [Alloys]. Avoiding the Breakdown of Corrosion-Resistance. (Simpson). See p. 437.

Bimetallic Double-Wall Tubing for Combating Corrosion. — (*Product Eng.*, 1946, 17, (2), 102-103; *Corr. Abs.*, 1946, 2, (3), 31).—Bimetallic tubing is suitable for withstanding two different and simultaneous types of corrosive attack in heat exchangers, oil refineries, synthetic-rubber manufacture, ammonia refrigeration systems, and chemical plants. Metals and alloys that may be combined include steel, stainless steel, aluminium, Monel, Admiralty copper, aluminium brass, Muntz metal, bronze, and copper-nickel alloy. For oil-refinery service and synthetic-rubber manufacture, steel is used outside to resist corrosive oil vapour and copper inside facing the fresh water. Other applications call for combinations such as copper-nickel outside, red brass inside; stainless steel outside, aluminium or brass inside.

***Measuring the "Existent Corrosivity" of Used Engine Oils.** R. G. Larsen, F. A. Armfield, and L. D. Grenot (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1945, 17, (1), 19-24).—Describes a test for determining the "existent corrosivity" of used engine oils, independently of previous history. Test strips of copper, electroplated with lead or other metals in graduated thicknesses from 0.00003 to 0.001 in., are immersed in the hot oil and examined after an interval. The extent to which the deposited metal has been stripped from the copper demonstrates visually the corrosiveness of the oil. The test has a practical application in determining the cause of bearing failures and indicating necessary oil drainage.—E. N.

***Bearing-Corrosion Characteristics of Lubricating Oils: Indiana Stirring-Corrosion Test.** C. M. Loane and J. W. Gaynor (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1945, 17, (2), 89-95).—Details are given of the Indiana stirring-corrosion test, and the results obtained are compared with those of the Chevrolet 36-hr. test. The limitations of both tests are discussed; like any other laboratory test, neither can duplicate engine conditions.—E. N.

***Corrosion by Hydrofluoric Acid.** W. Z. Friend and H. O. Teeple (*Oil and Gas J.*, 1946, 44, 87; *Corr. Abs.*, 1946, 2, (3), 33).—Laboratory corrosion data are given for Monel, 70:30 copper-nickel alloy, copper-aluminium alloy, fine silver, carbon steel, nickel, Inconel, lead, stainless steel, Ni-Resist, Hastelloy B, and Hastelloy C in acid concentrations varying from 10 to 100%, at temp. from 70° to 240° F. (21°-116° C.). F. and T. present data from test spools containing most of the above metals and from other metals situated in operating hydrofluoric acid alkylation units and acid-storage tanks. The character of the attack on the various metals is discussed. The effect of silicofluoric acid as an impurity is examined.

*Corrosion of Metals and Alloys in the Tanning Industry. A. H. Winheim and R. A. Mills (*J. Amer. Leather Chemists' Assoc.*, 1945, (Dec.), 441-478; *Corr. Abs.*, 1946, 2, (3), 29).—Corrosion-resistance of 1729 test specimens, representing 56 different metals and alloys, was studied in 11 different factories. Alloys tested included Inconel, Ni-Resist, Illium G, Durimet, Hastelloy A and C, and cast iron. A spool-type specimen holder made of Monel was used. Complete results are tabulated for all parts of the process and equipment.

*Investigation of the Processes of Corrosion on a Model of a Local Element. I.—The Field in the Electrolyte Above Short-Circuited Models Situated in One Plane. G. V. Akimov and A. I. Golubev (*Zhur. Fiz. Khim.*, 1946, 20, (3), 303-308).—[In Russian]. A. and G. studied the distribution of the equipotential surfaces and lines of force above short-circuited electrodes situated in one plane. Electrodes of copper and zinc were investigated in a solution of 3% NaCl + 0.06N-HCl, and electrodes of copper and magnesium in 0.1N₂NaCl solution. As a rule the field of the local element was distorted, being displaced in the direction of the anode or cathode in accordance with their polarization characteristics and the ratio of their areas. The general potential was not equal to the boundary potential; it was electropositive to the latter when displacement of the field was in the direction of the anode and electro-negative when in the direction of the cathode. The greater the displacement of the field, the greater was the difference between the general and boundary potentials. The height of the field was equal to approx. half the sum of the lengths of the anode and cathode.—N. A.

*Investigation of the Processes of Corrosion on a Model of a Local Element. II.—Current Distribution and Variation of Resistance on Short-Circuited Models. A. I. Golubev and G. V. Akimov (*Zhur. Fiz. Khim.*, 1946, 20, (3), 309-314).—[In Russian]. Cf. preceding abstract. The current distribution over the surface of the electrodes of the model was calculated from the polarization curves and the curves showing the distribution of potentials over the surface of the model. Near the edges of contact of the electrodes, the c.d. on the anode was usually different from that on the cathode. The magnitude of the current in the copper-zinc model studied in a solution of 3% NaCl + 0.06N-HCl + 0.24% H₂O₂, varies in direct proportion to the area of the cathode. The current strength is greatest where the cathodic inclusions are greatest. The resistance of the electrolyte does not vary linearly from the edge of contact to the periphery of the model.—N. A.

*The Theory of the Corrosion of Metals. III.—On the Uniformity of Corrosion. V. S. Daniel-Bek (*Zhur. Fiz. Khim.*, 1946, 20, (6), 567-573).—[In Russian]. Cf. *ibid.*, 1944, 18, 247; *Met. Abs.*, 1945, 12, 185. A model of a micro-element was made in the form of a bimetallic (copper and zinc) plate, the reverse side of which was covered with a layer of insulating material. The plate was put into a vessel filled with one of four electrolytes (0.05 and 0.01N-KCl and 0.2 and 0.05 N-KClO₃), and served as a partition dividing the vessel into two parts. The surface of the anode (zinc) was provided with a series of holes which enabled the potentials of different parts of the anode surface to be measured. The uniformity of corrosion of a metal increases with rise in the conductivity of the electrolyte and with the polarization of the corroding micro-element.—N. A.

Laboratory Tests to Predict the Performance of Metals [Zinc, Aluminium] Under Service Conditions. (Sawyer and Mears). See p. 430.

Cathodic Protection. Use of Magnesium for Preventing Corrosion. — (*Metal Inl.*, 1946, 68, (24), 474).—Describes the use, for preventing corrosion by cathodic protection, of a magnesium alloy containing aluminium 5.3-6.7, manganese 0.15, and zinc 2.5-3.5%.—J. H. W.

VII.—PROTECTION

(Other than by Electrodeposition.)

***Modified Chromic Acid Anodizing Process for Aluminium.** C. J. Slunder and H. A. Pray (*Indust. and Eng. Chem. (Indust. Edn.)*, 1946, 38, (6), 592-596).—On the basis of laboratory tests, a chromic-sulphuric anodizing bath appears to offer an attractive saving in chromic acid. The attendant difficulties and modifications of technique required are discussed. In particular, the new solution has a marked corrosive action on steel tanks such as are normally used for the straight chromic acid process.—H. J. A.

Chromic Acid Anodic Solution. The Effect of Sulphuric Acid Additions [for Aluminium Alloys]. — (*Metal Ind.*, 1946, 68, (24), 477).—Cf. preceding abstract. A summary of the results of a recent investigation in the U.S.A. The addition of sulphuric acid to a chromic acid anodic solution produced a coating on an aluminium alloy (composition: copper 4.6, manganese 0.6, magnesium 1.5%, aluminium remainder) which had better corrosion-resistance than the film produced by the standard chromic acid bath. Unfortunately, this solution has a severely corrosive effect on the linings, other than lead, of steel tanks.—J. H. W.

Anodic Oxidation of Aluminium and Its Alloys. R. F. C. Calder (*Elect. Eng. and Merchandiser*, 1946, 23, (3), 83-85).—A review of the chromic acid anodizing process, and a description of a simple device for checking film thickness.—H. J. A.

The Structure and Growth of Passivated Films. P. D. Dankov (*Izvest. Akad. Nauk S.S.S.R.*, 1946, [Tekhn.], (2), 137-142).—[In Russian]. A review of the development of the film theory of passivity (the work of V. A. Kistenevsky and his school).—N. A.

Research on Metallic Surfaces Organized in France. (Portevin). See p. 449.

Non-Ferrous Metals Aid in Steel's Use. [Tin, Zinc, Nickel, Chromium, &c.] J. Levin (*Domestic Commerce*, 1945, 33, (12), 37-40; *Corr. Abs.*, 1946, 2, (3), 35).—The rôle of non-ferrous metal coatings on steel is described. L. gives a general summary of the use of tin, zinc, nickel, chromium, and other metals that are plated, sprayed, or clad on steel.

"Dry" Galvanizing. Effect of Aluminium Additions to the Zinc Bath. H. Bablik (*Metal Ind.*, 1946, 68, (25), 487-489).—Small additions of aluminium to the zinc bath and a low working temp. result in an improved galvanized coating, reduction of wastage, and decreased dross formation. This "dry" process is said to have a considerable range of application for the galvanizing of shaped products.—J. H. W.

Hard-Surfacing Light Metals. [Metal Spraying]. (Reid). See p. 439.

"Dyed Metal" (Metal Finishes). (—). See p. 439.

Surface Finishes for Aluminium [and Its Alloys]. (Mason). See p. 439.

Spray-Finishing and Drying Aluminium Fabrications at Woodall Industries. (—). See p. 439.

The Preservative Qualities of Aluminium Paint. — (*Aluminium and Non-Ferrous Rev.*, 1945, 10, (7/9), 38, 40, 42).—The properties of aluminium paint are described, and its applications in a wide variety of industries are reviewed.—N. B. V.

Paint Manual—With Particular Reference to Federal Specifications. [Methods of Surface Preparation]. Percy H. Walker and Eugene F. Hickson (*U.S. Nat. Bur. Stand. Build. Mat. Structures Rep.*, 1945, (105), pp. 165).—Recommendations by the U.S. National Bureau of Standards for the most effective use of painting materials which satisfy Federal specifications. Methods of surface preparation and application of the coating are considered,

the failure of painted surfaces is discussed, and data on many paints and paint products are presented.—H. J. A.

American Corrosion-Preventive Materials. James A. Richardson (*Petroleum*, 1945, 8, 29; *Corr. Abs.*, 1946, 2, (3), 34).—Corrosion preventives are defined as materials which are applied to unpainted metal surfaces for their protection, and which are removable with petroleum solvent to leave the surface in as good a condition as when the material was applied. These are classified as thick-film type (usually petrolatum or mineral jelly), thin-film type (compounds diluted with volatile solvent), and fluid type (mineral oils with corrosion inhibitor added). Specifications are given for a general description of these types, together with a brief explanation of the control tests required to characterize each material.

VIII.—ELECTRODEPOSITION

Cadmium Plate and Passivated Cadmium-Plate Coatings. E. E. Halls (*Metallurgia*, 1946, 34, (204), 295–297).—Specimens of mild steel, copper, and brass, degreased, cleaned, and cadmium-plated by an industrial process, were either dipped in a hot solution of 5% plater's compound or immersed in a passivating solution for 10 sec. at room temp. Two types of test were applied after both after-treatments, one consisting of heat and humidity cycles and the other a standard salt-spray exposure. The results of these tests showed that chromate-passivation treatment ensures much improved serviceability for the cadmium finish.—J. W. D.

Improved Chromium Plate. Increased Resistance to Distortion and Impact. A. L. Peach (*Metal Ind.*, 1946, 69, (1), 14–16).—P. discusses a number of measures that provide a more resistant and better chromium-plated article from the engineer's point of view. In particular, he describes a method which considerably improves the resistance of hard chromium plate to the effects of distortion and impact, and to some extent increases the field in which thicker deposits may be used. The method is one in which two chromium baths are used to provide a composite deposit, comprising a "soft," adherent, and impact-absorbing undercoat, and a very hard, wear-resisting outer layer.—J. H. W.

***The Problem of the Hydrogen Embrittlement of Steel in Galvanic Processes. [Deposition of Zinc, Copper, Cadmium, Brass, or Silver].** H. Fischer and H. Bärmann (*Korrosion und Metallschutz*, 1940, 16, (12), 405–417).—The deposition of zinc, copper, cadmium, brass, or silver on spring steel from cyanide baths leads to marked embrittlement. The embrittlement takes place in the early stages of plating, and little or no further effect is observed once the steel has a sufficient protective coating. Thus, greater c.d. lessens embrittlement. Increased temp. has a deleterious effect. Cyanide-free baths are much less harmful. Small additions of zinc to a caustic soda bath increase the embrittlement, but do not do so in the presence of cyanides. Large concentrations of metal in cyanide baths are beneficial, especially cadmium. Weakly acid zinc, nickel, and lead plating baths are without harmful effect. In strongly acid zinc baths, there is a marked initial embrittlement, but prolonged treatment leads to a recovery, due apparently to the hydrogen diffusing back through pores in the coating. By the correct choice of an electrolyte, it is possible in most cases to reduce the effect to harmless proportions. No theoretical explanation can be advanced to account with certainty for the harmful effect of cyanide baths and zinc in caustic soda.—M. A. V.

Plating on to Hardware. Herbert Chase (*Iron Age*, 1946, 158, (12), 59–60).—C. describes the plating of motor-car fittings in a plant in which full use is made of conveyors. Rocking procedures, and solution and c.d. for copper

cyanide strikes are outlined, as well as the methods used for bright nickel, copper, and chromium plating. Various rinses are discussed in detail.

—J. H. W.

***Dry Rectifiers in Electroplating. (Investigation of the Influence of Polarization on the Shape of the Current and Voltage Curves.)** Julius Steiner (*Z. Elektrochem.*, 1944, 50, (8), 186–200).—Unloaded, dry, single-phase rectifiers, supplied with sine-wave A.C., give a voltage of almost sine-form half-cycles. When the rectifiers operate plating baths, polarization causes both the voltage and current curves to deviate from the sine form. By means of the oscillograph, S. studied the influence of the electrolyte and polarization phenomena on the current curves in acid copper, zinc, and nickel baths as well as in cyanide copper baths. It is shown that deviations from the sine form depend mainly on the ratio of polarization potential to rectifier voltage. Polarization potentials were approx. ascertained from oscillograms of bath potentials, and the assumption of their approx. linear form is closely confirmed for nickel baths, and somewhat less closely confirmed for the other baths. On this assumption, formulæ are developed for the chief variables of the current curves, and, as oscillographs are not always available, methods are given for measurement of the form factors, by means of D.C. and A.C. instruments, on the basis of these formulæ. The current form can also be obtained from measurements of the terminal voltage of the unloaded rectifier and the average value of the polarization potential of the bath.—E. N.

Economics of Electroplating. Optimum Current Density for Mass Production. T. F. O'Connor (*Metal Ind.*, 1946, 69, (5), 97–100; (7), 140–142).—In designing a plant for the successful production of electroplated articles, it is necessary to consider the number of cells and the c.d. A low c.d. involves a large number of cells, but is cheap in electrical cost; a higher c.d., if technically satisfactory, reduces the capital sunk in equipment, but is more expensive electrically. *A priori*, a balance can be struck to give the most economical results, and C. describes the use of a mathematical equation to determine the equilibrium point.—J. H. W.

Polarographic Method for the Control of [Brass] Electroplating Baths and Electrodeposits. (Vyakhirev). See p. 426.

***Spectrophotometric Determination of Nitrates in Plating Baths.** (Dolance and Healy). See p. 427.

Surface Finishes for Aluminium [and Its Alloys]. (Mason). See p. 439.

“Dyed Metal” (Metal Finishes). (—). See p. 439.

Glycerine in Metal Treatment. (Leffingwell and Lesser). See p. 439.

Aspects of Finishing Processes Applicable to Automobile Engines and Chassis. (Jackson). See p. 439.

XI.—ANALYSIS

***Separating and Detecting Cupric and Cadmium Ions in the Copper Sub-Group of Group II.** Gerald F. Grillot and Jerry B. Kelley (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1945, 17, (7), 458).—The ammoniacal solution from the separation of Bi⁺⁺⁺ is acidified with HNO₃ to 5 drops excess, evaporated to dryness, and heated until all NH₃ salts decompose. Cool, add 1–2 drops of 6N-HNO₃ and 1 c.c. of H₂O, followed by 10 drops of 6N-NaOH and 1 c.c. of 0.5M Rochelle salt solution, which prevents precipitation of Cu⁺⁺. Centrifuge; a white, gelatinous precipitate of Cd(OH)₂ confirms the presence of Cd.—E. N.

***The Reduction of Sexivalent Molybdenum and Its Application.** Folke Lindstrand (*Trans. Chalmers Univ. Technol., Gothenburg, Sweden*, 1945, (41), 3–12; *C. Abs.*, 1946, 40, 1417).—A rapid and accurate volumetric method for detecting Mo. Fe–Mo and Mo ores are attacked by fusion with Na₂O₂ and

KNaCO_3 , and Mo slags by HCl . Reduction of Mo^{VI} is accomplished in a cadmium reductor with a solution containing 20 c.c. of 12N- HCl per 0.2 g. sample. The reduced Mo is titrated with KMnO_4 in the presence of MnSO_4 and H_3PO_4 . Substitution of H_2SO_4 for HCl leads to incomplete reduction of the Mo.

***A Specific Spot-Test for Vanadium.** Gilbert Ashburn and J. H. Reedy (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1945, 17, (1), 63).—A drop of the solution to be tested (the V must be in the form of vanadate, vanadous compounds being oxidized with Br_2 and warming) is mixed, on a spot plate, with a drop of H_3PO_4 and allowed to stand for a few sec. to allow the acid to form complexes with any interfering ions. A drop of 10% Na_2WO_4 solution is then added. The appearance of a yellow to orange colour indicates the presence of V. There is little or no interference by common metallic ions or by the anions Cl , Br , SO_4 , NO_3 , CH_3COO , and ClO_3 .—E. N.

***Observations on the Rare Earths. Extraction of Ytterbium from Rare-Earth Mixtures with Sodium Amalgam.** Therald Moeller and Howard E. Kremers (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1945, 17, (12), 798–800).—The recovery of Yb, from rare-earth fractions, by the use of Na amalgam is described, together with a new test for its identification. To 5 c.c. of the nearly neutral rare-earth chloride solution add 5 c.c. of 0.1% Na amalgam, shake for 15 sec., add 10 drops of conc. HCl , and shake for several sec. to remove the bulk of the Na from the amalgam. As soon as the evolution of H_2 diminishes, an apple-green colour appears if 0.002 g. or more of Yb_2O_3 is present.—E. N.

***New Method for the Separation of Small Amounts of Zn, Ni, Co, Mn, Cd, Cu, and Ti from Large Amounts of Iron.** I. V. Tananaev and E. N. Deichman (*Zavod. Lab.*, 1946, 12, (1), 30–37).—[In Russian]. The new method of separation is based on the precipitation of the double salts: $5\text{NaF} \cdot 2\text{FeF}_3$ or $2\text{KF} \cdot \text{FeF}_3 \cdot \text{H}_2\text{O}$ and $11\text{KF} \cdot 4\text{FeF}_3 \cdot 12\text{H}_2\text{O}$. The completeness of the separation of the metals enumerated depends on the acidity of the solution (1–3 ml. conc. HCl or H_2SO_4 in 100 ml. of solution). The precipitate of crystalline double fluorides of Fe occupies a small vol., and on precipitation from hot solution it is well filtered.—N. A.

***Rapid Volumetric Method for [Determination of] Aluminium.** L. J. Snyder (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1945, 17, (1), 37–38).—A rapid and accurate method for the determination of Al in the presence of 1–10% of impurities such as Ca, Cu, Cr, Fe, Mg, Mn, and Zn. $\text{Al}(\text{OH})_3$, formed by the neutralization of an Al salt to the phenolphthalein end point, reacts with KF to form the neutral salt $\text{AlF}_3 \cdot 3\text{KF}$ which, in the presence of Rochelle salt, liberates, practically instantaneously, three molecules of KOH per molecule of Al present. The acid used to titrate the liberated base is a direct measure of the Al present. An analysis can be performed in 5–10 min.—E. N.

***A Method for the Determination of Alumina in Anodic Baths and Other Solutions Containing Hexavalent Chromium.** Winslow H. Hartford (*Aluminium and Non-Ferrous Rev.*, 1945, 10, (4/6), 33–34).—Reprinted from *Metal Finishing*, 1944, 42, 72; *Met. Abs.*, 1945, 12, 285.—N. B. V.

***Colorimetric Reaction for the Determination of Antimony.** A. I. Kokorin (*Zavod. Lab.*, 1946, 12, (1), 64–68).—[In Russian]. K. points out the possibility of using the reduction of phosphomolybdic acid with Sb^{+++} as a reaction for the quantitative colorimetric determination of Sb.—N. A.

***Potentiometric Determination of Beryllium.** V. M. Tarayan (*Zavod. Lab.*, 1946, 12, (6), 543–546).—[In Russian]. The complex Na_2BeF_4 is sufficiently stable to make possible the potentiometric determination of Be with NaF . The stability of Na_3AlF_6 is of the same order, however, so that the presence of Al interferes with the potentiometric titration of Be and vice versa. Mg does not interfere with the determination of Be. A description of the scheme of analysis is given.—N. A.

***Silver Sulphide Method for the Determination of Cadmium.** N. N. Lapin (*Zavod. Lab.*, 1946, 12, (2), 158-160).—[In Russian]. A new method for the volumetric determination of Cd has been evolved, using the values of the solubility products of a series of sulphides. Cd is precipitated from HCl solution by means of H_2S , and the precipitate is treated by titration with $AgNO_3$ solution. A definite amount of Ag passes into the precipitate and an equivalent amount of Cd passes into solution. The quantity of Ag is determined by back titration and the Cd calculated. The accuracy of the method depends on the completeness of the reaction between the sulphide precipitate and the $AgNO_3$ solution.—N. A.

***Volumetric Determination of Calcium in the Presence of Silica, Iron, Aluminium, Magnesium, Phosphorus, Titanium, and Manganese.** James J. Lingane (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1945, 17, (1), 39-41).—A volumetric oxalate-permanganate method, which permits the direct determination of Ca in the presence of Si, Fe, Al, Mg, and PO_4 , and also in the presence of small amounts of Ti and Mn. Dissolve 0.4 g. of the sample in 5 c.c. of H_2O and 10 c.c. of conc. HCl (36N), dilute to 50 c.c., and heat almost to boiling. Run in slowly 100 c.c. of hot ($90^\circ C.$) 5% solution of $(COONH_4)_2 \cdot H_2O$, add a few drops of a 0.1% indicator solution of methyl orange, followed by a dropwise addition of 1:1 NH_4OH over 5-10 min., which precipitates the Ca as oxalate, the neutralization being stopped when the methyl orange changes to a pinkish-yellow colour (pH 3.5-4.5). Stand for not longer than 20-30 min., filter the precipitate into a Gooch, and wash 8-10 times with > 100 c.c. of ice-cold H_2O . Dissolve the precipitate in 5-6 c.c. of conc. H_2SO_4 (36N) and 100 c.c. of H_2O , heat to $90^\circ C.$, and titrate with 0.1N- $KMnO_4$, keeping the temp. above $60^\circ C.$ Duplicate assays can be completed in 2 hr., and the accuracy compares favourably with the more laborious classical methods. Details of the applications of the method are given.—E. N.

***Rapid Method of Determining Minute Quantities of Carbon in Metals.** J. K. Stanley and T. D. Yensen (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1945, 17, (11), 699-702).—A combustion method for the determination of $< 0.01\%$ C with an accuracy of $\pm 0.0005\%$ in soft magnetic materials, Ni, and Cr-Ni alloys is described. The milled sample, at -20 and +100 mesh, is heated for 10 min. at $1100^\circ C.$, or 5 min. at $1200^\circ C.$, in a stream of pure O_2 . The gaseous products are collected, the H_2O and SO_3 frozen out with dry ice, and the CO_2 frozen out with liquid air. The C is then determined by heating the solid CO_2 to room temp., expanding into an evacuated known vol., and noting the pressure. S. and Y. discuss the effects of preheating the sample, temp. and time of oxidation, the effect of O_2 pressure on oxidation, the formation of CO, the effect of S, adsorbed CO_2 , C in the residues, and the preparation of the sample. As increase of time and temp. does not remove the last traces of C from pure Ni and Cr-Ni alloys, they must be mixed with four times as much of an easily oxidizable material, such as Si-Fe alloy of known C content.—E. N.

***Determination of Iron in the Presence of Cobalt. Two-Component Colorimetric Method.** Ernest A. Brown (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1945, 17, (4), 228-230).—A description of a colorimetric thiocyanate method for determining 0.07-0.5 mg. of Fe in the presence of up to 90 mg. of Co, although no serious deviations occur when the amount of Co exceeds this figure. A filter-type photometer with two colour filters overcomes the interference due to the colour of Co ions, while fading of the $Fe(CNS)_3$ colour is not serious if the time taken in making the final solution and adjusting the photometer is < 8 min. The method is rapid and accurate to $\pm 3\%$; it is suitable for determining traces of Fe in a large range of Co salts.—E. N.

***Rapid Polarographic Method for the Determination of Lead in Smelter Products.** William Hered and Grace R. Hered (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1945, 17, (12), 780-781).—Fuse 0.2 g. of the sample with 2.3 g. of Na_2O_2 ,

cool, and break the tube into a beaker. Add 50 c.c. of H_2O and stand for 15 min. so that the material separates completely from the glass fragments. Add, rapidly, 25 c.c. of conc. HCl, obtaining a clear yellow solution to which 3 g. of tartaric acid is added to prevent precipitation of $SbOCl$ on dilution; dilute to 100 c.c. Determine the Pb polarographically in an aliquot portion, adding gelatine to suppress maxima if the supporting electrolyte is $N-HCl$. Each smelter product presents a distinct problem as far as the supporting medium is concerned; suitable electrolytes are: 0.1*N*-KCl, 1*N*-HCl, 1*N*- HNO_3 , 1*N*-NaOH, or alkaline tartrate. The method is more accurate and takes only half the time required for the molybdate titration method.—E. N.

***Polarographic Analysis of Aluminium Alloys.** I. M. Kolthoff and George Matsuyama (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1945, 17, (10), 615–620).—The determination of Fe, Cu, Pb, Ni, and Zn in Al alloys is described in detail. Dissolve the sample in NaOH, acidify with dil. HNO_3 , and, in the absence of Cl⁻, measure the Fe^{III} and Cu waves, reducing the Fe^{III} with $NH_2OH.HCl$ if the Fe:Cu ratio is large. Reduce the Fe^{III}, precipitate the Cu as $Cu_2(CNS)_2$, adjust the pH, and measure the Pb wave. Ni and Zn are determined after adjustment of the pH of the original solution of the alloy and addition of $NH_2OH.HCl$, CNS⁻, sodium citrate, and pyridine. The behaviour of Ni in CNS⁻ and CNS⁻-citrate solutions is discussed, and typical current-voltage curves are given. Determination of all five elements takes approx. 45 min., and the method is suitable for routine analysis.—E. N.

***Colorimetric Determination of Copper in Aluminium Alloys.** Robert F. Patridge (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1945, 17, (7), 422–424).—Dissolve 0.2 g. of the alloy in a solution of H_2SO_4 , HNO_3 , and HCl and evaporate to fumes. Cool, add 60 c.c. hot H_2O , boil until the residue is dissolved, cool, and dilute to 100 c.c. To 10 c.c. of this add 10 c.c. citric acid, 5 drops of dimethylglyoxime, and 10 c.c. dil. NH_4OH , stand for 3 min., and filter off any Ni present, washing well with hot water. Transfer the filtrate to a separating funnel, add 20 c.c. of a 0.1% solution of sodium diethyldithiocarbamate, and extract with 2–25 c.c. portions of CCl_4 , in which the copper complex dissolves to form a yellow solution. Drain off the lower layers of CCl_4 , make up to 50 c.c. with CCl_4 , transfer an aliquot to a colorimeter, and match the colour against standards in the usual way, using a green filter with a max. transmission of 540 m μ . The method can be applied to all commercial Al alloys containing >8% Cu; it is rapid and accurate to within $\pm 0.03\%$ Cu. Mn, Fe, Zn, Ni, Si, Mg, Pb, Cr, Sn, Bi, and Ti do not interfere.—E. N.

Determining Iron Content. A New Method for Aluminium Alloys. — (*Metal Ind.*, 1946, 69, (6), 112).—A method for determining the iron content of aluminium alloys, based on the colour reaction between the iron and ortho-phenanthroline. The latter turns orange when it unites with ferrous iron.

—J. H. W.

***Photocolorimetric Determination of Bismuth in Copper.** A. I. Kokorin and I. G. Dermanova (*Zavod. Lab.*, 1946, 12, (1), 59–63).—[In Russian]. The method, which is based on the reaction of Bi with NH_4CNS , permits the determination of 0.0005–0.003% Bi in 5 g. of Cu.—N. A.

Copper and Lead Estimation. Speedy "Spekker" and Centrifuge Method [for Brasses]. C. E. Gubbins (*Metal Ind.*, 1946, 68, (16), 312).—Lead in brasses containing copper 55–60, lead 1–3.5% was determined by precipitation with H_2SO_4 in HNO_3 solution containing urea, and centrifuging in a flask fitted with a "milk-sedimentation capillary" for 5 min. at 300 r.p.m. The percentage of precipitated $PbSO_4$ is read off directly on the tube, which is graduated so that 2 mm. = 0.5% lead, thus giving the lead content to 0.25%. The copper solution is transferred to a Spekker, specially mounted on a spring platform to obviate vibration from heavy machinery. Traces of tin are filtered off before measuring, as neither citric nor tartaric acid may be used.

—J. H. W.

***Analysis of Manganese Bronze.** Harold Ravner (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1945, 17, (1), 41-43).—With the use of a single sample wt., Cu, Pb, Sn, Fe, and Ni may be accurately determined in Mn bronze. Cu and Pb are plated out in the presence of HF, which serves to hold Sn in solution; care must be taken that the Cu is completely deposited or it follows Sn through the subsequent separation, causing low Sn values. Pb is usually high due to Mn contamination, and this can be corrected by transferring the anode, with the PbO₂ deposit, to a previously boiled 20% HNO₃ solution, reversing the current for a few sec., and then replating for 1 hr. Sn is subsequently separated from the Fe and Ni with H₂S, reduced with Pb, and titrated with KI-KIO₃ solution. The H₂S separation also serves to reduce Fe⁺⁺⁺ to Fe⁺⁺, in which state it is determined with CeSO₄ solution. Ni is precipitated from the resultant solution with dimethylglyoxime. The results check closely with longer conventional methods.—E. N.

Polarographic Method for the Control of [Brass] Electroplating Baths and Electrodeposits. D. A. Vyakhirev (*Zavod. Lab.*, 1946, 12, (3), 276-278).—[In Russian]. V. describes a polarographic method for determining Cu and Zn in brass-plating baths and brass electrodeposits, using an ammoniacal solution.—N. A.

***Potentiometric Methods for Determining Aluminium in Elektron-Type Magnesium Alloys.** L. Ya. Polyak (*Zavod. Lab.*, 1946, 12, (3), 268-275).—[In Russian]. A method is described for determining Al by titration with NaF and another, very rapid, method by titration with NaOH.—N. A.

***Determination of Hydrogen, Carbon, and Nitrogen in Magnesium Alloys.** E. G. Bobalek and S. A. Shrader (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1945, 17, (9), 544-553).—The determination of H₂, CO, CO₂, and N₂ in Mg alloys was studied by various methods: helium extraction, vacuum extraction, electrical degassing by ionic bombardment, combustion in O₂, and Kjeldahl (for N₂ only). The He extraction was specific for H₂, H₂O vapour, and oxides of C, but needed careful purification of the He at the source, and analysis of the gases in the He after it has passed through the molten metal. Vacuum extraction, when done in a twin-type sublimation furnace, was the best for speed and precision, as large samples (10 g.) could be handled, thus minimizing errors. For pure Mg, the extraction was complete in 2-3 min. at 600° C., but the time and temp. increased with complex alloys, and the removal of the last traces was slow and could be confused with the blank degassing of the furnace. Degassing by ionic bombardment, making the specimen the cathode in a discharge tube, was too complicated to provide a convenient analytical procedure. The combustion method, burning in pure O₂ and measuring the H₂O and CO₂ liberated, needed a high degree of refinement in manipulation and was tedious, but gave the most consistent and accurate results for oxides of C. The Kjeldahl method was most accurate for N₂ determination. Although all three extraction methods gave consistent results, it is concluded that they are only of the greatest precision for the determination of H₂.—E. N.

***Electrodeposition of Zinc in Magnesium Alloys Employing Various Buffered Solutions.** Thomas F. Boyd, George Norwitz, and Sidney Weinberg (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1945, 17, (8), 472-473).—The electrodeposition of Zn from NH₄OH, NaOH, citric acid, tartaric acid, and formic acid solutions was studied and the results compared with gravimetric and volumetric methods of determination. Although Zn can be quantitatively deposited over a wide range of pH with acceptable precision, the best results are obtained with deposition from solutions containing formic acid. The recommended procedure is: dissolve 0.5 g. of the alloy in 40 c.c. dil. H₂SO₄ (1:9), add 2 c.c. of 25% tartaric acid solution and 7-8 g. of (NH₄)₂SO₄, dilute to 200 c.c. with H₂O, stir, make just ammoniacal using methyl red as indicator, add formic

acid (1 : 4) until just acid and then 5–6 drops in excess, electrolyse at 3 amp. for 25 min., agitating with air, wash, dry at 100° C., cool, and weigh.—E. N.

The Application of the Polarographic Method of Analysis to Production Control in Non-Ferrous Metallurgy. S. A. Pletnev, T. V. Aref'eva, E. M. Tal, and E. I. Dubovitskaya (*Zavod. Lab.*, 1946, 12, (1), 38–58).—[In Russian]. Methods are described for : (1) determining Cu, Pb, and Zn in Cd, (2) the control of industrial solutions and products in Co production, (3) determining Cu, Bi, Pb, Cd, and Zn in Sn and Pb–Sn solders, (4) determining impurities in Pb, (5) rapid determination of Pb, Cd, and Zn in ores and tailings from enriched ores. In many cases, for the basis electrolyte, use was made of solutions of salts of the metals being analysed, thus enabling the necessary determinations to be carried out without the sample having to undergo any kind of chemical treatment, with consequent economy in time.—N. A.

***Evaluation of Spectrographic Analytical Data [of Aluminium Alloys].** H. V. Churchill and J. R. Churchill (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1945, 17, (12), 751–754).—Discusses statistical methods of handling data obtained from the spectrographic analysis of Si, Fe, Cu, Mn, Mg, Cr, and Ni in Al alloys, reference being made to the influence of random and systematic errors in manipulation and methods. It is concluded that regularly made spectrographic analyses are of high quality, and that the probable errors are not greater than those encountered in routine chemical analyses.—E. N.

Spectrographic Analysis of Powdered [Aluminium] Alloys. N. K. Rudnevsky (*Zavod. Lab.*, 1946, 12, (2), 189–193).—[In Russian]. Conditions are given for the spectrographic analysis of alloys containing: Zn <0.5, Mg <0.5, Mn <0.5, Fe <1.5, Si 4.5–6.0, Cu 6.25–7.75%, aluminium the remainder.—N. A.

Quantitative Spectrographic Determination of Nickel in Copper Alloys. V. F. Vetoshkin (*Tsvet. Metall.*, 1945, (4), 58–60).—[In Russian]. A description of the method and of the construction of the calibration curves.—N. A.

***Spectrographic Analysis of Lead and Its Oxides.** K. I. Taganov (*Zavod. Lab.*, 1946, 12, (4/5), 449–454).—[In Russian]. T. describes the apparatus, the preparation of standard specimens, and the method of analysis, and gives results obtained in control analyses.—N. A.

***Simultaneous Spectrophotometric Determination of Titanium, Vanadium, and Molybdenum.** Alfred Weissler (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1945, 17, (11), 695–698).—In 70% HClO₄ solutions the H₂O₂ complex of Ti is yellow, of V reddish-yellow, and of Mo a pale yellow. The complex of Mo can be intensified by additions of H₃PO₄, which also serves to eliminate extraneous colour due to Fe. The optical densities of the absorption spectra bear a linear relationship to concentration, and are additive at the various wave-lengths, 330 m μ for Mo, 410 m μ for Ti, and 460 m μ for V, thus enabling the three ions to be determined simultaneously in a Beckman spectrophotometer, using monochromatic light.—E. N.

***Spectrophotometric Determination of Nitrates in Plating Baths.** Albert Dolance and Paul W. Healy (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1945, 17, (11), 718–719).—NO₃' in silver-plating baths containing 0–120 g./l. KNO₃, together with AgCN, KCN, K₂CO₃, and KOH, may be determined with an accuracy of ± 2.5 g./l. by the method. 5 c.c. of the plating-bath solution are placed in a 100 c.c. beaker, and a precipitating solution (13.5 g. HClO₄, 93.6 g. AgClO₄, 258 g. Ba(ClO₄)₂/l.) added drop by drop until no further precipitation occurs. Stand for 1 hr., filter, and wash precipitate three times with distilled H₂O. Dilute the filtrate and washings to 50 c.c., and measure the absorption of light due to NO₃' at 305 m μ , using a Beckman quartz spectrophotometer. The precipitating solution removes CN', CO₃', and OH', as they show light absorption.—E. N.

Spectroscopy Applied to Ferrous and Non-Ferrous Materials. Wm. J. Pochlman (*Weld. J. (J. Amer. Weld. Soc.)*, 1945, 24, (11), 564-572S).—A brief account of the history, principles, and uses of the spectroscope in a modern metallurgical laboratory. Examples of its application, and some typical results, are given.—P. H.

***Device and Method for Quantitative Analysis [with X-Ray Diffraction Powder Camera].** Stanley Brosky (*Indust. Radiography Non-Destructive Test.*, 1946, 5, (1), 36-39).—The unknown (e.g., containing silica) is mixed with an equal quantity of a known reference substance (e.g., NiO), and the mixture is used as the specimen in an X-ray diffraction powder camera. Part of the pattern is filtered by a wedge consisting of 1, 2, 3, . . . 10 thicknesses of aluminium placed in contact with the film. After calibration, the amount of the unknown present may be estimated by comparing the number of aluminium steps through which reference lines of the standard and unknown are visible.—L. M.

The Application of the Mass Spectrometer to Chemical Analysis. A. Keith Brewer (*Bull. Amer. Soc. Test. Mat.*, 1946, (140), 38-42).—A discussion of the use of the mass spectrometer in the analysis of hydrocarbon molecules, with suggestions as to how the technique may be applied to alloys.—H. J. A.

A Generator for a Multi-Crater Arc and a Set of Universal Accessories for Spectrographic Analysis. P. F. Lokhov (*Izvest. Akad. Nauk S.S.S.R.*, 1945, [Fiz.], 9, (6), 753-758).—[In Russian]. By superimposing a magnetic field on the ordinary A.C. arc greater stability of the spectrum is obtained because a number of arcs are struck instead of one. A combined spark and arc source for use with a steelometer is described, with the aid of a circuit diagram; either form of excitation can be selected by means of two double-throw switches. In the determination of Mo in steel, better results were obtained with the multiple arc than with the spark source. A set of five gadgets for improving the efficiency of the steelometer is also described and illustrated.

—N. B. V.

Quality Control. II.—Chemical Laboratories. H. L. Collins and H. Shehyn (*Canad. Metals*, 1945, 8, (7), 20-25, 38).—Describes the detailed layout and organization of a chemical laboratory for metallurgical analysis.

—H. J. A.

XII.—LABORATORY APPARATUS, INSTRUMENTS, &c.

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

The Kelvin Double Bridge for Measuring Surface Resistance of Aluminium Alloys. (*Weld. J. (J. Amer. Weld. Soc.)*, 1945, 24, (9), 458-459S).—The apparatus consists of two parts, namely, a press in which coupons are clamped together under known pressure, and a bridge. Circuit diagrams are given.

—P. H.

***A Photo-Electric Method of Measuring Damping in Metal Forks at Elevated Temperatures.** T. E. Pochapsky and W. J. Mase (*J. Appl. Mechanics*, 1946, 13, (2), A157-A161).—Describes details of construction and tests performed to establish the accuracy of a new apparatus for measuring internal friction in metals. A photo-electric method of measuring amplitude decay was developed by using shutters on a vibrating fork to modulate light directed at a photocell. The apparatus works satisfactorily up to 1500° F. (815° C.).

—H. J. A.

Semi-Automatic Spectrographic Analysis. R. H. Zachariason (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1945, 17, (12), 749-750).—Spectrographic operations may be simplified and made more rapid by using semi-automatic devices, which are described and illustrated, for positioning the plate after each ex-

posure, focusing the electrodes, controlling the exposure, and changing the electrodes. 13 exposures may be made on one small plate.—E. N.

Time-Switching Apparatus. P. H. Keck (*Spectrochim. Acta*, 1944, 2, (8), 389–395).—Details are given of a fully automatic delayed-action time switch, constructed throughout of standard commercial components. The beginning and duration of an exposure in spectrographic analysis can be accurately controlled.—M. A. V.

A Generator for a Multi-Crater Arc and a Set of Universal Accessories for Spectrographic Analysis. (Lakhov). See p. 428.

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

Questionnaire Relating to Machines and Apparatus for Mechanical Testing. F. P. Belyankin. N. N. Davidenkov. V. D. Kuznetsov. I. A. Oding and I. V. Kudryavtsev. S. V. Serensen. Ya. B. Fridman. E. M. Shevandin (*Zavod. Lab.*, 1946, 12, (3), 328–362).—[In Russian]. Reports the answers given by the persons indicated above to questions on the prospects for the development and invention of improved machines and apparatus for the mechanical testing of materials.—N. A.

Quality Control. V.—Mechanical Testing. A. E. Hyde (*Canad. Metals*, 1945, 8, (10), 26–29, 45).—Brief review of the principles of tensile and hardness testing.—H. J. A.

Micro-Hardness Testing. A Description of a Technique Developed in Sweden. E. Börje Bergsman (*Metal Ind.*, 1946, 69, (6), 109–112).—B. describes a micro-hardness-testing apparatus, using an ordinary Vickers diamond for both scratch and indentation hardness. The technique is designed for use with any standard inverted microscope, with only slight modification in the attaching device to suit various types of stage and object holders.—J. H. W.

Method of Notching Impact-Test Specimens. S. E. Siemen (*Bull. Amer. Soc. Test. Mat.*, 1946, (139), 45–46).

***The Mechanics of the Tensile Test.** E. Siebel (*Wiss. Abhandl. deut. Materialprüfungsanst.*, 1944, (5), 1–4).—The stress distribution in the neck of a tensile test-piece is calculated theoretically, and the variation from the surface to the axis determined. The zone in which plastic flow takes place decreases with increased necking. This agrees with experiment.—M. A. V.

***Tension Testing at Elevated Temperatures [Aluminium].** T. M. Blackmon, P. R. Nourse, and E. H. Plesset (*Bull. Amer. Soc. Test. Mat.*, 1946, (140), 32–37).—Aluminium test bars have been satisfactorily heated to 550° F. (290° C.) by the resistance heating of a current flowing in the test bar. Two extensometers for measurement in the elastic and plastic regions have been developed, together with a technique for determining the true load at fracture.—H. J. A.

***Tension Tests of Single-Row Spot-Welded Joints in 24S-T Alclad Aluminium Alloy Sheet.** (Della-Vedova). See p. 443.

Calculation of the Elongation from One Length to Another. I. V. Kudryavtsev (*Zavod. Lab.*, 1946, 12, (2), 233–235).—[In Russian]. Formulæ are deduced for calculating elongation in the tensile testing of metals.—N. A.

***Determination of the Modulus of Elasticity Using the Method of Coincident Oscillations of Conjugate Pendulums.** F. F. Vitman and B. S. Joffe (*Zavod. Lab.*, 1946, 12, (4/5), 458–472).—[In Russian]. The phenomenon of coincident oscillations has been utilized in working out a method for the determination of the modulus of elasticity. The results obtained confirm in essentials the work of Le Rolland and Sorin (*Rev. Mét.*, 1933, 30, 112; *J. Inst. Metals*, 1933, 53, 518), although carried out independently. In conclusion, a description is given of the apparatus devised by V. and J.—N. A.

Proof-Stress Determination. R. A. Beaumont (*Aircraft Prodn.*, 1946, 8, (87), 42-51).—Procedure and equipment for proof-stress determination are discussed with special reference to the machines and apparatus used, and also to the observation of proof stresses without the necessity for plotting stress-strain diagrams.—H. S.

The Specification of Test Loads [Aircraft Structures]. A. G. Pugsley (*Aircraft Eng.*, 1945, 17, (202), 352-353).—Loading conditions for strength tests on aeroplane structures are discussed in relation to the loads which occur in service. Observations on load fluctuations which occur in level flight indicate broadly the more or less continual occurrence of stress fluctuations of $\pm 5\%$ to $\pm 10\%$ about the average. P. indicates the loading conditions for fatigue tests, based on the specified ultimate strength, and suggests that collapse should not occur before 50 million fluctuations. To meet the severe loading condition that may or may not occur once or a few times in the life of the aeroplane during a severe manœuvre. P. suggests that the structure should remain airworthy during and after 5 repetitions of loading to the proof load, and should not break before 20 applications of that load. For information on the performance under loads occurring more frequently in manœuvres of a less severe character, P. suggests that the structure should remain airworthy during and after 100 repetitions of loading to half the specified ultimate stress, and should not collapse before 500 repetitions. The importance of studies of the performance of structures under fluctuating and repeated loads is emphasized, and attention is directed to the importance of scatter in such tests, on which at present there is little information available.—H. S.

Determination of Allowable Working Stresses. D. P. Barkley (*Commonwealth Eng.*, 1946, 33, (11), 384-388).—The concept of "factor of safety" in engineering design is analysed and discussed.—H. J. A.

Strain Analysis by Photogrid Method. W. F. Brown, Jr., and M. H. Jones (*Iron Age*, 1946, 158, (11), 50-55).—The data required for an evaluation of the characteristics of a metal for a certain forming operation can be determined by measuring the distance between a given pair of lines during or after the process of forming. A series of such lines constitutes a grid. The requirements of a grid are detailed, and the technique of applying the grid to a metal surface and the subsequent strain measurement are discussed.—J. H. W.

Use of Statistics in Writing Specifications. (Goffman and Manuele). See p. 451.

Laboratory Tests to Predict the Performance of Metals [Zinc, Aluminium] Under Service Conditions. D. W. Sawyer and R. B. Moars (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1945, 17, (1), 1-5).—S. and M. review the conditions of relationship between laboratory and service tests and give examples. Measurement of the solution potentials of zinc and aluminium has been found to be a useful laboratory test for predicting the feasibility of using cathodic protection for aluminium chemical plant. A correlation between service results and potential measurements is given.—E. N.

Aluminium Alloy Forgings. Inspection Standards for High-Temperature Oxidation. — (*Metal Ind.*, 1946, 68, (22), 425-426).—A summary of the results of a recent investigation on high-temp. oxidation in aluminium forgings to establish a standard inspection procedure for the acceptance or rejection of these forgings. Macrography and tensile-test results should be supplemented by microscopic tests in order to obtain a definite classification of the forging.—J. H. W.

Identifying Aged Material. Temper Determination of Clad 24S. — (*Metal Ind.*, 1946, 68, (26), 518).—To test whether an unidentifiable part of clad aluminium alloy 24S (copper 4.6, manganese 0.6, magnesium 1.5%) has been aged or not, a small micro-specimen is mounted along with a known aged sample, polished, and etched in a solution of 1% nitric acid and 5% acetic

acid in water. The specimens are then examined at a high enough magnification to resolve the grain boundaries. If these can be seen, the material has been aged. A check test consists in repolishing the specimen and immersing it in a 2% aqueous solution of ferric chloride: aged material evolves gas bubbles from its surface after a few sec.—J. H. W.

***Soft-Solder Selection Aided by Simple Test.** (Schumacher, Bouton, and Phipps). See p. 440.

Materials Engineering at Home and Abroad. (Townsend). See p. 448.

Supersonics in Metallurgy. A Review of Recent French Work. N. Marinesco (*Metal Ind.*, 1946, 69, (7), 136–138).—Condensation of a paper read to the Centre de Perfectionnement Technique. M. describes the progress made in the use of supersonics in both light and heavy engineering and the good results so far obtained. Applications include the decreasing of the solidification temp. of metals, the tinning of aluminium, modifying in magnetic properties, and increasing the chemical activity of metals.—J. H. W.

Supersonic Flaw Detector. — (*Canad. Metals*, 1946, 9, (9), 31, 42).—A brief outline of the principles and methods of supersonic flaw detection in metals.—W. G. A.

Electron Diffraction in Practice. Wayne T. Sproull (*Indust. Radiography Non-Destructive Test.*, 1946, 5, (1), 40–44).—An introduction to the theory and technique of electron diffraction. The important differences between electron- and X-ray diffraction are reviewed. The applications mentioned include studies of electroplating, electrolytic polishing, mercury and its amalgams, and the electrical conductivity of thin surface films.—L. M.

Correlation of Inspection Methods in the Metal Industry.—I, II. James V. Rigbey (*Canad. Metals*, 1945, 8, (11), 36–40; (12), 38–41, 48, 50, 52).—A review of the application of radiography, magnetic crack detection, fluorescent crack detection, microscopic metallography, and supersonic crack detection.

—H. J. A.

***Fluoroscopy. Application to the Examination of Metallic Objects.** B. Cassen and D. S. Clark (*Metal Ind.*, 1945, 67, (23), 375–377; 1946, 69, (2), 25–27; and *Aircraft Prod.*, 1946, 8, (93), 352–354).—Cf. *Met. Abs.*, this vol., pp. 99, 265. Describes investigations at California Institute of Technology on fluoroscopic examination of castings. The fluoroscope does not show large numbers of very small defects that are seen on radiographs. With the use of rotational scanning, the fluoroscope shows a surprisingly large number of medium and larger defects that are not detected radiographically.—H. S.

The History and Present Status of Emission Spectroscopy as Applied to Industry. (Convey). See p. 451.

RADIOLOGY

Accurate Interpretation of Radiographs. Henry R. Clauser (*Materials and Methods*, 1945, 22, (5), 1418–1422).—The use of penetrameters is discussed, reference being made to the influence of contrast and definition on sensitivity. Some of the more common types of film blemishes are described and the importance of good viewing facilities is emphasized.—J. C. C.

Acceptance Standards for Castings. Leslie W. Ball (*Aircraft Prod.*, 1946, 8, (87), 3–6).—Cf. *Met. Abs.*, this vol., p. 59. B. discusses the use of radiography and X-ray micrography in assessing quality, with special reference to light-alloy castings for aircraft applications.—H. S.

Quality Control. IV.—Radiography. J. K. E. Cox (*Canad. Metals*, 1945, 8, (9), 20–24).—The technique of radiography is reviewed, and the interpretation of radiographic results is discussed.—H. J. A.

Continuous X-Ray Inspection—Results Achieved with 2,000,000-Volt Unit at Large U.S. Ordnance Plant. David Goodman (*Canad. Metals*, 1945, 8, (11), 32–35, 52).—The apparatus is described and an account is given of the

routine employed at an American ordnance factory where heavy bombs are radiographed. Details are given of safety measures and of the economics of the testing process.—H. J. A.

*Preliminary Investigation of Metal Pouring by Ciné Radiography. S. L. Fry (*Proc. Inst. Brit. Found.*, 1944-45, 38, A45-A53; discussion, A53-A54).—See *Met. Abs.*, 1945, 12, 337.

XV.—FOUNDRY PRACTICE AND APPLIANCES

Aluminium Foundry Alloys. Their Selection and Preparation. E. Carington (*Metal Ind.*, 1946, 69, (3), 45-47; (4), 69-72).—C. discusses the problem of the selection of aluminium alloys and reviews their commercial requirements for various applications. The specifications for high-, medium-, and low-strength alloys are tabulated. Dealing with the foundryman's requirements in these alloys, C. surveys their expansion and contraction, their preparation, the use of scrap, effects of gas, degassing, and the use of fluxes in melting.

—J. H. W.

Better-Quality Aluminium and Magnesium Castings for Aircraft. Robert E. Ward (*Aluminium and Non-Ferrous Rev.*, 1945, 10, (1/3), 13-14, 16).—Reprinted from *Trans. Amer. Found. Assoc.*, 1944, 52, 475; *Met. Abs.*, 1945, 12, 60.—N. B. V.

Melting Light Alloys. Developments in Open-Hearth Furnaces. H. Hocking (*Metal Ind.*, 1946, 68, (22), 430).—Briefly describes suitable modifications to open-hearth furnaces for increasing the efficiency of melting for bulk outputs of light alloys.—J. H. W.

Fluxing Molten Aluminium with Dry Nitrogen. P. M. Hulme (*Materials and Methods*, 1945, 22, (5), 1435-1438).—Nitrogen scavenging is now used successfully for producing sound castings of aluminium and aluminium alloys and is as effective as the use of chlorine, provided that too rapid a stream of nitrogen is not employed. The effect is to bring finely dispersed inclusions to the surface, and remove entrapped gases and dissolved hydrogen. Methods of introducing nitrogen into the melt in both crucible and reverberatory furnaces are described.—J. C. C.

Aluminium Casting Processes and Applications. Hiram Brown (*Modern Metals*, 1946, 2, (4), 8-12).—Sand casting, gravity and pressure die-casting, plaster- and centrifugal-casting methods are described, and mention is made of new alloy developments and typical applications.—N. B. V.

Some High-Tensile Aluminium Casting Alloys. J. Morgan (*Proc. Inst. Brit. Found.*, 1944-45, 38, B134-B137; discussion, B137-B139).—See *Met. Abs.*, 1945, 12, 144.

Sodium Silicate Sealing for Aluminium Castings. — (*Iron Age*, 1946, 157, (2), 63).—The sodium silicate system of sealing aluminium castings is not always completely effective. Tests were made to secure protection against leaking by baking at 220° F. (105° C.) for 2 hr. after treatment. No measurable effect resulted from the baking.—J. H. W.

The Future of the Light-Alloy Foundry Industry. W. C. Devereux (*Proc. Inst. Brit. Found.*, 1944-45, 38, A14-A22).—See *Met. Abs.*, 1945, 12, 338.

The Electric-Furnace Melting of Copper. R. H. Waddington and J. C. Bischoff (*Canad. Min. Met. Bull.*, 1946, (409), 199-226).—Complete operational details are given for a method of continuous melting of copper in a three-phase direct-arc electric furnace. The economic benefits obtained from the electric-arc melting process are summarized.—H. J. A.

Porosity in Copper Alloy Castings. Causes and Prevention in Materials with High Copper Contents. K. Strauss (*Canad. Metals*, 1945, 8, (1), 27-28).—A review of gas porosity as encountered in tin-bronzes, phosphor bronzes, gun-metals, &c.—H. J. A.

***Precision Casting Heat-Treatable Copper-Base Alloys.** H. Rosenthal, S. Lipson, and H. Markus (*Iron Age*, 1946, 158, (12), 48–54).—Describes an investigation of the properties of cast “aluminium bronze” and beryllium-copper resulting from the heat-treatment of precision investment-cast specimens. An essential feature of the research was the adaptation of the insulating properties of the investment by quenching while the alloy was still in the solid-solution-temp. range. By quenching the castings immediately after solidification and then giving them a low-temp. reheating, their hardness and tensile properties become equivalent to those of specimens given the conventional heat-treatment. The properties attainable by the use of this special quenching technique meet the A.S.T.M. requirements for cast material.

—J. H. W.

***Mould Dressings. Effect on the Surface Quality of Bronze Ingots.** W. T. Pell-Walpole (*Metal Ind.*, 1946, 69, (7), 129–134).—Describes work on the development of a mould dressing that can be used thinly, but which is strong, as is required for securing max. internal soundness of bronze ingots cast in chill moulds. “Blowing” in such ingots can be eliminated, even under unfavourable conditions, by using a thin coating of resinous aluminium paint (Otopose), or some similar suspension of aluminium powder or oxide. Stockholm tar and a commercial refractory dressing, “B,” also tend to reduce blowing, though to a less extent than the aluminium paint.—J. H. W.

Chill-Cast Bronzes. W. T. Pell-Walpole (*Metal Ind.*, 1946, 68, (16), 303–305; (17), 323–324; (18), 346–348).—A comprehensive review of the relation between porosity and tensile strength in chill-cast bronzes. P.-W. discusses the various types of porosity commonly met in the foundry; the cause, nature, and appearance of entrapped-gas-, shrinkage-, and soluble-gas porosity; and the graphical representation of the percentage porosity and corresponding tensile properties of two series of chill-cast phosphor bronzes. Shrinkage porosity has the most detrimental effects on tensile properties, while entrapped-gas porosity has the least harmful effects.—J. H. W.

The Technology of Producing Propeller Screws in the United States. V. A. Leonov (*Sudostroenie*, 1946, (3), 23–26).—[In Russian]. L. gives a detailed description of American practice, in particular of the methods used by the Iron Works Corporation in producing propellers for “Liberty” ships. The propellers are cast almost to size in cement moulds and are then finished by means of pneumatic grinding tools.—N. B. V.

***The Continuous Casting of Ingots of LT96 and Other Copper-Zinc Alloys.** A. A. Budaev (*Tsvet. Metallurgy*, 1945, (6), 52–56).—[In Russian]. A machine for the continuous casting of ingots of 30–100 mm. dia. has been devised and tested, and the conditions have been established for producing copper-zinc alloy ingots of 50 and 60 mm. dia. The effect of the casting conditions on the macrostructure of the ingots has been studied.—N. A.

Casting and Handling Ten-Ton Lead Bullion Blocks. K. Harms and T. D. Jones (*Min. and Met.*, 1946, 27, (475), 391–392).—To facilitate transport, one American smelter now casts lead in 10-ton blocks instead of 100-lb. bars. The lead is cast in a rectangular cast-steel mould, from which the solid block is subsequently lifted by two steel screws that have been cast in. The screws are then removed and the holes left by them are plugged with more lead.

—N. B. V.

Lead Products—Manufacture Involves Melting, Casting, Extrusion, Rolling, and Burning. — (*Canad. Metals*, 1945, 8, (10), 30–32).—The operations of the lead division of the Canada Metal Company, Ltd., are reviewed.

—H. J. A.

Magnesium-Melting-Pot Life Increased by Sprayed Special Alloy Coating. A. V. Keller (*Indust. Heating*, 1945, 12, (12), 2074, 2076, 2078, 2080; and *Metal Ind.*, 1946, 68, (16), 306).—Cast-steel pots of 600 lb. capacity, used in

casting Dow Metal C, are subject to severe scaling in areas in contact with the flame from gas burners. The life of the pots has been more than quadrupled by Metcolizing. The cleaned pot is sprayed (a) with a chromium-nickel alloy, (b) with pure aluminium, and (c) with a proprietary sealing compound. Service data for treated and untreated pots are compared.—P. R.

***The Cause and Control of Microporosity in Magnesium Alloys.** E. A. G. Liddiard and W. A. Baker (*Proc. Inst. Brit. Found.*, 1944-45, 38, A63-A75; discussion, A75-A77).—See *Met. Abs.*, 1945, 12, 339, 412.

Bearings and Bearing Metals. (Brouk). See p. 447.

Non-Ferrous [Zinc Alloy] Dies and Moulds. L. Sanderson (*Indian and Eastern Eng.*, 1946, 48, (2), 253-256).—S. discusses the use of zinc alloy dies and moulds for the blanking of aluminium sheet or the moulding of plastics. A typical composition of the alloy used is: aluminium 3.9-4.1, magnesium 0.03-0.04, copper 1.0, lead, cadmium, and tin <0.003%.—H. J. A.

***The Study of Casting Systems by Means of Models.** A. A. Bocharov, E. M. Notkin, S. I. Spektorova, and N. M. Sadchikova (*Izvest. Akad. Nauk S.S.S.R.*, 1946, [Tekhn.], (6), 875-882).—[In Russian]. A new method of making models of complicated castings has been introduced, using transparent organic material for the mould. A study of the effect of the cross-sections of the principal parts of the casting (run from below and also by means of a vertical gate) has shown that the rate of filling the mould depends chiefly on the cross-section of the gate. The separation of oxides and slag depends on the cross-section of the gate and on the shape and size of the arrangement for entrapping them. With increase in the dia. of the gate, the time of filling the mould is reduced, but turbulence and the quantity of oxides and slag carried over increase markedly. With gates and risers of small dimensions, the vertical-gate system ensures filling of the mould layer upon layer, which is an important advantage over the method of casting from below from the point of view of directionality of crystallization. Further study must be directed to the evolution of casting systems in which improved separation of oxides and slags would be achieved without reduction of the rate of filling the mould.—N. A.

Precision Casting by the Lost-Wax Process. Adam Dunlop (*Proc. Inst. Brit. Found.*, 1944-45, 38, B1-B7; discussion, B7-B10).—See *Met. Abs.*, 1945, 12, 125.

Acceptance Standards for Castings. (Ball). See p. 431.

Uses of Gases in the Foundry. Harold Haynes (*Proc. Inst. Brit. Found.*, 1944-45, 38, B68-B71; discussion, B71-B74).—See *Met. Abs.*, 1945, 12, 198.

A Study of Moulding Methods for Sound Castings. Frederick G. Seifing (*Proc. Inst. Brit. Found.*, 1944-45, 38, A142-A150; discussion, A150-A154).—See *Met. Abs.*, 1945, 12, 262, 339, 413.

The Development and Application of Pattern Equipment for the Production of a Light-Alloy Casting. F. H. Houlst (*Proc. Inst. Brit. Found.*, 1944-45, 38, B104-B111; discussion, B111-B113).—See *Met. Abs.*, 1945, 12, 261, 415.

Plaster, Plastics, and Low-Melting-Point Metals in Pattern-Making. H. Plucknett (*Proc. Inst. Brit. Found.*, 1944-45, 38, B64-B67).—See *Met. Abs.*, 1945, 12, 262.

***Synthetic Foundry Sands with Cement as a Binder.** K. Endell and W. Strasmann (*Giesserei*, 1942, 29, (21), 349-356).—E. and S. review the literature on synthetic foundry sands with cement binders; and describe experiments on three German types of cement, in which the effect of water content on shear strength and permeability was investigated. Ordinary Portland cement was found to be less suitable than either Novo (a high-quality Portland cement) or fused aluminous cement. Higher initial strengths were obtained with low water content with Novo than with fused aluminous cement. Novo further had the advantage of sintering less markedly at 1400° C.—M. A. V.

Resin Binders Improve Sand Cores. F. G. Felske (*Modern Plastics*, 1945, 23, (2), 118–120; *C. Abs.*, 1946, 40, 1690).—Urea-resin binder cures in 30–90 min. at 325° F. (163° C.). It is especially useful in casting aluminium and magnesium owing to its low temp. of breakdown.

Foundry Practice at Consolidated—Production of Wide Range of Castings for Maintenance and Repair. T. R. Stanley (*Canad. Metals*, 1945, 8, (12), 24–26).—Describes the operating techniques employed at the foundry of the Consolidated Mining and Smelting Company of Canada.—H. J. A.

Gravity Die-Casting. Theoretical and Production Aspects Applied to Aluminium Alloys. R. Hinchcliffe (*Metal Ind.*, 1946, 69, (8), 151–153; (9) 174–176; (10), 193–195).—H. describes (a) the characteristic properties of aluminium and its alloys as they affect the process of gravity die-casting, (b) the problem of solidification, (c) the proper gating, (d) the feeding methods required, and (e) the mechanical design of gravity dies. Details of some difficult die-castings are given.—J. H. W.

Aluminium Die-Castings. S. K. Ghaswala (*Indian and Eastern Eng.*, 1946, 99, (1), 66–68).—A review of American practice for the die-casting of aluminium-copper, aluminium-zinc, aluminium-silicon, and aluminium-manganese alloys. Pressure die-casting machines are described, and the relative advantages compared of steel, cast iron, and aluminium alloy for the manufacture of dies.—W. G. A.

Permanent-Mould Fundamentals. [Aluminium Alloys]. J. W. Wheeler (*Modern Metals*, 1946, 2, (2), 11–16).—A review of the gravity die-casting of aluminium alloys.—N. B. V.

New Magnesium Die-Casting Alloy [Eclipsaloy]. (Hauser). See p. 412.

Die-Casting [Machines and Alloys]. Herbert Chase (*Materials and Methods*, 1945, 22, (5), 1441–1452).—A “*Materials and Methods*” manual” describing concisely die-casting machines and alloys and discussing the advantages and limitations of die-castings, design principles, and present and future applications.—J. C. C.

Gravity Die-Casting. A. R. Palmer (*Proc. Inst. Brit. Found.*, 1944–45, 38, B94–B101); discussion, B101–B103.—See *Met. Abs.*, 1945, 12, 374.

Some Aspects of Good Foundry Management. A. C. Boak (*Canad. Metals*, 1945, 8, (10), 33–36).—Samples of report and record cards which may be of use in foundry management are illustrated.—H. J. A.

The Foundry Data Sheet. — (*Foundry*, 1945, 73, (12), 145–146; 1946, 74, (1), 157–158; (2), 151–152; (3), 161–162; (4), 167–168; (5) 203–204; (6) 187–188; (7), 169).—A glossary of terms used in the foundry.—J. E. G.

XVII.—FURNACES, FUELS, AND REFRACTORY MATERIALS

New Conveyor Design Increases Output of Aluminium Billet-Heating Furnace. John H. Loux (*Indust. Heating*, 1946, 13, (1), 90; and *Metal Ind.*, 1946, 68, (19), 364).—A conveyor device for moving aluminium billets through a heating furnace consists of a motor-activated drive tube, extending through the furnace; the billet rests partly on this and partly on a series of obliquely set idler rollers. The revolution of the tube causes the billet to rotate, and to bring the rollers into operation, the billet being moved forward.—P. R.

Melting Light Alloys. Developments in Open-Hearth Furnaces. (Hocking). See p. 432.

The Electric-Furnace Melting of Copper. (Waddington and Bischoff). See p. 432.

Brazing and Heat-Treating Assemblies for Magnilastic Expansion Joints. (—). See p. 441.

Heating-up of Electric Resistor Furnaces. Victor Paschkis (*Indust. Heating*, 1946, 13, (2), 250, 252, 254, 256, 258, 260; (3), 434, 436, 438, 460).—The initial rate of energy output and the design of furnace walls are considered in relation to the heating-up time and the power consumption of electric-resistor furnaces. The process of heating-up falls into two phases: in the first, the rate of energy input is const. and equal to the connected load. When the operating temp. is reached, the second phase is entered, when the furnace temp. is held practically const. and the rate of heating decreases until steady conditions are reached. Graphs show the effects of individual variables such as "excess ratio," rate of energy input, and thickness and thermal conductivity of walls.—P. R.

Induction Heating. Practical Hints on the Design of Coils. W. S. Williams (*Metal Ind.*, 1946, 68, (25), 500).—All induction-heating coils are based on four types: the internal helix, the external helix, the pancake, and the hair-pin. W. discusses the use of each of these singly and in combination, and gives practical hints on induction heating generally.—J. H. W.

High-Frequency Heating. L. G. Thomas (*Elect. Eng. and Merchandiser*, 1946, 23, (3), 73-78).—A general review of induction and dielectric heating.
—H. J. A.

Electronic "Blow Torch" may Revolutionize High-Frequency Heating. —(*Indust. Heating*, 1945, 12, (11), 1902, 1904).—The electronic "blow torch" is a dielectric heating device which projects ultra-short radar waves towards an object to be polymerized, cured, or bonded. The torch can be used in restricted areas and on pieces of irregular shape.—P. R.

Some Statistical Methods in Refractory Testing. E. H. M. Badger (*Trans. Brit. Ceram. Soc.*, 1946, 45, (1), 33-43; discussion, 43-44).—In testing samples taken from a consignment of refractory materials there is bound to be variation between individual pieces. An attempt is made to apply the Gaussian theory of frequency distribution to the problem of assessing the results of tests.
—M. A. V.

XVIII.—HEAT-TREATMENT

Annealing Welded Joints in Pipelines. A. W. Isermann (*Elektroschweissung*, 1940, 11, (6), 99-102).—Description of a portable electric-resistance heater, which can be clamped round welded joints in pipelines for annealing *in situ*.—M. A. V.

Salt Baths. A Novel Device for Handling Molten Chromate. F. P. Golby (*Metal Ind.*, 1946, 69, (6), 113-115).—A method of avoiding the risk of dermatitis in the use of fused chromate compounds in the heat-treatment of magnesium alloys.—J. H. W.

A Critical Survey of Controlled Atmospheres. Edward J. Funk, Jr., and David Lee von Ludwig (*Iron Age*, 1946, 158, (12), 42-47).—Controlled atmospheres for various heat-treatments of ferrous and non-ferrous metals and alloys are evaluated from the point of view of economics and metallurgical suitability. A code system is suggested whereby the base atmospheres and their modifications can be readily and systematically identified.—J. H. W.

XIX.—WORKING

***On Some Rolling Problems and Rolling Effects in Aluminium-Copper-Magnesium Alloys.** H. Bohner (*Metallwirtschaft*, 1944, 23, (44/47), 407-415).—In rolling Duralumin alloys, anomalous mechanical properties and a coarse grain structure frequently develop in sheets of varying thickness. A study was made of the effects of (a) ingot pouring rate for both chill- and continuously

cast ingots, (b) hot-rolling temp., (c) rolling of previously forged billets, (d) progressively increasing rolling reductions, and (e) temp. and time of solution- and ageing treatment, on the properties of the final sheets. Samples taken longitudinally and transversely to the direction of rolling, from the surface and middle of the sheets, were examined for proof strength, tensile strength, and elongation, while their structure was examined by microscopic and X-ray methods. Little difference was found between chill- and continuously cast billets provided the pouring rates were correct, and initial forging of the billet had only a negligible effect on the final properties of the sheet. The mechanical properties were found to increase with increase of rolling reduction until a critical value was reached, after which the proof stress and tensile strength diminished while the elongation continued to increase. Similarly, it was not until a critical rolling reduction was reached that the centre had mechanical properties superior to those of the outside. Low mechanical properties could be improved by increasing the solution temp. provided that the rolling reduction had not exceeded 70%. The anomalous mechanical properties and crystal structures are almost entirely determined by the conditions of the penultimate and final heat-treatments and by the magnitude of the rolling reduction between them.—E. N.

Lead Products—Manufacture Involves Melting, Casting, Extrusion, Rolling, and Burning. (—). See p. 433.

***The Influence of Rate on the Resistance of Metals to Plastic Deformation.** (Sokolov). See p. 409.

Zinc Extrusions Attain Commercial Status. Herbert Chase (*Materials and Methods*, 1945, 22, (6), 1724–1727).—Rods, bars, and special shapes in zinc and zinc alloys are now produced by extrusion, using a vertical press taking billets 18 in. long and 5 in. in dia.—J. C. C.

Extrusion. A Comparison of Direct and Indirect Methods. A. Ahearne Heron (*Metal Ind.*, 1946, 68, (20), 389–391).—The chief disadvantages of direct extrusion, the only method at present adopted in practice, are slow speed, inconsistency of product, and the production of a bar with marked flow characteristics. Indirect, or inverted, extrusion, in which the die is moved on to a stationary billet, would overcome these difficulties, and have these advantages: less generation of heat, better flow conditions, and hence faster extrusion; use of larger containers for the same size of press; an improved forging bar with no pronounced flow lines; smaller discard; and the possibility of extruding aluminium-coated bars.—J. H. W.

Recent Improvements in the Design of Extruding Presses for Welding-Electrode Coatings. R. Müller-Börner (*Elektroschweissung*, 1940, 11, (6), 97–99).—Older processes for extruding coatings for welding electrodes suffer from the disadvantage of a change in the direction of flow of the coating material. Apart from the question of increased power requirements, the high pressure necessary is apt to lead to the moisture being forced out of the binder. The type of extrusion press here described avoids these difficulties by maintaining the flow of material as nearly as possible in one direction.—M. A. V.

***Investigation of the Character of the Flow of Non-Ferrous Metals in Hot Extrusion.** V. V. Zholobov (*Tsvet. Metally*, 1945, (4), 53–57).—[In Russian]. Z. describes some tests, using a co-ordinate lattice, on brass in a 1000-ton horizontal press using an unheated container and no lubrication, and in a 600-ton vertical press using a graphite lubricant.—N. A.

***The Behaviour Under Tensile Stress of Metals Deformed by Compression.** (Körber, Eichinger, and Möller). See p. 414.

Processing with Magnesium [Alloys]. Avoiding the Breakdown of Corrosion-Resistance. N. H. Simpson (*Metal Ind.*, 1946, 69, (4), 67–68).—An outline of the common methods of fabrication and processing with magnesium alloys.—J. H. W.

***Magnesium [Alloy] Forgings.** An Investigation into Their Production and Properties. — (*Metal Ind.*, 1946, 69, (1), 8-11; (2), 30-32).—A summary of the main conclusions of the four reports on "The Production and Properties of Magnesium Press and Hammer Forgings," issued by the U.S. War Production Board. The reports describe the manufacture of complicated forgings in standard magnesium forging alloys, the production of a large number of magnesium forgings made in dies originally designed for aluminium alloys, and the static mechanical properties developed in certain of the forgings. The production and testing of a large structural member in both magnesium and aluminium alloys are discussed, and a comparison is given of the mechanical characteristics of both alloys. The effects are studied of variations in the handling of the high-strength alloy (aluminium 8.5, zinc 0.5%, magnesium remainder) on its forgeability and properties.—J. H. W.

KirkSITE A for Tooling [for Forming Light Alloys]. W. W. Richmond (*Modern Metals*, 1946, 2, (5), 21-22, 24).—The properties of KirkSITE A and its use for dies for forming light alloys are briefly dealt with.—N. B. V.

Forming Magnesium [Alloy]. — (*Modern Metals*, 1946, 2, (3), 14-18).—An account of the bending and forming of magnesium alloy sheet, extrusions, and tubes, reproduced from a booklet "Designing with Magnesium," published by the American Magnesium Corp. The properties and forming characteristics of the wrought alloys used in structural design are tabulated. In general the same methods of working may be used as for aluminium, but with some modifications necessitated by the elevated working temp. that has to be used (400°-700° F. (204°-371° C.)).—N. B. V.

Hot Dimpling. Modern Techniques for High-Strength Aluminium Alloys. — (*Metal Ind.*, 1946, 69, (11), 213-216; (12), 238-239).—Gives results of an investigation, carried out in the U.S.A., on the general subject of dimpling. In particular, new techniques in hot dimpling are described. The heated-die method of hot dimpling is considered; the direct resistance-heating method is preferred.—J. H. W.

Riveting, Countersinking, and Dimpling Magnesium. L. B. Harkins (*Modern Metals*, 1946, 2, (4), 20-23).—Practical hints.—N. B. V.

Aircraft Components. Shop Layout for Their Production from Light Alloys. C. Monday (*Metal Ind.*, 1946, 69, (1), 3-6).—M. describes the lithographic-reproduction process for the preparation of detail parts, and the drilling, routing, and pressing operations that follow. Notes on shop layout for efficient production are given. Many of the processes and machines can be used for practically any free-milling non-ferrous metal.—J. H. W.

Carbide Mills Aluminium Alloys. G. R. Gwynne (*Machinist (Eur. Edn.)*, 1946, 90, (25), 1008-1009).—Only cemented-carbide tools can be used for milling 14S-T and 75S-T alloys at high speed. The methods of using these cutters, and precautions required to protect the cutting edges, are described.—J. H. W.

Temperature in the Cutting of Metals. M. P. Levitsky (*Zhur. Tekhn. Fiziki*, 1946, 16, (4), 455-462).—[In Russian]. L. corrects an error in the integration of an equation given in an earlier paper (*ibid.*, 1940, 10, (13)).—N. A.

Forty Years' Progress in Cutting Tools. J. H. Barber (*Proc. Inst. Mech. Eng.*, 1946, 154, (1), 18-21).—A review of the subject from 1900 to 1946.

—H. J. A.

Fusion Cutting by High-Speed Band Saw. R. W. Hancock (*Sheet Metal Ind.*, 1945, 22, (219), 1205-1210).—A band saw is operated at a speed of 12,000 ft./min. and, owing to the intense heat generated by friction when work is fed into the machine, the work is cut partly by the normal action of the saw, and partly by the saw brushing away the semi-molten material. Fast cutting of pressings, armour plate, and non-ferrous ingots is possible with no appreciable work drag or distortion.—R. GR.

XX.—CLEANING AND FINISHING

Surface Finishes for Aluminium [and Its Alloys]. J. F. Mason (*Iron Age*, 1946, 158, (9), 40-43; (10), 50-53; (11), 66-69).—M. describes the formation of electrolytic oxide coatings for the protection of aluminium against corrosion and abrasion, and discusses the use of various acids and several patented processes. Information is given on electropolishing, colouring and sealing anodic films, methods of applying a wide variety of metals to aluminium and its alloys by electroplating, composition of plating baths, times and temp. of plating, cleaning, pre-treatment, and after-treatment.—J. H. W.

Spray-Finishing and Drying Aluminium Fabrications at Woodall Industries. — (*Indust. Heating*, 1946, 13, (2), 301-308).—Illustrated accounts are given of the spraying booth and the dipping and drying equipment used in applying sprayed coatings of zinc-chromate primer and aluminium paint to light-alloy aircraft parts.—P. R.

Hard-Surfacing Light Metals. [Metal Spraying]. W. C. Reid (*Modern Metals*, 1946, 2, (3), 6-7).—Aluminium and magnesium alloys can be hard-surfaced to any required depth with any other metal or alloy by means of a metallizing gun. The bond is purely mechanical and is secured by roughening the light-metal surface by blasting or by means of a special tool. All metals except brasses and bronzes can be applied directly to the prepared surfaces; brasses and bronzes should be applied over a thin coating (0.002-0.004 in.) of stainless steel. Slight surface preheating ensures even stronger bonds. Finishing by any of the customary methods can proceed immediately after spraying. The process has numerous applications in cases where a high wear-resistance is required in light alloys.—N. B. V.

***The Surface Preparation of Aluminium Alloy Sheet for Spot Welding.** (Wyant, Ashcraft, Cameron, and Moore). See p. 442.

"Dyed Metal" (Metal Finishes). — (*Standards Rev.*, 1946, (6), 15-19).—Brief review of electroplating, phosphating, and anodizing; several examples of the latter are illustrated in colour. Standard specifications covering thickness of film, resistance to abrasion, reflectivity, and tests for fastness of colour, are in preparation by the British Standards Institution.—P. R.

Aspects of Finishing Processes Applicable to Automobile Engines and Chassis. H. H. Jackson (*J. Inst. Automobile Eng.*, 1946, 14, (8), ix-xii; **Body Corrosion.** J. R. Stanfield (*ibid.*, xii-xiii); **A Motor-Cycle Manufacturer's Views on Finish and Protective Coatings.** V. Page (*ibid.*, xiii-xiv); **Discussion** (*ibid.*, xiv-xxii).—A report of a joint meeting of the Birmingham Centre of the Institution of Automobile Engineers and the Electrodepositors' Technical Society. Topics discussed include, besides plating for decorative purposes, plating of bearings, cylinder bores, and gears.—N. B. V.

Glycerine in Metal Treatment. Georgia Leffingwell and Milton A. Lesser (*Materials and Methods*, 1945, 22, (5), 1432-1434).—A brief review, with 24 references, of the uses of glycerine in solutions for quenching, plating, cleaning, and electropolishing.—J. C. C.

Selection of Metal-Cleaning Methods. Charles Delmar Townsend (*Material and Methods*, 1945, 22, (5), 1411-1417).—Discusses methods of cleaning various metals and alloys by sand blasting, tumbling, alkalis, electrolytic treatments, solvents, or vapour degreasing plant. Recommendations are summarized in tabular form.—J. C. C.

Selecting a Liquid Metal Cleaner. Gilbert C. Close (*Finish*, 1945, 2, (10), 17-19; *C. Abs.*, 1946, 40, 1128).—C. discusses cleaning requirements, difficulties caused by drawing compounds in metal-forming operations, the mechanics of cleaning, and types of cleaner and their characteristics.

***Recovery of Copper from Waste Waters [Used After Pickling Copper or Brass].** (Southgate and Grindley). See p. 451.

XXI.—JOINING

†Glass-to-Metal Seal Design. W. J. Scott (*J. Sci. Instruments*, 1946, 23, (9), 193-202).—A general account of the different types of glass-to-metal seals, and of the factors which produce a satisfactory result. Joints may be either directly metal-to-glass, or through an intermediate layer of oxide. The latter type gives the stronger bond, but a thick, porous, oxide layer is harmful. The coeff. of expansion of metals and alloys suitable for sealing into glass are discussed, and the way in which strains are built up described. Solid glass does not fail under pure compression; it fails on account of the tension component of stress, and joints should be designed to avoid harmful tension. Joints of different types are illustrated and discussed.—W. H.-R.

*Soft Soldering. Morris E. Fine and Ralph L. Dowdell (*Trans. Amer. Soc. Metals*, 1946, 37, 245-272; discussion, 273-277).—The soldering characteristics of a number of soft solders and fluxes, when used on sheet steel, were studied by means of spread-of-drop tests and capillary-rise tests between steel strips (clamped together and suspended vertically with their lower ends immersed in molten solder for 15 min. or 1 min.). All the tests indicate that greatest spreading is obtained with the 50:50 tin-lead alloy, and that the presence of lead chloride in the flux is advantageous. Preferred fluxes are mixtures of: stannous chloride 20, zinc chloride 40, and ammonium chloride 40%; lead chloride 50, zinc chloride 50%; and zinc chloride 15, lead chloride 5 g., petrolatum 25, and water 2 c.c. The action of fluxes is considered to be to clean the solder and metal surfaces, to protect them from further oxidation, and to change the character of the surfaces (by "plating out" lead or tin) so as to cause the solder to spread more freely. The alloying action between various solders and Armco iron after heating in contact for 1-20 hr. at 650° and 825° F. (343° and 441° C.) was studied microscopically. Tensile tests are described on lap joints between steel strips, made with 50:50 tin-lead and 87.5:12:0.5 lead-antimony-arsenic solders, and it is concluded that, in sound joints, the strength is independent of the solder thickness, but that the effects of soldering temp. and time depend on the solder composition. Joints made with 50:50 tin-lead solder become weaker on ageing or reheating to 50°-120° C., probably as a result of recrystallization. Joints made with the lead-antimony-arsenic alloy, however, are not subject to age-softening.

—J. C. C.

*Soft-Solder Selection Aided by Simple Test. E. E. Schumacher, G. M. Bouton, and G. S. Phipps (*Materials and Methods*, 1945, 22, (5), 1407-1410).—A pair of 0.040-in. wires, twisted so that adjacent turns are 1 in. apart, are fluxed and their lower ends immersed vertically for 15 sec. in a bath of molten solder. The capillary rise is observed and interpreted as a measure of the wetting ability of the solder under the conditions used. Results of tests on copper, brass, and iron wires fluxed with zinc chloride-ammonium chloride or rosin indicate that the max. rise is obtained with solders containing 40-50% tin. Photomicrographs of sections at various distances from the solder level show that there is a progressive change in the composition of the solder, the alloy at the higher levels becoming richer in eutectic. The mechanism is similar to that of a fractionation process, and with low-tin solders the amount of solder at the higher levels is relatively small, even though penetration may be good.—J. C. C.

Low-Tin and Tin-Free Solders and Tinning Materials. E. S. Shpichinetsky and I. L. Rogel'berg (*Tsvet. Metall.*, 1945, (2), 27-32).—[In Russian]. A review of the literature.—N. A.

*Metal Flow and Fillet Formation in Brazing Aluminium [and Its Alloys]. Mike A. Miller (*Weld J. (J. Amer. Weld. Soc.)*, 1946, 25, (2), 102-114S, 122S).—M. has examined the size and shape of fillets formed in various capillary

environments and established a number of relationships by a trigonometric evaluation of data. Aluminium brazing alloys are inherent fillet-formers.

—P. H.

Copper Brazing of Incendiary Bombs. — (*Indust. Heating*, 1945, 12, (10), 1722, 1724, 1726, 1728, 1730, 1798).—The firing mechanism of an incendiary bomb developed in the U.S.A. consisted of five parts, which were assembled and placed in a steel casing before brazing. The brazing copper penetrated between the various parts and formed a tight, uniform seal round the casing, about 14 g. of copper brazing about 30 sq.in. of joints.—P. R.

Copper-Brazing of Steel Assemblies. J. D. Jevons (*Canad. Metals*, 1945, 8, (1), 24–26).—A review of the advantages, techniques, and precautions to be observed in copper-brazing steel components. J. discusses the strength of the resulting joint, and possible applications of the method.—H. J. A.

Brazing and Heat-Treating Assemblies for Magnalastic Expansion Joints. — (*Indust. Heating*, 1946, 13, (1), 38, 40, 42, 44, 92, 94).—A proprietary expansion joint consists of a series of diaphragms, joined alternately at their inner and outer peripheries. Materials used include phosphor bronze, Inconel, Monel, beryllium-copper, copper, and brass. The assemblies may be soldered, welded, or brazed. An account is given of a large controlled-atmosphere electrically heated brazing furnace, with "flame curtains" at both charging and discharge ends, and a water-cooled cooling chamber.—P. R.

Joining Metals by Welding, Brazing, and Allied Processes. E. V. Beatson (*Coventry Eng. Soc. J.*, 1946, 27, (2), 29–32; (3), 35–42; discussion, 42–43).—A review of methods of joining metals. The influence of composition on the properties and applications of tin-lead solders is illustrated by a phase diagram. B. summarizes the essential features of soldering with the iron and of dip, flame, carbon-resistance, direct-resistance, and high-frequency induction soldering. Alloys and fluxes for brazing are briefly reviewed, as are the procedures in torch, resistance, furnace, and copper brazing. Short descriptions are given of the different welding processes.—P. R.

Fabrication by Electric-Furnace Brazing. H. M. Webber (*Gen. Elect. Rev.*, 1946, 49, (5), 22–29).—Describes several applications of electric-furnace brazing in the production of military equipment.—E. V. W.

Welding Aluminium and Aluminium Alloys. — (*Aluminium and Non-Ferrous Rev.*, 1945, 10, (7/9), 46, 48–50).—Reprinted from "The Oxy-Acetylene Handbook," published by The Linde Air Products Co.—N. B. V.

Development of the Weibel Welding Process for Aircraft Construction [Aluminium]. F. Heibling (*Junkers Nach.*, 1943, 14, (7/8), 53–59).—The turned-up edges of aluminium and suitable aluminium alloy sheets are laid together and are welded between carbon electrodes applied directly to the sides of the joint, resulting in a butt weld. The current-control gear provides for 3.5–8 V. and 80–260 amp. The electrodes are of hard carbon, copper-coated to a distance of 20 mm. from the arc, and the coating wears off as the carbon is used up. The electrode tips have to be of proper shape. The tongs holding the electrodes are of special design with spring mechanism, the gap being controlled by hand. They are water-cooled to permit lightness of the metal sections. Joints can be made between sheets of thickness 0.3–0.6 mm., and in long runs. Pickled surfaces are preferred. Flux is applied only to the under-side and not to the side to which the electrodes are applied. As the turned-up edges of the parts to be welded should register closely at a uniform height and should fit exactly, precision forming is advised. Data are given for height of turn-up and radius for sheets of 0.3–1.5 mm. thickness in aluminium, Al-Mg 5, Al-Mg 7, and Al-Mg-Si materials.—H. S.

Carbon-Arc Welding of Aluminium Speeds Fabrication. W. J. Conley (*Materials and Methods*, 1945, 22, (5), 1423–1425).—Describes equipment and

methods used for constructing the hollow deck balk of a military floating bridge.—J. C. C.

***The Surface Preparation of Aluminium Alloy Sheet for Spot Welding.** R. A. Wyant, D. J. Ashcraft, T. B. Cameron, and K. H. Moore (*Weld. J. (J. Amer. Weld. Soc.)*, 1946, 25, (2), 65-76S).—Contact-resistance measurements and electron-diffraction studies are used to determine the effect of various surface-preparation techniques. Foreign material must be removed from Alclad sheet before solution-treatment. The metal should not be allowed to dry before rinsing after cleaning in alkaline solutions containing inhibitors. Immersion of Alclad sheet in hot water causes the formation of a surface film of Boehmite which may make ineffective the subsequent chemical preparation for welding. Hot-water immersion after alkaline cleaning produces no ill effects. Surface treatment in hydrofluosilicic acid solutions produces a condition suitable for welding, and stable for many weeks, even after oiling and degreasing.—P. H.

***An Investigation of the Spot Welding of Aluminium Alloys Using Magnetic-Energy Storage Equipment Provided by the Sciaky Brothers.** W. F. Hess, R. A. Wyant, and B. L. Averbach (*Weld. J. (J. Amer. Weld. Soc.)*, 1945, 24, (12), 629-643S).—The performance of the apparatus is critically examined and the results of employing various techniques compared. In particular, the relation between pressure cycle and weld quality is discussed. Crack- and porosity-free welds of equal quality may be obtained by the use of either a forge cycle or const. high electrode pressure. Forging pressure must be applied rapidly and without delay to secure optimum properties. The consistency of welds is comparable with that obtained with condenser-discharge and A.-C. equipment. Correct operation of the primary contactors is essential for consistent operation.—P. H.

Spot Welding of Heavier Gauges of Aluminium Alloy. II.—New Portable Instruments for Rapid Measurement of Current and Tip Force in Spot-Welding Machines. R. C. McMaster and N. A. Begovich (*Weld. J. (J. Amer. Weld. Soc.)*, 1945, 24, (12), 644-667).—Cf. *Met. Abs.*, 1946, 13, 108. Current and tip force are measured by means of a small unit, comprising a toroid and a strain-gauge bridge. The unit may be slipped over the electrode holder of any spot welder and clamped ready for use in a few min. The simultaneous records of welding current and tip force obtained by this unit may be applied to either a magnetic or a cathode-ray oscillograph. By using a long-persistence tube in the cathode-ray oscillograph, visual checking of welder performance may be carried out. Otherwise, permanent records may be obtained by employing a 35-mm. camera in conjunction with the tube.—P. H.

***The Spot Welding of Dissimilar Thicknesses of Alclad 24S-T.** W. F. Hess, R. A. Wyant, and B. L. Averbach (*Weld. J. (J. Amer. Weld. Soc.)*, 1945, 24, (12), 667-672S).—Welding of dissimilar thicknesses of 24S-T alloy requires special attention to electrode contour and surface resistance. To keep the surface of the thin sheet smooth it is necessary to use a flat tip against the thin sheet and a domed tip or smaller flat against the thick sheet. The resultant tendency for concentration of the fusion zone in the thicker sheet cannot be corrected by using a low-conductivity electrode against the thin sheet. Medium or high surface resistance is necessary when the dissimilar-thickness ratio becomes of the order of 3:1. It is inadvisable to weld a dissimilar-thickness ratio of 6:1 because of the erratic nature of the fusion zone and high sheet separation.—P. H.

***An Investigation of Current Wave-Form for Spot Welding Alclad 24S-T in 0.020-in. Thickness.** W. F. Hess, R. A. Wyant, and B. L. Averbach (*Weld. J. (J. Amer. Weld. Soc.)*, 1946, 25, (1), 20-29S).—The effect of using two different current wave-forms in conjunction with other variables was studied. Weld strength, particularly in chemically treated stock, is less affected by changes

in current when a rapidly rising-current wave-form is employed. Current wave-form affects the distribution of current over the contact area, the rapidly rising wave-form tending to produce toroidal-shaped welds.—P. H.

***Tension Tests of Single-Row Spot-Welded Joints in 24S-T Alclad Aluminium Alloy Sheet.** R. Della-Vedova (*Weld. J. (J. Amer. Weld. Soc.)*, 1946, 25, (2), 115–122S).—The strength of spot-welded joints in tension increases with decrease in weld spacing until the weld nuggets touch. A still further decrease in spacing causes a corresponding reduction of strength in tension. Differences in nugget penetration have no effect on the tension strength of spot welds of the same dia. Small, closely spaced welds have a higher tension strength than large, closely spaced welds.—P. H.

The Spot Welding of Heavy-Gauge Aluminium-Coated Duralumin. H. E. Dixon (*Welding*, 1945, 13, (11), 486–498).—D. gives data relating to weld quality as affected by various factors, and makes recommendations for suitable welding technique. Machines of the stored-energy type are preferred, and some method of securing a consistent current cycle is necessary when making a rapid succession of unidirectional discharges. Electrode working conditions are more severe than when welding thin sheets, since local deformation and “point” contact are reduced. Chemical pre-cleaning is recommended, and the importance emphasized of adequate production tests prior to selecting the machine setting.—P. H.

Aluminium Spot Welding and Carriage Construction on the S.B.B. [Swiss Federal Railway]. F. Halm (*Schweiz. Arch. angew. Wiss. Techn.*, 1946, 12, (8), 257–264).—[In German]. A general account of the introduction of aluminium into the construction of carriages for a Swiss narrow-gauge line. No technical details of construction are given, but several small-scale diagrams are included.—N. B. V.

***The Structure of Aluminium [and Aluminium Alloy] Spot Welds.** (Hug). See p. 415.

***The Flash Welding of Alclad 24S-T Alloy in the 0.064-in. Thickness.** W. F. Hess and F. J. Winsor (*Weld. J. (J. Amer. Weld. Soc.)*, 1946, 25, (1), 9–20S).—An account of an exploratory investigation. The most important and critical variable is the timing of current cut-off with respect to upset. Highest weld strengths are obtained when current cut-off and upset are simultaneous. The amount of upset is also important, though less critical than the timing. The upset should be enough to squeeze out oxidized material, but not enough to deform the metal severely in its hot-short condition. The magnitude of the power level during flashing has little effect upon results if it is high enough to prevent initial butting.—P. H.

Aluminium Bonded to Steel or Cast Iron. M. G. Whitfield and V. Sheshunoff (*Materials and Methods*, 1945, 22, (4), 1090–1096; and *Metal Treatment*, 1946, 13, (45), 70–76).—The Al-Fin process was originally developed for manufacturing aluminium-finned cylinder barrels, and consists in casting the light metal on a specially prepared steel surface. Aluminium and such aluminium alloys as No. 43, 355, 122, or 142 may be bonded to plain, alloy, or stainless steels or cast iron. The authors discuss the properties of the composite materials, and refer to the application of the process for cylinder barrels, steel-backed aluminium bearings, electronic-tube assemblies, and service at high temp. where resistance to oxidation and sulphur attack is required.—J. C. C.

Welded Aluminium Alloy Tank Cars. A. H. Woollen (*Weld. J. (J. Amer. Weld. Soc.)*, 1946, 25, (2), 129–130).—A brief account of the uses and development of aluminium alloy tank cars of welded construction.—P. H.

***Pressure Welding (Production of Light Alloy Charge-Cooler Elements).** H. Herrmann (*Welding*, 1946, 14, (3), 120–126; *Metal Ind.*, 1946, 68, (8), 143–147; *Aircraft Prodn.*, 1946, 8, (91), 207–210).—Translation by the Ministry of Aircraft Production of a paper not previously published in Germany.

Cf. *Iron Age*, 1946, 158, (6), 56-60. A process developed in Germany for the welding of light-alloy components without fusion. Two thin sheets are laid cold, one on the other, between hot-welding dies. Pressure sufficient to cause a definite reduction in thickness is then applied, and welding takes place. Working temp. and pressures average 450° C. and 2-5 tons/sq.in., respectively, for light alloys. Pre-cleaning of the sheet is critical.—P. H.

Plastic Bonding of Light Metals. E. Preiswerk and A. von Zeerleder (*Plastics*, 1946, 10, (110), 357-360; *Light Metals*, 1946, 9, (102), 356-360).—See *Met. Abs.*, this vol., p. 341.

Aircraft Welding: New Applications Speed Production Rate. H. O. Klinke (*Canad. Metals*, 1945, 8, (4), 41).—An address to the Canadian Welding Society.—H. J. A.

Welding Precious Metals [Gold, Silver, Platinum]. F. W. Meyers, Jr. (*Iron Age*, 1946, 158, (8), 59-62).—Describes practical methods of welding gold, silver, and platinum by the torch and by the hammer methods. Both pure and clad metals are included.—J. H. W.

The Spot Welding of Magnesium (a Review of Available Literature). R. F. Tylecote (*Welding*, 1946, 14, (2), 74-79).—Methods of surface preparation are discussed and various chemical reagents compared on the basis of contact-resistance. Increase in weld strength with increase of c.d. is limited by splashing or spitting, which necessitates a compromise. The electrodes now preferred are radius domed, and of the usual construction. A great improvement in strength results on annealing welds, and it is suggested that suitable modifications may allow this to be done in the machine. An after-weld protective treatment, such as chromating, is preferred to the use of a sealing compound.—P. H.

Heliarc Welding of Magnesium. — (*Modern Metals*, 1946, 2, (2), 17-18).—A general account of the process.—N. B. V.

Helium-Shielded Arc Welding of Magnesium Alloys. F. A. Wassall (*Aluminium and Non-Ferrous Rev.*, 1945, 10, (1/3), 10, 12; (4/6), 26).—Reprinted from *Weld. J. (J. Amer. Weld. Soc.)*, 1944, 23, 148; *Met. Abs.*, 1944, 11, 202.—N. B. V.

Magnesium Alloy Sheet and Tube, and Its Fabrication by Oxy-Acetylene Welding. E. Ryalls (*Welding*, 1945, 13, (11), 499-508).—R. discusses, in a practical way, the weldability of magnesium alloys, the design and preparation of welds, and the welding technique, and gives examples of fabrication with suggestions for forming. He stresses the importance of design in relation to flux removal, and the difficulty of joining AM503 and AZM alloys. Working after welding, to rectify distortion, should only be carried out in the hot state.—P. H.

Resistance Welding of Heat-Resisting Materials: Application to Stainless Steel, Inconel, and Nickel-Chromium Alloy. H. E. Lardge (*Aircraft Prodn.*, 1946, 2, (89), 107-113).—L. discusses spot welding, seam welding, and stitch welding of annealed sheet materials in thickness varying from 16 to 26 S.W.G. Distortion during welding is reduced by welding under water or by a flow of water over the electrodes and the work. Pickling after welding is not advised on account of the difficulty of removing residues from joints. Electrode pressures used are higher than those for welding mild steel, and spot welds may be made at closer pitch than in mild steel, without adverse effect on the static strength of each weld, the higher electrical resistivities of the materials causing less "shunt" effect in welding.—H. S.

Controlling Distortion in the Gas Welding of Sheet Metals. C. G. Bainbridge (*Sheet Metal Ind.*, 1946, 23, (226), 356-362).—B. considers the causes of distortion and makes suggestions on the best method of designing and locating joints. He also deals with welding procedure, blow-pipe manipulation, and the use of jigs.—R. Gr.

Electronic Control in Resistance Welding. B. G. Higgins (*Aircraft Prodn.*, 1946, 8, (90), 155–159).—The control of welding time by electronic control of the welding-transformer primary current is described with special reference to spot welding and seam welding. Details are given of timing circuits in which ignition control is used.—H. S.

Atomic-Hydrogen Welding. I. H. Hogg (*Metro-Vick. Gaz.*, 1945, 21, (350), 117–125).—Reviews the history, apparatus, techniques, and applications of the atomic-hydrogen method of welding.—H. J. A.

Recent Improvements in the Design of Extruding Presses for Welding-Electrode Coatings. (Müller-Börner). See p. 437.

How Metal Bellows are Fabricated. (Geschelin). See p. 448.

Annealing Welded Joints in Pipelines. (Isermann). See p. 436.

Welding and Brazing Combined Form New Uses for Steel Stampings. — (*Steel Processing*, 1945, 31, (11), 699–702).—Resistance or spot welding may be used in place of jigs to hold parts in position during copper or silver-solder brazing. Examples of complex assemblies are illustrated. Strip or wire spirals may sometimes be used to form threads where close accuracy is not required.—J. C. C.

Practical Tests in Welding Instruction. J. Krakat (*Elektroschweissung*, 1940, 11, (5), 86–90).—Details of 18 suggested welding tests which a competent craftsman should be able to carry out successfully. These are intended for electric-arc welders, but are based on recommendations previously made for gas-welders.—M. A. V.

Overhead Charges in the Electric-Welding Shop. A. Schmid (*Elektroschweissung*, 1940, 11, (10), 157–162).—The allocation of overhead charges to costs of electric welding presents some difficulties, and an examination was made of the costs of carrying out simple butt-welds on plates of different thicknesses. The overheads depended largely on the consumption of current and electrode material, and therefore on the plate thickness, and a table is given, analysing the total cost of welding plates of different thicknesses.

—M. A. V.

Riveting, Countersinking, and Dimpling Magnesium. (Harkins). See p. 438.

New Aspects of the Bonding of Rubber to Metals. H. E. Zentler-Gordon and K. W. Hillier (*Sci. J. Roy. Coll. Sci.*, 1944, 14, 140–160; *C. Abs.*, 1946, 40, 1687).—Critical discussion and review of alloy-plating on α -brass, the behaviour of various types of rubber, and the design and application of rubber-metal units. 17 references are given.

Bonding Rubber to Metals. John H. Gerstenmaier (*Modern Metals*, 1946, 2, (4), 13).—G. deals briefly with several recent applications of rubber-bonded metal parts.—N. B. V.

XXII.—INDUSTRIAL USES AND APPLICATIONS

Post-War Horizons for Aluminium [Alloys]. F. Keller (*Min. and Met.*, 1946, 27, (476), 431–433).—War-time improvements in aluminium alloys and in techniques for their fabrication are indicated, and future applications of the alloys are surveyed.—N. B. V.

Aluminium [Alloys] and the Automobile Engineer. E. G. West (*J. Inst. Automobile Eng.*, 1946, 14, (4), 109–146).—W. reviews the properties, fabrication, and finishing of the principal cast and wrought aluminium alloys, and indicates briefly the uses to which they have been put in power units, motor cars and motor cycles, and commercial vehicles.—N. B. V.

Light Alloys in Cars. Improved Performance by Weight Reduction. G. Geoffrey Smith (*Metal Ind.*, 1946, 69, (14), 288).—Read before the Vauxhall Supervising Group. By the application of present-day metallurgical know-

ledge, it should be possible to effect a saving of about 15% in the weight of a motor car. Since cars have nowadays to last longer, more efficient protection against rusting is required.—J. H. W.

Light-Alloy Cylinder Heads from German Aircraft Engines. C. Wilson (*Automotive Ind.*, 1945, 92, (3), 54, 58).—A report, prepared for the Ministry of Aircraft Production, describing the composition, design, and properties of three types of light-alloy cylinder head recovered from German aircraft engines.—P. R.

Important Engineering Data on Aluminium Alloy Bearings for Engines. D. B. Wood (*Automotive Ind.*, 1946, 94, (11), 27–30, 74–78).—W. studies three aluminium-base bearing alloys, 750-T533, XA750-T7, and XA80-S, and tabulates physical and mechanical properties. It is claimed that the general durability and resistance to severe loading of these alloys are superior to those of most bearing materials.—P. R.

How and When to Use Aluminium Alloys. R. L. Moore (*Engineering News-Record*, 1945, 135, 518–524; *C. Abs.*, 1946, 40, 1436).—M. discusses the mechanical properties of commonly used aluminium alloys in relation to their structural applications.

Aluminium and Its Alloys. E. G. West (*Aluminium and Non-Ferrous Rev.*, 1945, 10, (10/12), 59–60, 62, 64–66).—A paper presented to the Design and Industries Association. Properties, methods of fabrication and finishing, and uses are reviewed.—N. B. V.

Aluminium [in Display, Exhibition, and Store-Planning Applications]. E. G. West (*Display*, 1946, 27, (11), 16–18, 20).—N. B. V.

The Use of Aluminium Alloys as Constructional Material for Domestic Washing Machines. — (*Aluminium and Non-Ferrous Rev.*, 1945, 10, (4/6), 18, 20, 22).—Tests have shown that pure aluminium and corrosion-resistant aluminium casting alloys are quite suitable for the construction of washing machines, provided that the washing lyes used have known characteristics. Excess soda must be avoided unless water glass is added to the washing media. Some of the tests are described.—N. B. V.

Aluminium Portable Washing Machine. — (*Modern Metals*, 1946, 2, (3), 19).—N. B. V.

Palletize for Handling [Aluminium]. T. Palmer (*Modern Metals*, 1946, 2, (5), 14–16).—Aluminium pallets, though initially much dearer than wooden ones, should in the long run effect considerable saving in the bulk transportation of all types of package. Economics are examined, and the construction of pallets in 52S alloy is described.—N. B. V.

The Aluminium [Alloy] Blitz Can. A. B. Carlson (*Modern Metals*, 1946, 2, (2), 6–7).—Towards the end of the war, aluminium (52S alloy) was substituted for steel in the 5-gall. containers extensively used by the U.S. Forces. C. describes the construction of them by seam welding and the external finishing of them by means of a zinc chromate primer and paint. No protection was required internally.—N. B. V.

[Aluminium] Lawn Sprinkler. L. A. Weil (*Modern Metals*, 1946, 2, (4), 24).—N. B. V.

Aluminium Foil and Its Application in Modern Packaging Technique. J. C. Bailey (*Brit. Packer*, 1946, 7, (9), 4–8).—The uses of plain and paper- or plastic-backed foils are described.—N. B. V.

Boron Carbide—Hardest Man-Made Material. Edwin Laird Cady (*Materials and Methods*, 1945, 22, (4), 1058–1063).—Boron-carbide powder is used, as a substitute for diamond dust, for lapping such parts as tungsten-carbide dies; sintered pressings are used for lining pestles and mortars, for abrasive-blast nozzles, and other similar applications.—J. C. C.

New Uses for Cerium. G. Ahrens (*Metals and Alloys*, 1945, 22, (3), 748–750).—Cf. *Modern Metals*, 1945, 1, (8), 20–21; *Met. Abs.*, this vol., p. 274.

Reviews briefly the uses of cerium standard alloy (cerium 45–50, iron 0–5, silicon 0.1–0.3%, balance other rare earths) as an addition to aluminium and magnesium alloys. A bibliography of 37 references is appended.—J. C. C.

Brasses A.S.T.M. B36–43T, Alloys 1 to 8; B134–42T, Alloys 1 to 8; B135–43T, Alloys 1 to 5. — (*Machine Design*, 1944, 16, (8), 149–153).—Discusses hot- and cold-working properties, corrosion-resistance, and suitability for welding and brazing; and gives recommendations regarding fabrication.

—P. R.

Bearings and Bearing Metals. Bernard O. Brouk (*J. Amer. Soc. Naval Eng.*, 1946, 58, (3), 418–440).—B. discusses types of sleeve bearings and bearing metals used in Diesel engines and other types of propulsion equipment. Bearings referred to include tin and lead-base white metals, lead-bronze bearings, aluminium alloy bearings, tin-substitute bearing metal, and specially treated, graphitized, tin-base white metals. Special consideration is given to bonding problems, pressure die-cast bearings, the centrifugal casting of bearings and linings, grid bearings, and the supersonic method of testing bearings. B. reviews types and causes of failure in bearings and suggests methods for their elimination. Tests were made to determine the bond strength and resistance to shear of tin-base bearings on steel shells. Other tests were carried out on the corrosion of bearings, and on the use of a dimethylsilicone polymer fluid as a lubricant with seven different types of bearing metal. Reference is made to running-surface conditions and to the maintenance and safeguarding of bearings while in operation.—J. W. D.

Standard [Bi-Metallic] Bushes. — (*Automobile Eng.*, 1946, 36, (476), 253–254).—Cf. *Machinery (Lond.)*, 1946, 68, (1756), 713–718; *Met. Abs.*, this vol., p. 339. The development of standard wrapped bushes, made from bi-metallic material, consisting of steel strip lined with a lead-bronze alloy, which is bonded to the steel by a sintering process, is described. The advantages of such bushes over cast bushes as regards cost, lightness, strength, and life are summarized, and their suitability for various applications discussed.

—J. W. D.

Magnesium [Alloy] Appliance Mover. L. M. Oldt (*Modern Metals*, 1946, 2, (5), 10–13).—Describes the design and fabrication of a truck intended for moving household appliances such as stoves and refrigerators. It is built up mainly of arc-welded magnesium alloy extrusions and sheet.—N. B. V.

Bell Telephone—A Magnesium Consumer. J. P. Guerard (*Modern Metals*, 1946, 2, (4), 6–7).—After a brief account of the properties of magnesium, G. mentions its use in aircraft instruments.—N. B. V.

Titanium—a Growing Industry. Otto Herres (*Min. and Met.*, 1946, 27, (472), 210–212).—Sources and uses of titanium and its compounds are reviewed.—N. B. V.

Roll-Cap Roofing [Zinc Sheet]. — (*Zinc Bull.*, 1946, N.S. (1), 2–3).—An information sheet on the roll-cap system of roofing with zinc sheet.

—W. G. A.

Zinc-Base Die-Casting Alloys A.S.T.M. No. B86–43; Alloys Nos. XXI, XXIII, and XXV. — (*Machine Design*, 1944, 16, (9), 149–150, 152).—The principal physical properties, chemical compositions, and important mechanical properties of three zinc-base die-casting alloys are tabulated. Other information includes strength and hardness at low and at elevated temp., recommendations for drilling, reaming, tapping, bending, and forming, notes on electrodeposited, lacquer, and enamel finishes, and an account of the corrosibility of the alloys by hydrocarbon fuels and lubricants, ink, alcohol, glycerine, soaps, and creams.—P. R.

Zirconium in Industry. M. Schofield (*Indust. Chemist*, 1945, 21, (251), 641–643).—S. describes the occurrence, extraction, and uses of zirconium. The metal is used as a photo-flash starter and as a primer for ammunition

because of its low ignition point and great heat of combustion. The sintered or drawn metal is used for electrodes; other uses include the deoxidation of brasses and bronzes. Zirconium-copper has properties resembling those of beryllium-copper.—P. R.

Production and Uses of Rare Metals. W. J. Kroll (*Min. and Met.*, 1946, 27, (473), 262-266).—A review. K. urges the need for intensive investigation into the properties and possible applications of some of the rare metals.

—N. B. V.

Non-Ferrous Alloys Used in War-Time Germany. A. A. Bochyar (*Tsvet. Metall.*, 1946, (3), 40-54).—[In Russian]. A review of copper, aluminium, and zinc alloys.—N. A.

Substitute Materials for Fittings. F. Petrak (*Chem. Techn.*, 1943, 16, (5), 39-43).—P. discusses the re-design and use of substitute materials for various types of fittings, such as sluice valves, central-heating- and cold-water fittings, chemical-engineering plant, and gauges. By the use of plain carbon steels with and without chromium plating, cast iron, zinc alloys, non-metallic linings, and weld-on corrosion-resistant faces, in place of alloy steels, bronzes, brasses, and corrosion-resistant alloys, substantial savings were made in the use of strategic materials, thus satisfying the needs of German war economy. The results have a peace-time application.—E. N.

Materials Engineering at Home and Abroad. J. R. Townsend (*Bull. Amer. Soc. Test. Mat.*, 1946, (140), 19-22).—An appeal is made for co-operation between buyer and supplier in the acceptance-testing of mass-production components.—H. J. A.

Some Vibration Problems in Gas-Turbine Engines. R. G. Voysey (*Proc. Inst. Mech. Eng.*, 1945, 153, (12), 483-495).—Describes the history and investigation of vibration troubles with the centrifugal impeller of the early jet-propulsion units. V. sketches the evolution of a method of estimating fundamental frequencies in the components, and gives details of vibration problems in turbine blades. Also discussed are the failure of plastic compressor blades and the importance of internal damping capacity in the field of vibration problems.—H. J. A.

†**Recent Developments in Materials for Gas Turbines.** T. A. Taylor (*Proc. Inst. Mech. Eng.*, 1945, 153, (12), 505-512; and (condensed) *Metallurgia*, 1946, 34, (204), 316-320).—The metallurgical requirements, and possible modes of failure, of various components in a gas turbine are discussed. Nominal compositions and test data for some of the materials are given, including Brown-Firth's Stayblade and Rex 78. The nickel-base alloy, Nimonic 75, has found use in the construction of flame tubes, while high-strength, cast aluminium alloy components have also been employed.—H. J. A.

The Cleaning and Repair of Stills and Tanks: Revision of Factory Form 814. [Use of Non-Ferrous Dip Rods]. — (*Indust. Chemist*, 1944, 20, (236), 481-488).—Attention is directed to several of the less obvious risks in the cleaning, examination, or repair of stills, drums, &c., which have contained materials giving rise to poisonous or inflammable gases or vapours. Causes of explosions and of the actual ignition are reviewed, and the revised safety recommendations include the use of nickel, copper, aluminium, gun-metal, or Monel-metal dip rods instead of iron or steel.—P. R.

How Metal Bellows are Fabricated. Joseph Geschelin (*Automotive Ind.*, 1945, 92, (4), 36-38, 64).—Metal bellows are produced from a variety of alloys, including phosphor bronze, brass, copper, beryllium-copper, Monel metal, Inconel, and nickel-silver. Joining methods include welding and brazing. Gas-flux torches, induction heaters, and controlled-atmosphere electric furnaces are used for brazing; a large unit of the last-named type is described.

—P. R.

The Forming of Metal Bellows. R. A. Collacott (*Canad. Metals*, 1945, 8, (1), 30).—C. discusses the choice of materials for the construction of metal bellows, and the mechanism of failure of these articles.—H. J. A.

The Repair of Oil-Engine Components [by Metal Spraying]. O. S. M. Raw (*Indian and Eastern Eng.*, 1946, 99, (1), 111-114).—R. reviews the metal-spray process for the repair and building up of worn bearing surfaces and fractured shafts. The sprayed surface has the advantage of being able to absorb lubricating oil, and it is feasible that certain wearing parts may, in the future, be produced originally by the metal-spray process.—W. G. A.

Worn Shafts [Building Up by Metal Spraying]. S. Staton (*Iron and Steel*, 1946, 19, (10), 511-512).—S. discusses the building up of worn shafts by metal spraying. He deals briefly with metal-spraying equipment, the suitability of the process, the preparation of the surface, either by shot-blasting or rough machining, and the application of the metal spray.—J. W. D.

***The Load in a Bolt Due to Tightening the Nut. [Effect of Metallic Coatings].** John L. M. Morrison (*Engineering*, 1946, 161, (4190), 409-412).—A method is described involving the measurement of the torque in a bolt to determine the effective coeff. of friction during the tightening of nuts. The effects of coating bolts and nuts with zinc and cadmium, and of Coslettizing, were studied. If cadmium-plating finish is added or substituted for another, the initial load with oil as lubricant is much increased. The use of graphite as a lubricant seems to minimize or eliminate the variations otherwise caused in the coeff. of friction by different rubbing surfaces.—R. Gr.

†**The Industry of the Non-Ferrous Metals and Particularly of the Light Metals.** André Dumas (*Mém. Soc. Ing. Civils France*, 1945, 98, (6/8), 292-317; discussion, 318-322).—The evolution of the principal non-ferrous metals: copper, zinc, lead, tin, and, particularly, aluminium and magnesium, during the last six years is reviewed as regards production and consumption, secondary material, primary mineral sources, methods of manufacture, forging, metallurgical progress, applications, and economies. *Léon Guillet*, in the discussion, dealt with the metallurgical developments that have resulted in the production of aluminium of 99.99% purity, and cited special recently devised alloys. He directed attention to the principal physical properties and the special applications of the relatively rare metals, niobium, tantalum, boron, titanium, zirconium, beryllium, gallium, indium, rhenium, and uranium.

—J. H. W.

XXIII.—MISCELLANEOUS

The British Non-Ferrous Metals Research Association. A Year's Progress. W. L. Hall (*Metallurgia*, 1946, 34, (203), 257-260).—A review of the activities of the Association and of the researches in progress.—J. W. D.

Metallurgical Research at the National Physical Laboratory. N. P. Allen (*Metallurgia*, 1946, 34, (203), 252-254).—A brief review of the researches being carried out on metals and alloys.—J. W. D.

Research and the Smaller Firm. (Sir) Edward Appleton (*Mech. World*, 1946, 120, (3121), 462-464).—An address to the Manchester Joint Research Council's conference on "Research and the Smaller Firm." Deals briefly with the relationship between the D.S.I.R., the Research Associations, and industry.—W. G. A.

Trends in Metallurgy. Gustav W. Pirk (*Wire and Wire Products*, 1945, 20, (10), 758-761, 764-765, 768-770, 797).—An elementary account of the crystal structure of metals, and the effects of cold working and alloying.

—J. C. C.

Research on Metallic Surfaces Organized in France. Albert M. Portevin (*Metal Progress*, 1946, 49, (3), 560-561).—A short account is given of the

formation in France, in 1942, of a Technical Committee on the Conditions and Properties of Metallic Surfaces for the study of the problems presented in the industrial applications of metals, for the planning and carrying out of research, and the co-ordination and dissemination of the results obtained. The sub-committees deal respectively with mechanical surface studies, thermal processes, paints and other non-metallic coatings, metallic coatings, chemical treatments and tests, and corrosion studies.—P. R.

A Metallurgical Inventory: Some of the Things That Have Happened in the Last Fifteen Years. H. W. Gillett (*Min. and Met.*, 1945, 26, (465), 419-423).—G. surveys broadly some of the chief advances in both ferrous and non-ferrous metallurgy that have occurred during the life of the Battelle Memorial Institute, of which he is Chief Technical Advisor.—N. B. V.

Non-Ferrous Physical Metallurgy [in 1944]: Notable Advances in Processing, Fabrication, and Surface Treatment. Michael B. Bever and Carl F. Floe (*Min. and Met.*, 1945, 26, (458), 90-96).—A review of progress during 1944, principally as recorded in the American literature.—N. B. V.

Non-Ferrous Physical Metallurgy [in 1945]. Ralph Hultgren and Earl R. Parker (*Min. and Met.*, 1946, 27, (470), 93-100; and (condensed) *Metal Ind.*, 1946, 68, (19), 371-374).—A survey of the principal research papers published in America in 1945.—N. B. V.

Recent Developments in the Field of Materials and Processes. Paul E. Lamoureux (*Eng. J.*, 1945, (12), 38-46; discussion, 46-48).—Read before the Engineering Institute of Canada. L. reviews a wide field of materials and processes which are of interest in aircraft construction, and mentions an aluminium-zinc-magnesium alloy (Alcoa 75S) which has superior properties over Alclad 24S-T. The composition and properties are given of a naturally ageing aluminium-5.25% zinc alloy. Other subjects dealt with include brazing, electroplating, heat-treatment, and the application of plastics as bonding agents for metal components.—H. J. A.

War-Time Materials Developments and the Post-War World. J. C. De Haven (*Bull. Amer. Soc. Test. Mat.*, 1946, (138), 17-24).—DeH. reviews such topics as the war-time development of the "lost-wax" casting process, forming processes for aluminium sheet, and some applications of magnesium alloys.—H. J. A.

German War-Time Technical Development. — (*Iron Age*, 1946, 158, (9), 39).—Summary of reports of German practice in various technical fields, issued by the Office of the Publication Board, Washington. Subjects include supersonic testing, the use of titanium, protective coatings, nickel substitute, fluorescent screens, and a copper-contact rectifier.—J. H. W.

† **Aeronautics and the Metallurgist.** Leslie Aitchison (*J. Roy. Aeronaut. Soc.*, 1946, 50, (429), 677-693; discussion, 693-709; (condensed) *Aircraft Prodn.*, 1946, 8, (92), 276-280; and *Aeroplane*, 1946, 70, (1823), 511-512).—The general position of metallic materials for aircraft construction is discussed in relation to advances made during the last 30 years. Special reference is made to advances in the light-alloy field. The general requirements as to ductility are indicated, and the significance of ductility is considered from its various aspects. While the prospects of further advances may appear slight in particular fields, A. stresses the importance of improvements in manufacturing technique, and of progress along new lines indicated by fundamental research in the various fields of long-range study.—H. S.

Standard Specifications. Principles of Preparation for Aluminium Alloys. G. M. Hutt (*Metal Ind.*, 1946, 69, (13), 255-258; (14), 281-282).—Since few British Standards exist for aluminium alloys in the general engineering series, D.T.D. specifications serve the function of standard specifications. The principles to be observed in drawing up such specifications are described.

—J. H. W.

A Chronology of Wire and Wire Products. F. A. Morral (*Wire and Wire Products*, 1945, 20, (11), 862-866, 885-887).—See *Met. Abs.*, this vol., p. 65. A revised compilation.—J. C. C.

The History and Present Status of Emission Spectroscopy as Applied to Industry. John Convey (*Metallurgia*, 1946, 34, (204), 331-335).—C. discusses the historical foundations of spectroscopy, and considers the recognition of characteristic spectra and the development of quantitative spectrochemistry. Special reference is made to the improvements of spectrographs, the control of spectral excitation, and the photometric precision of spectral-line densitometry.

—J. W. D.

Electronics—and the Chemical Industry. J. A. Hutcheson (*New Zealand Eng.*, 1946, 1, (4), 292-295).—A short review of the mass spectrograph, electron diffraction, induction heating, and dielectric heating.—H. J. A.

Use of Statistics in Writing Specifications. Casper Goffman and Joseph Manuele (*Bull. Amer. Soc. Test. Mat.*, 1946, 139, 13-17).—The nomenclature and elementary theory of statistical quality control are indicated. The application of such methods to acceptance-testing specifications is discussed.

—H. J. A.

Systematic Designation of Metallic Materials. E. Siebel and G. Fick (*Aluminium*, 1944, 26, (4), 52-53).—Describes a systematic nomenclature for aluminium alloys, taking into account their composition, properties, and applications. (See also abstract below).—E. N.

***Systematic Nomenclature for Metallic Materials.** Erich Siebel and Franz Fischer (*Metall u. Erz*, 1944, 41, (13/14), 155-157).—A system of nomenclature for ferrous and non-ferrous alloys has been devised which takes into account their composition, purpose, and mechanical properties. Thus: (1) D.Zn.AlCu43 is a pressure-casting zinc alloy with 4% aluminium and 3% copper; (2) Mg.Al9(Ah26) is a forging alloy of magnesium containing 9% aluminium which in the age-hardened condition has a minimum tensile strength of ≤ 26 kg./sq.mm.—E. N.

***Recovery of Copper from Waste Waters [Used After Pickling Copper or Brass].** B. A. Southgate and J. Grindley (*Indust. Chemist*, 1945, 21, (242), 144-152).—Describes a method developed by the Water Pollution Research Board at the request of the Ministry of Supply. It applies particularly to the treatment of waste washing waters used after the pickling of copper or brass, but spent pickle liquor can also be treated. Washing waters may be electrolysed, the copper being recovered as metal and the sulphuric acid regenerated, or treated with lime or scrap steel. The use of steel is preferable, as the copper is precipitated as metal rather than as an impure copper-hydroxide sludge. Descriptions are given of preliminary experiments on the most effective method of treating with steel, and of the operation of a full-scale recovery plant in the North of England. The copper recovered represented 0.05-0.06% of the wt. of copper pickled, and 95.6-97.4% of the copper present in the waste water. The value of the recovered copper was, however, reduced by contamination by iron.—P. R.

Magnesium in Industry. Magnesium Burns. Frank J. Jarzynka (*Indust. Med.*, 1943, 12, 427-431).

The Planning and Equipment of Libraries in Research Organizations and Industrial Concerns. B. Fullman (*J. Documentation*, 1946, 2, (2), 68-75).—The author is the Information Officer of the British Non-Ferrous Metals Research Association.—S. G.

The Basic Principle of the Method of Indexing Equipment in Industry, with Reference to Non-Ferrous Metals. I. M. Razumov (*Sbornik Nauch. Trudov Moskov. Inst. Tsvet. Metallov Zolota*, 1940, (9), 620-637).—[In Russian].—N. A.

Non-Ferrous Cost Accounting. — (*Foundry*, 1946, 74, (2), 82-85, 238, 240-242; (3), 100-102, 154, 156, 158; (4), 216-219).—A detailed account of

the accounting procedure and cost methods developed by the Non-Ferrous Founders' Society of America.—J. E. G.

The Patentability of Metallic Materials. Wilhelm Lidle (*Metall u. Erz*, 1942, 39, 221-224, 241-243, 255-259).

Patent Policies for Sponsored Research. Ralph A. Morgen (*J. Eng. Education*, 1946, 36, (10), 618-620).—M. describes the policy of the University of Florida with respect to the patenting of the results of sponsored research. This policy was formulated after an examination of the practice in other American University Institutions.—H. J. A.

XXIV.—BIBLIOGRAPHY

(Publications marked * have been received.)

***Alar, Ltd.** *Technical Data Sheets*. 13½ × 8½ in. 1946. London: The Company, 35, New Broad Street, E.C. 2.

[A folder has been issued by the Company, containing all the current data sheets, which have been revised. The data sheets comprise: Aluminium Casting Alloys; Guide to the Selection of Aluminium Casting Alloys; L33 Aluminium-Silicon Casting Alloy; Alar 00-12 Aluminium-Silicon Casting Alloy; Alar 00-5 Aluminium-Silicon Casting Alloy; L.A.C. 112A Aluminium-Silicon Casting Alloy; D.T.D. 424 Aluminium Casting Alloy.]

***Aluminium Development Association.** *Forming of Aluminium and its Alloys by the Drop Stamp*. (A.D.A. Information Bulletin No. 12.) Demy 8vo. Pp. 24, with 21 illustrations. 1946. London: The Association, 67 Brook St., W. 1. (1s.)

***American Metal Market.** *Metal Statistics, 1946*. 39th annual edition. Post 8vo. Pp. 816. 1946. New York: American Metal Market, 18 Cliff Street. (\$2.)

***Andrade, E. N. da C.** (Advisory Editor.) *Industrial Research, 1946*. Edited by T. Todd. Demy 8vo. Pp. 736. [1946.] London: Todd Publishing Co., Ltd.; Distributors: Geo. G. Harrap and Co., Ltd., 182 High Holborn, London, W.C. 1. (21s. net.)

***Australia.** *Parliament of the Commonwealth of Australia. Nineteenth Annual Report of the Council for Scientific and Industrial Research for the Year ended 30th June, 1945*. 13 × 8 in. Pp. 164. 1945. Canberra: L. F. Johnston, Commonwealth Government Printer. (7s.)

***Belcher, Ronald.** *Microchemistry and its Applications*. Demy 8vo. Pp. 52. 1946. London: The Royal Institute of Chemistry.

[Monograph based on three lectures given by the author at meetings of the Royal Institute of Chemistry.]

Belcher, R., and Cecil L. Wilson. *Qualitative Inorganic Micro-analysis*. Cr. 8vo. Pp. viii + 68. 1946. London: Longmans, Green, and Co. (2s. 6d.)

[A short elementary course.]

Bowker, John W. *American Learned Journals*. (American Council of Learned Societies, Bulletin No. 37.) Pp. 70. 1945. Washington, D.C.: American Council of Learned Societies. (25c.)

Brillouin, L. *Wave Propagation in Periodic Structures*. (International Series in Pure and Applied Physics.) 5½ × 8½ in. Pp. 315, with 137 illustrations. 1946. New York: McGraw-Hill Book Co., Inc. (\$4.00.)

***British Intelligence Objectives Sub-Committee.** *Antimony Smelting Industry*. (Final Report No. 328. Item No. 21.) [Mimeographed.] 9½ × 7½ in. Pp. 31. 1946. London: H.M. Stationery Office. (3s. 2d., post free.)

- *British Intelligence Objectives Sub-Committee. *Brass Hardware and Fittings*. (Final Report No. 517. Item Nos. 31 and 36.) [Mimeographed.] $9\frac{1}{2} \times 7\frac{1}{4}$ in. Pp. 18. 1946. London: H.M. Stationery Office. (2s. 1d., post free.)
- *British Intelligence Objectives Sub-Committee. *Recent Cable Development in Germany*. (F.I.A.T. Final Report No. 516.) [Mimeographed.] $9\frac{1}{2} \times 7\frac{1}{4}$ in. Pp. 4. 1946. London: H.M. Stationery Office. (7d., post free.)
- *British Intelligence Objectives Sub-Committee. *Rhenium*. (F.I.A.T. Final Report No. 697.) [Mimeographed.] $9\frac{1}{2} \times 7\frac{1}{4}$ in. Pp. 4. 1946. London: H.M. Stationery Office. (7d., post free.)
- *British Intelligence Objectives Sub-Committee. *Sintered Iron and Steel Components*. (Final Report No. 595. Item No. 21.) [Mimeographed.] $9\frac{1}{2} \times 7\frac{1}{4}$ in. Pp. 61. 1946. London: H.M. Stationery Office. (5s. 8d., post free.)
- *British Intelligence Objectives Sub-Committee. *Some Characteristics of Selenium Rectifiers Prepared by the Vacuum Method*. (F.I.A.T. Final Report No. 671.) [Mimeographed.] $9\frac{1}{2} \times 7\frac{1}{4}$ in. Pp. 6. 1946. London: H.M. Stationery Office. (1s. 1d., post free.)
- *British Intelligence Objectives Sub-Committee. *The Beryllium Industries of Germany and Italy (1939-1945)*. (F.I.A.T. Final Report No. 522.) [Mimeographed.] $9\frac{1}{2} \times 7\frac{1}{4}$ in. Pp. 102. 1946. London: H.M. Stationery Office. (9s. 3d., post free.)
- *British Intelligence Objectives Sub-Committee. *The German Radio-Component Industry*. (Final Report No. 563. Item Nos. 7 and 9.) [Mimeographed.] $9\frac{1}{2} \times 7\frac{1}{4}$ in. Pp. 64, with 18 illustrations. 1946. London: H.M. Stationery Office. (6s. 8d., post free.)
- *British Intelligence Objectives Sub-Committee. *The Platinum Metals Industry in Germany*. (Final Report No. 441. Item No. 21.) [Mimeographed.] $9\frac{1}{2} \times 7\frac{1}{4}$ in. Pp. 68. 1946. London: H.M. Stationery Office. (6s. 2d., post free.)
- *British Intelligence Objectives Sub-Committee. *Tungsten and Molybdenum Wire*. (F.I.A.T. Final Report No. 413.) [Mimeographed.] $9\frac{1}{2} \times 7\frac{1}{4}$ in. Pp. 16. 1946. London: H.M. Stationery Office. (1s. 7d., post free.)
- British Welding Research Association. *Pressure Welding of Light Alloys without Fusion*. Pp. 16. 1946. London: The Association, 29 Park Crescent, N.W. 1. (5s.)
- British Welding Research Association. *Technique for the Gas Welding of Magnesium Alloys*. 1946. London: The Association, 29, Park Crescent, N.W.1. (2s., post free.)
- Chute, G. M. *Electronics in Industry*. $5\frac{1}{4} \times 8\frac{1}{4}$ in. Pp. 474, with 292 illustrations. 1946. New York: McGraw-Hill Book Co., Inc. (\$5.00.)
- *Combined Intelligence Objectives Sub-Committee. *The Vereinigte Leichtmetallwerke, Hanover*. (Item No. 21. File No. XXXIII-32.) [Mimeographed.] $9\frac{1}{2} \times 7\frac{1}{4}$ in. Pp. 39. 1946. London: H.M. Stationery Office. (3s. 8d., post free.)
- Eastwood, L. W. *Gas in Light Alloys*. $8\frac{1}{2} \times 5\frac{1}{2}$ in. Pp. 99. [1946.] New York: John Wiley and Sons, Inc. (\$2.50.)
- Fournier, H. *Étude sur les Alliages Aluminium-Manganèse*. (Publications Scientifiques et techniques du Ministère de l'Air, No. 185.) 27×18.5 cm. Pp. viii + 53, with 29 illustrations. 1945. Paris: Gauthier-Villars. (50 fr.)

- *Gabor, D. *The Electron Microscope: Its Development, Present Performance, and Future Possibilities.* (Electronic Engineering Monographs.) Demy 8vo. Pp. 104, with 53 illustrations. [1945.] London: Hulton Press, Ltd., 43 Shoe Lane, E.C. 4. (4s. 6d. net.)
- Goddard, G. *Cold Working of Brass, with Special Reference to Cartridge (70:30) Brass.* Pp. 104. 1946. Cleveland, Ohio: American Society for Metals, 7301 Euclid Avenue. (\$2.00.)
[Slightly modified reprint of articles which appeared in *Metal Progress* in 1943-44.]
- Heath, (Sir) H. F., and A. L. Hetherington. *Industrial Research and Development in the United Kingdom: a Survey.* Pp. xix + 375, with a frontispiece and 12 plates. 1946. London: Faber and Faber, Ltd. (25s.)
- Hemsley, S. H. *Optical Instruments in Engineering.* 8vo. Pp. 80, with 40 diagrams. 1945. London: Paul Elek (Publishers), Ltd. (7s. 6d.)
- Hirst, H. *Engineering Practice.* Pp. 159, with 44 illustrations and 40 tables. 1945. Melbourne, Australia: "Engineering Practice." (25s.)
[A purely metallurgical review of modern technique.]
- Hodge, Edwin S. *Collected Abstracts Published in 1945 on Spectrochemical Analysis.* Pp. 64. 1946. Ohio, U.S.A.: Ohio Valley Spectrographic Society, Engineers Club Building, Dayton. (\$1.00.)
- *Hoke, C. M. *Testing Precious Metals: Gold, Silver, Platinum Metals. Identifying—Buying—Selling. A Handbook for the Jeweller, Dentist, Antiquarian, Layman.* Third, revised edition. Demy 8vo. Pp. 92. 1946. New York: Jewellers' Technical Advice Company. (\$2.00.)
- *Hume-Rothery, William. *Atomic Theory for Students of Metallurgy.* (Institute of Metals Monograph and Report Series No. 3.) Demy 8vo. Pp. viii + 286, with 124 illustrations. 1946. London: The Institute of Metals, 4 Grosvenor Gardens, S.W. 1. (7s. 6d., post free.)
- Institute of British Foundrymen. *Methods of Testing Prepared Foundry Sands.* 8vo. Pp. 36, illustrated. 1945. Manchester: The Institute, St. John Street Chambers, Deansgate. (10s. 6d. to non-members.)
[First Report of the Joint Committee on Sand Testing.]
- *International Council of Scientific Unions and International Union of Chemistry. Published under the auspices of. *Annual Tables of Constants and Numerical Data.* 18 × 25 cm. Parts 33-40. Paris: Hermann et Cie.
[Part 33: *Acoustics.* By A. Proca. *Diffusion-Osmosis.* By E. Baumgardt and H. R. Bruins. Vol. XII (Years 1935-1936). Sections 15-16. 1941. (40 fr.). Part 34: *Cryometry: Ebullimetry.* By W. Swietoslawski, M. Laziński, and J. Pomorski. Vol. XI² (Years 1931-1936). Sections 51-52. 1941. (40 fr.). Part 35: *Zeeman Effect.* By J. Jacquinet and R. Fortrat. Vol. XI² (Years 1931-1936). Section 37. 1941. (40 fr.). Part 36: *Ionization: Thermionic Emission: Critical Potentials.* By E. Bauer and M. Surdin. *Electronic Rays.* By M. Rouault and P. Auger. Vol. XI² (Years 1931-1936). Sections 42-43. 1941. (75 fr.). Part 37: *Adsorption.* By H. S. Taylor and J. F. Woodman. Vol. XIII (Years 1931-1936). Section 65. 1941. (90 fr.). Part 38: *Velocity of Reaction.* By R. O. Griffith, McKeown, and W. S. Shutt. Vol. XIII (Years 1931-1936). Section 55. 1941. (120 fr.). Part 39: *Adsorption Spectra of Liquids, Solutions, and Solids.* By M. Magat and N. Meyer. Vol. XIII (Years 1931-1936). Section 33. (280 fr.). Part 40: *Colloids.* By D. Dervichiafi. Vol. XIV (Years 1931-1936). Section 62. 1945. (200 fr.).]
- Jacquet, P.-A. *Le Polissage électrolytique des Surfaces métalliques et ses Applications.* Tome 1: *Aluminium, Magnésium, Alliages légers.* Preface de A. Portevin. 21 × 27 cm. Pp. 340, with 320 illustrations. 1946. Paris: Éditions Métaux, 32, Rue de Maréchal-Joffre, Saint-Germain-en-Laye (S.-et.-O.). (1800 fr.)
- *Joint Committee on Metallurgical Education. *Metallurgy. A Scientific Career in Industry.* Demy 8vo. Pp. 36, illustrated. 1946. London: The Committee, 4 Grosvenor Gardens, S.W. 1.

- Laissus, J.** *Diffusion du Glucinium dans les Aciers spéciaux à 13% de Chrome, 8% de Nickel. Diffusion du Glucinium dans les Métaux et Alliages légers et ultra-légers.* (Groupement Français pour le Développement des Recherches Aéronautiques. Note Technique No. 29.) [Mimeographed.] 27 × 21 cm. Pp. 61, with 40 illustrations. 1945. Paris: Le Groupement Français pour le Développement des Recherches Aéronautiques, 3 rue Léon-Bonnat.
- Letort, Y.** *Produits Réfractaires: Matières Premières. Fabrication. Usage.* Préface de L. Guillet. 8vo. Pp. viii + 199. 1945. Paris: Dunod. (12s. 6d.)
- L'Hermite, R., et D. Séférian.** *Les Essais d'Endurance en Flexion répétée comme Critère de Soudabilité des Tôles. 3e Rapport: Application à une Tôle d'un Alliage Aluminium-Magnésium à 5% de Magnésium.* (Groupement Français sur le Développement des Recherches Aéronautiques. Rapport Technique, No. 18.) 8vo. Pp. 48, with 16 illustrations. 1945. Paris: Le Groupement Français sur le Développement des Recherches Aéronautiques, 3 rue Léon-Bonnat.
- *Lightfoot, G.** *C.S.I.R.—1945.* 9½ × 7¼ in. Pp. 98, with 20 plates. 1945. Melbourne, Australia: The Council for Scientific and Industrial Research.
- [A review of the work of the Council for Scientific and Industrial Research of the Commonwealth of Australia during 1945.]
- Losana, Luigi.** *Lezione di Chimica Applicata.* Fourth edition. 8vo. Pp. 488, with 180 illustrations. 1946. Turin: V. Giorgio. (L. 650.)
- Mann, W. B.,** Edited by. *Reports on Progress in Physics* (Volume X (1944–45)). Pp. 442. 1946. London: The Physical Society, 1 Lowther Gardens, Prince Consort Road, S.W. 7. (30s., post free.)
- *Morgan Crucible Co., Ltd., The.** *Morgan's at War. A Story of Achievement under Fire.* 9 × 6½ in. Pp. 76, with many illustrations. 1946. London: The Company, Battersea, S.W.11.
- Newmark, Maxim.** *Dictionary of Science and Technology in English, French, German, and Spanish.* Pp. 386. 1946. London: Sir Isaac Pitman. (30s.)
- Pendred, L. St. L.** Edited by. *Kempe's Engineers' Year Book.* Pp. 2897. 1946. London: Morgan Bros. (45s.)
- *Perrault, Robert.** *Le Cobalt.* Préface de Pierre Chevenard. 16 × 25 cm. Pp. viii + 151, with 26 illustrations (and a bibliography of 141 references). 1946. Paris: Dunod. (390 fr.)
- Prot, M.** *Recherches sur les Propriétés Mécaniques des Métaux.* (Publications scientifiques et techniques du Ministère de l'Air, No. 196.) 27 × 18.5 cm. Pp. iv + 121, with 115 illustrations. 1945. Paris: Gauthier-Villars.
- Reinberg, Thelma.** *A.S.M. Review of Metal Literature. Vol. I.* 1944. Pp. 699. 1945. Cleveland, O.: American Society for Metals, 7301 Euclid Avenue. (\$15.00.)
- *Simons, Eric N.** *Saws and Sawing Machinery.* 8vo. Pp. viii + 224, with 145 illustrations. 1946. London: Sir Isaac Pitman and Sons, Ltd. (15s. net.)
- *Scientific Instrument Manufacturers' Association of Great Britain, Ltd.** *Handbook and Classified Index of Instruments.* Demy 8vo. Pp. 73. 1946. London: The Association.
- Sproull, W. T.** *X-Rays in Practice.* 8½ × 5½ in. Pp. 615, with 304 illustrations. 1946. New York: McGraw-Hill Book Co., Inc. (\$6.00.)

- Strong, R. K.** Edited by. *Kingzett's Chemical Encyclopædia. A Digest of Chemistry and Its Industrial Applications.* Seventh edition. 8vo. Pp. x + 1092. 1945. London: Baillière, Tindall, and Cox. (45s.)
- U.S. Navy Department: Bureau of Ships.** *Foundry Manual: Melting and Moulding of Ferrous and Non-Ferrous Metals and Alloys.* Pp. 157. 1945. Washington, D.C.: Government Printing Office. (45 cents.)
- Walker, R. C.** *Electronic Equipment and Accessories.* Pp. viii + 394, with illustrations. 1945. Brooklyn, N.Y.: Chemical Publishing Co. (\$6.00.)
[Principles of electronics and their application in industry.]
- Wilson, W.** *The Cathode-Ray Oscillograph in Industry.* Second, revised edition. Pp. xii + 244, with 194 illustrations. 1946. London: Chapman and Hall. (18s.)
- Wood, Alexander.** *The Cavendish Laboratory, Cambridge.* 17 × 10 cm. Pp. 59, with 4 plates. 1946. Cambridge: The University Press.
- Young, C. B. F., and K. W. Coons.** *Surface Active Agents: Theoretical Aspects and Applications.* Pp. 381. 1945. New York: Chemical Publishing Co. (\$6.00.)

NEW JOURNALS.

- Hutnické Listy.** Official organ of the Czechoslovakian Foundryman's Association. Published monthly by the Association at 8, Mucednická, Brno-Zabovresky. Short reviews of papers appear in English, French, and Russian. (150 CS crowns per year.)
- Manufacturing and Management.** Published monthly by the Tait Publishing Co. Pty., Ltd., 349, Collins Street, Melbourne, Australia. First issue published 15 July 1946. (10s. per year.)
- Métaux et Civilisations.** (Les Métaux dans l'Histoire, les Techniques, les Arts.) Published in French six times a year by Éditions Métaux, 32 rue de Maréchal Joffre, Saint Germain-en-Laye (S.-et-O.), Paris. First issue published 1945. (500 fr. per year.)

XXV.—BOOK REVIEWS

- Saws and Sawing Machinery.** By Eric N. Simons. 8vo. Pp. viii + 224, with 145 illustrations. 1946. London: Sir Isaac Pitman and Sons, Ltd. (15s. net.)

This book contains valuable information on all types of saws and sawing machinery, and should prove useful to users and purchasers alike. It contains not only descriptions and specifications of a wide range of the most modern sawing machines for various purposes, but also gives expert information on the proper use and running of each. Important innovations dealt with are hydraulic sawing, segmental saws, tungsten-carbide-tipped saws, and improvements in the form of teeth, methods of sharpening, and the quality of steel used for blades. No type of saw appears to be omitted, for detailed attention is given to hand, power, wood, metal, circular, hack, band, and contour saws. Two appendices are included, one dealing with methods of guarding most of the types of sawing machines discussed, and the other containing useful information and tables.—J. W. DONALDSON.

- Metal Statistics, 1946.** Thirty-ninth annual edition. Post 8vo. Pp. 816. 1946. New York: American Metal Market, 18 Cliff Street. (\$2.)

This annual volume of statistics has long been recognized as a very complete and reliable reference book. After some useful general information, appropriate statistics (the headings vary, of course, rather widely for the different materials) are given for iron and steel (and manganese ore and alloys; tinplate; and alloying elements—molybdenum, tungsten, and vanadium); fuels; aluminium; antimony; cadmium; cobalt; copper; copper, brass, and bronze products; gold; lead; magnesium; mercury; nickel; platinum metals; silver; tin; zinc; and miscellaneous statistics, which include beryllium.

In your post-war planning
leave your

PRESSING

problems to

FISHER

AND

LUDLOW

LIMITED



Head Offices

Rea Street . . . Birmingham, 5

Established 1852



*Pioneers in Light Alloys
in this country*

"DURALUMIN"
"DURAL"

REGISTERED TRADE MARKS

Telephone :
EAST 1221

JAMES BOOTH & COMPANY, LIMITED

ARGYLE STREET WORKS, NEEHELLS, BIRMINGHAM, 7

Telegrams : BOOTH
BIRMINGHAM, 7

What's the Answer?



THINK

OF IRON AND STEEL
OF THE DAMP AND ACID LADEN
ATMOSPHERE - OF SALT WATER
ACTION AND OF THE CORROSION
AND WASTAGE CAUSED THEREBY

THINK

OF THEIR EXPOSURE TO SUCH
ATTACK AND OF THEIR
PROTECTION AGAINST IT

IF CORROSION IS YOUR PROBLEM

MELLOZING IS THE ANSWER

(METAL SPRAYING PROCESS)

MELLOWES & COMPANY LIMITED
SHEFFIELD · LONDON · OLDHAM
ALSO DEPOTS IN ALL PARTS

ALL COMMUNICATIONS REGARDING ADVERTISEMENTS SHOULD BE ADDRESSED TO THE ADVERTISING MANAGERS,
MESSRS. T. G. SCOTT & SON, LTD., TALBOT HOUSE, ARUNDEL STREET, LONDON, W.C.2.

PRINTED IN GREAT BRITAIN BY RICHARD CLAY AND COMPANY, LTD., BUNGAY, SUFFOLK.