

to Whewell for advice on various points, especially in regard to textbooks, for he felt that the textbooks used at Cambridge would be useless for his class at Edinburgh, owing to the then low state of mathematical knowledge among Scottish students. He consulted Whewell on many points in natural philosophy and mechanics, and towards the close of his first session, on March 29, 1834, wrote to Whewell: "I find the greatest advantage from having been obliged to study these subjects in a way necessary to convey a precise idea of them to others; which I feel that almost no other circumstance would have induced me to spend so much labour upon. . . . A month hence, I shall have finished my course, and then propose to escape for a little relaxation. I shall probably go to London, and hope to see you. I am certainly relieved at having got well through so much of my course. The responsibility I felt was oppressive. But my labours have been more than rewarded by the efforts of my pupils, and the obvious improvement in the method and degree of study which has been the consequence. I have given about twenty lectures to the more advanced, going as far as 'Poisson's Demonstration of the Direct Problem of Central Forces', which, humble as it may appear to you, is a step among us 'hyperborean sages'."

Steam Road Carriages

In the first third of last century, steam road carriages were made by many inventors, including Trevithick, Gurney, Hancock, Church, James, Squire, Maceroni and Dance, and some of the vehicles were used for regular passenger services. Two other pioneers were Richard Roberts and John Scott Russell. A carriage made by Roberts made an experimental trip in December 1833, followed by a second three months later. On March 29, 1834, the *Manchester Advertiser* said, "on Thursday the carriage started from the works in Falkner-street at half-past six in the evening under the guidance of Mr. Roberts, with upwards of forty passengers. It proceeded about a mile and a half up Oxford-road, namely, to near the end of Nelson-street, where owing to an apprehension of a deficiency of water, a sudden turn was made. The breadth of the road at this point was insufficient to allow of free scope for the engine, and about six minutes were occupied in making the turn. The carriage then proceeded back to the works where it arrived without accident just nineteen minutes after starting. The maximum speed on a level was twenty miles per hour." On April 4 the carriage was taken out again, but the trial was stopped through the failure of the boiler tubes.

Of Russell's carriage the *Weekly Dispatch* of March 30 said: "A new steam-carriage [Mr. Russell's] commenced plying between Glasgow and Paisley on Wednesday. The carriage is attended by a supplementary vehicle containing the necessary supply of charcoal and water. The carriage is superbly fitted up, holds six inside and twenty outside passengers, and is hung upon springs, quite free of the boiler and machinery. The boiler is extremely small and occupies the space immediately below the carriage while the boot contains the engines. The boiler is capable of generating steam in twenty minutes. The two engines fourteen horse power each situated above the hind axle are connected with it by cranks working at right angles to one another so as to produce continuous rotary motion."

Societies and Academies

LONDON

Institute of Metals (Annual General Meeting), March 7. G. A. HANKINS and C. W. ALDOUS: Minimum dimensions of test samples for Brinell and diamond pyramid hardness tests. The metals investigated include copper, brass, aluminium and steel. A width of test-specimen of $4\frac{1}{2}$ times the diameter of the impression is satisfactory for accurate Brinell tests. For Brinell tests, the limiting value of the ratio of thickness of test sample to depth of impression for accurate results appears to be a characteristic of the test material; a value of the ratio of 6 is required for mild steel, about 15 for copper and more than 20 for spring steel. For diamond pyramid hardness tests a limiting value of the ratio of test-sample thickness to impression diagonal of $1\frac{1}{2}$ gives results which are practically independent of test-sample thickness except with soft copper and soft brass. I. G. SLATER: Note on the influence of gases in an 8 per cent copper-aluminium alloy on normal and inverse segregation. In a sand-cast ingot, 3 in. in diameter by 3 in., segregation is inverse with very gassy melts but normal with degassed melts. GILBERT RIGG: The diffusion of zinc and iron at temperatures below the melting point of zinc. When clean rolled zinc sheet is heated in close contact with clean iron, diffusion commences at below 300° C. and is fairly rapid at above 380° C.; it proceeds by the formation of cones of diffusion products, which spread out from isolated points where the contact between the metals is most perfect, and gradually penetrate into the zinc and across its surface. Two well-defined layers of diffusion products are formed, a thin layer of constant thickness (about 0.08 mm.) containing about 17 per cent iron being next to the iron, and a thicker layer containing 0-11 per cent iron outside this. On continued heating, the thin layer moves towards the zinc, being continuously converted into the zinc-rich layer; this would seem to indicate that the principal diffusion constituent is the iron. H. G. GOUGH, H. L. COX and D. G. SORWORTH: A study of the influence of the intercrystalline boundary on fatigue characteristics. With the object of studying the process of fatigue in relation to crystalline boundaries, tests under alternating torsional stresses have been made on three specimens of aluminium each consisting of two crystals. The distribution of slip bands showed that the effect of the boundaries on the distribution of stress was extremely slight, each crystal of each specimen behaving as if it alone composed the whole specimen. It appears that the presence of intercrystalline boundaries may considerably strengthen the constituent crystals against fatigue; but that the effect of the boundaries on the distribution or even on the amount of slip is very small. It is probable that the major effect of the boundary may lie in some restriction of strain that it imposes. C. E. PEARSON: The viscous properties of extruded eutectic alloys of lead-tin and bismuth-tin. Elongations up to 2,000 per cent have been obtained in tensile tests employing prolonged loading. An apparatus designed to maintain a constant stress on the test-piece during extension shows that deformation takes place at a uniform rate which is greatest in freshly extruded rods and decreases with age or on annealing. The viscosity is not that of simple liquids, but resembles that shown by some disperse systems in which the viscosity

coefficient is a function of the stress causing flow. The locus of viscous flow is found to be at the inter-crystalline boundaries. E. W. FELL: A note on some formulæ concerning viscous and plastic flow in soft metals. In particular, the flow of the metal in a prolonged ball-hardness test is compared with the flow in tensile test-pieces under a constant stress per unit area of cross-section. A. PORTEVIN and P. BASTIEN: Castability of ternary alloys. The ability of a molten metal or alloy to fill a mould completely is termed 'castability'; it can be determined by ascertaining the length of a spiral cast-iron mould filled by the metal under predetermined casting conditions. The castability of a pure metal is a linear function of the difference between the pouring temperature θ and the melting point F ; the slopes of the castability ($\theta - F$) curves vary with the viscosity of the metal. The castability of binary alloys varies with the solidification range and with the mode of crystallisation, being greater when polyhedral crystals separate than when the primary crystals are dendritic. Maximum castability occurs with the eutectic composition and minimum at the limit of solid solubility. The castability of ternary alloys generally varies inversely with the primary solidification range.

PARIS

Academy of Sciences, January 29 (C.R., 193, 409-512). E. JOUGUET: Generalisation of the problem of the refraction of adiabatics. ARMAND DE GRAMONT and DANIEL BERETZKI: A property of triode valves. CHARLES NICOLLE, PAUL GIROUD and MME. HELENE SPARROW: The exceptional presence of the murin virus in the urine of rats experimentally infected with this virus. In two experiments out of ninety-three, positive results of infection by urine were obtained. LOUIS ROY: The focal image of stars. MME. HILDA GEIRINGER: A general method of theoretical statistics. FRANCESCO SEVERI: The general theory of correspondences between two algebraic surfaces. PAUL LÉVY: A generalisation of Rolle's theorem. M. HAIMOVICI: Fundamental formulæ in the theory of hypersurfaces of a Finsler space. ROBERT GIBRAT: The solutions of a fairly general class of singular integral equations. JEAN LERAY and ALEXANDRE WEINSTEIN: A problem of conformal representation set by the theory of Helmholtz. PAUL BOISSEAU: New integrals and differentiators. P. SONIER: Charged and compressed thin plates. E. CRAUSSE: Contribution to the study of the vibration of a metallic tube immersed in a liquid in a transitory state. C. POPOVICI: The analytical explanation of air pockets. W. M. ELSASSER: The equations of motion of a neutron. N. SALTYSKOW: The canonical transformation of Lagrange equations on the movement of several bodies. J. ELLSWORTH: The variation of the period of the double system, R. Canis Majoris, with eclipses. Supplementing the theory of Tisserand with the effect of aberration, the spectroscopic and photometric results can be satisfactorily explained. FLORIAN LA PORTE: The use of radiogoniometric bearings at a great distance. E. BARRILLON: Geometry of the vessel. Extension of the metacentric method by the use of metacentric sections. AL. PROCA: The quantum mechanics of photons. Pauli's approximation. L. GOLDSTEIN: The theory of elementary corpuscles. ELIGIO PERUCCA: The conductivity of metallic films in an electric field. Using extremely thin films of gold and platinum, deposited by cathode sputtering on quartz

threads, variations of resistance with variations of an external electric field were measured. For certain thicknesses of film the change in resistance amounted to 40 per cent. CH. LAVANCHY: A general method for calculating high voltage electrical networks interconnected in a state of permanent equilibrium. G. CARPENISEANU: The anodic oxidation of the lactic ion to the pyruvic ion. Study of the conditions under which the anodic oxidation of sodium lactate to pyruvate can take place. The yields of pyruvate are always small. LÉON CAPDECOMME: The use of vacuum cells for the comparison of feeble light intensities. GUY EMSCHWILLER: The chemical action of light on vinyl iodide. Vinyl iodide on photolysis gives acetylene, ethylene and iodine as primary products. In the presence of oxygen, besides iodine, formic acid, formaldehyde, glycolic aldehyde, carbon monoxide and dioxide and some acetylene are produced. JEAN LOUIS DESTOUCHES: Theoretical remarks on the emission of corpuscular rays (β -rays or positrons) and on the symmetry between corpuscles and anticorpuscles. L. DOMANGE: The densities of aqueous solutions of hydrofluoric acid. The determinations were made in a gravity bottle of bakelite, a material which was proved to be unattacked by the acid. Data are given for twelve strengths of acid between 5 and 54 per cent. E. CANALS, MME. G. CAUQUIL and P. PEYROT: The molecular diffusion of light in liquids. JULES GUÉRON: The hydrolysis of solutions of stannic chloride. R. CHARONNAT and L. DEGLAUDE: The criteria of purity of crystallised digitaline (digitoxoside). The authors regard the specific rotatory power as the best criterion of purity. G. DARZENS and MAXENCE MEYER: New methods of preparation of diethoxyacetone and the β -substituted α -diethylines. MARCEL GODCHOT, MAX MOUSSEON and ROBERT GRANGER: The action of hypochlorous acid on active 1-methyl- Δ_3 -cyclohexene. RENÉ JACQUEMAIN: Some tertiary alcohols derived from mesityl oxide. V. LEBEDEF and G. CHOUBERT: New observations on the minerals of Niari (A.E.F.) basin. L. BARRABÉ: The outcrop of the ancient base of the Petites Antilles in the island of Désirade (Guadeloupe). J. BLAYAC, A. MICHEL-LÉVY and M. THORAL: A basic conglomerate in the Cambrian of the Monts de Lacane and on the pre-Cambrian age of the granitic formations of the Mendic near Graissac (Hérault). C. DAUZÈRE and J. BOUGET: The variations of the conductivity of the air in caves. Although the temperature and hygrometric state of the air in caves remain very nearly constant, the electrical conductivity of the air undergoes variations of considerable amplitude. J. GAUZIT: The study of the atmospheric ozone at the Pic du Midi by direct vision of the sun at the horizon. The data given were based on spectrophotometric observations. HUBERT GARRIGUE: The radioactivity of the air of the house at the Observatory of the Pic du Midi. LÉON LEMMEL: The spectroscopic study of the wood of the "Pino Sylvestre" of Rascafria (Spain). In addition to the elements which would be expected, the presence of boron, lead and silver was proved. GEORGES DEFLANDRE: The existence on the flagellæ of lateral or terminal filaments (mastigonemes). HERBERT H. JASPER and ANDRÉ PEZARD: The relation between the rapidity of a striated muscle and its histological structure. J. VELLARD, OSWINO PENNA and MIGUELOTE VIANNA: The comparative action of the poisons of *Lachesis atrox* and of *Naja tripudians* in experimental sarcoma in the rat. P. BRUÈRE: Proportions and distribution of manganese in the

grain of wheat. THÉODORE POSTERNAK: A hexose phosphoric acid obtained by the hydrolysis of starch. G. RAMON and E. LEMÉTAYER: Infectious anæmia of the horse. MARCENAC: The anthelmintic power of certain chlorine compounds of butane in cylicostomosis of the horse. Dichlorbutane and chlorobutene have powerful anthelmintic properties and possess advantages over other products usually prescribed for the treatment of cylicostomosis of the horse.

COPENHAGEN

Royal Danish Academy of Sciences and Letters, Oct. 20. TH. MORTENSEN. The marine fauna of St. Helena. It is demonstrated through the study particularly of the echinoderms, based on collections made during investigations at St. Helena in 1929, that the marine fauna of the island originated from three different sources: North Africa-Mediterranean, West Indies-Brazil, and South Africa-Indian Ocean, the various forms having been transported to the island by means of currents, either as pelagic larvæ or as adults, on floating Algæ. The island has never been in connexion with either Africa or South America. The statements of the existence of manatees at St. Helena in recent or pleistocene times—which would seem to prove the existence of former land-connexion—rest on misapplication of the name 'manatee' to sea-lions (see also NATURE, March 17, p. 417).

November 17. JOHS. LINDHARD: The so-called muscle action current experiments on individual muscle fibres show that the action current does not occur when separate fibres are directly stimulated. On the other hand, when the motor end plates are directly stimulated, whether in normal combination with undamaged muscle fibres, or separated from the main mass of fibres, the action current occurs.

December 2. HARALD BOHR: The uniform convergence of Fourier series. A general theorem concerning integration of exponential-polynomials.

January 12. ELIS STRÖMGREN: The use of purely mathematical and of numerical methods in the problem of three bodies.

Forthcoming Events

Monday, March 26

VICTORIA INSTITUTE, at 4.30.—G. R. GAIR: "The Cradle of Mankind".

ROYAL GEOGRAPHICAL SOCIETY, at 5.30.—"A Survey Ship on the Coast of Labrador" (Geographical Film).

Tuesday, March 27

ROYAL AERONAUTICAL SOCIETY, at 6.30.—Annual General Meeting.

ROYAL SOCIETY OF ARTS, at 4.30.—Miss Margery Perham: "Some Problems of Indirect Rule in Tropical Africa". (Joint Meeting with the African Society.)

Wednesday, March 28

ROYAL METEOROLOGICAL SOCIETY, at 5.30.—Prof. W. Schmidt: "Micro-Climatological Work in Austria".

Official Publications Received

GREAT BRITAIN AND IRELAND

University of Leeds. Twenty-ninth Report, 1932-33. Pp. 160. Publications and Abstracts of Theses by Members of the University during Session 1932-33. Pp. 81. (Leeds.)

Ministry of Health: Advisory Committee on the Welfare of the Blind. Handbook on the Welfare of the Blind in England and Wales. Revised edition. Pp. iv+50. (London: H.M. Stationery Office.) 1s. net.

Empire Cotton Growing Corporation. Reports received from Experimental Stations, 1932-1933. Pp. xi+234. (London: Empire Cotton Growing Corporation.) 2s. 6d.

The Scientific Proceedings of the Royal Dublin Society. Vol. 21 (N.S.), No. 5: The Oxidation of Hydrazine by Potassium Ferricyanide, Part 1: The Influence of Gaseous Supersaturation on the Measurement of Reaction Velocity; Part 2: The Reaction in Presence of Acetone. By Thomas Norman Richardson and Dr. Kenneth Claude Bailey. Pp. 43-56. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) 1s.

Ministry of Health. Report to the Minister of Health by the Departmental Committee on Qualifications, Recruitment, Training and Promotion of Local Government Officers. Pp. 91. (London: H.M. Stationery Office.) 1s. 6d. net.

The National Institute of Agricultural Botany. Fourteenth Report and Accounts, 1932-33. Pp. 19. (Cambridge.)

OTHER COUNTRIES

Canada: Department of Mines: Mines Branch. Anthracite and Coke Analysis Survey conducted at the Fuel Research Laboratories. (No. 737-5.) Pp. 13. (Ottawa: King's Printer.)

Commonwealth of Australia: Council for Scientific and Industrial Research. Pamphlet No. 47: Properties of Australian Timbers. Part 1: Eight Timbers of the Genus *Eucalyptus* (Ash Group). Collated and edited by H. E. Dadswell. (Division of Forest Products: Technical Paper No. 13.) Pp. 28+10 plates. (Melbourne: Government Printer.)

U.S. Department of the Interior: Geological Survey. Water-Supply Paper 727: Surface Water Supply of the United States, 1932. Part 2: South Atlantic Slope and Eastern Gulf of Mexico Basins. Pp. vii+221. 15 cents. Water-Supply Paper 731: Surface Water Supply of the United States, 1932. Part 6: Missouri River Basin. Pp. x+349. 20 cents. Water-Supply Paper 733: Surface Water Supply of the United States, 1932. Part 8: Western Gulf of Mexico Basins. Pp. vi+197. 15 cents. Water-Supply Paper 739: Surface Water Supply of the United States, 1932. Part 12: North Pacific Slope Basins. C: Pacific Slope Drainage Basins in Oregon and Lower Columbia River Basin. Pp. vi+167. 15 cents. (Washington, D.C.: Government Printing Office.)

Cornell University Agricultural Experiment Station. Bulletin 577: The Rate of Photosynthesis of Apple Leaves under Natural Conditions, Part 1. By A. J. Heinicke and M. B. Hoffman. Pp. 32. Bulletin 578: The Effect of Different Planes of Protein Intake upon Milk Production. 2: Further Comparisons of 16-, 20- and 24- per cent Mixtures. By E. S. Harrison, E. S. Savage and S. H. Work. Pp. 12. Bulletin 579: The Diagnosis and Control of Mastitis. By D. H. Udall and S. D. Johnson. Pp. 15. Memoir 150: Biochemistry and Biophysics of the Developing Hen's Egg. 2: Influence of Composition of Air. By Alexis L. Romanoff and Anastasia J. Romanoff. Pp. 36. (Ithaca, N.Y.)

Bergens Museum. Årsberetning, 1932-1933. Pp. 90. Årbok, 1933. Hefte 2: Naturvidenskapelig rekke. Pp. 255+5. (Bergen: A.S. John Griegs Boktrykkeri.)

Fiskeridirektoratets Skrifter, Serie Havundøkelser (Reports on Norwegian Fishery and Marine Investigations.) Vol. 4, No. 4: On the Age and Growth of the Pollack (*Gadus pollachius* L.) from the Norwegian Skagerrack Coast. By Alf Dannevig and Adolf Sørensen. Pp. 16. Vol. 4, No. 5: Nogen iakttagelser over fiskeyngel i trålfangster i Barentshavet. Av Thor Iversen. Pp. 12. Vol. 4, No. 6: A Norwegian Fat-Herring Fjord; an Oceanographical Study of the Eidsfjord. By Jens Eggvin. Pp. 22. Vol. 4, No. 7: Torsken og Fiskehavet 1933 (The Cod and the Sea in 1933). Pp. 27+1 plate. (Bergen: A.S. John Griegs Boktrykkeri.)

Science Reports of the Tokyo Bunrika Daigaku, Section B. No. 15: The Herpetological Fauna in the Vicinity of Nikkō, Japan. By Yaichirō Okado. Pp. 159-173. 30 sen. No. 16: Habitat Notes on the Freshwater Pearl-Mussel, *Margaritana margaritifera* (Linné) in Hokkaidō, Japan. By Kazuo Koba. Pp. 175-180. 15 sen. No. 17: Über einige neue Cillaten aus dem Darmkanal von japanischen Echinoideen (1). Von Mitsuo Uyemura. Pp. 181-191. 20 sen. No. 18: On the Syngamy of some Myxomycetes. By Seiji Abe. Pp. 193-202. 15 sen. (Tokyo: Maruzen Co., Ltd.)

Fiftieth Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution, 1932-1933. Pp. 7. (Washington, D.C.: Smithsonian Institution.)

The Parliament of the Commonwealth of Australia, 1932-33. Seventh Annual Report of the Council for Scientific and Industrial Research for the Year ended 30th June 1933. Pp. 87. (Canberra: Commonwealth Government Printer.) 3s. 8d.

CATALOGUES

Special Sale Catalogue of Important Journals and Periodicals (Scientific, Technical, Medical, Economic). Pp. 20. (London: Oppenheim and Co. (Rare Books), Ltd.)

Periodica, Iconographia, Rara et Curiosa. (No. 85.) Pp. 62. (Berlin: W. Junk.)

A Catalogue of Books and Periodicals on Botany. (No. 485.) Pp. 64. (London: Bernard Quaritch, Ltd.)

Murby's Maps and Models for Geology, including Models of Extinct Vertebrates. Pp. 16. (London: Thomas Murby and Co.)

Bright Annealing by the O.R.P. (Oxide Reduction) Process. Pp. 4. (London: Wild-Barfield Electric Furnaces, Ltd.)

Editorial and Publishing Offices:

MACMILLAN & CO., LTD.

ST. MARTIN'S STREET, LONDON, W.C.2

Telephone Number: WHITEHALL 8831

Telegraphic Address: PHUSIS, LESQUARE, LONDON