

steel tape is driven by synchronous motors at a normal speed of 90 metres per minute, between two drums similar to those used in a cinematograph film projector. In its passage the tape passes in succession through three pairs of special bi-polar electromagnets, which are used in turn for 'wiping-out' any previous record, for recording and for reproducing. The heads carrying the two latter sets of magnets are provided with micrometer adjustments for controlling the separation of the pole pieces, since this adjustment affects the response characteristics. The three heads of the apparatus are connected by screened twin leads to their appropriate places on the amplifying and control panels, and means are provided for obtaining the correct level required for recording and reproduction. The recording magnet is also supplied with auxiliary direct current to operate the tape at the best part of the magnetisation characteristic for recording. A suitable audio-frequency correcting circuit is connected in the reproducing amplifier, and the proximity of the recording and reproducing heads on the apparatus enables an instantaneous comparison to be made between the input signals and the output from the equipment.

The magnetic record, once made, is permanent and may be utilised any number of times until it is wiped out by the demagnetising process for use on another programme. The whole process now finds widespread application in broadcasting services, particularly for the relaying of important or interesting programmes at different times.

University and Educational Intelligence

CAMBRIDGE.—J. Yudkin, of Christ's College, has been appointed to the Benn W. Levy research studentship in biochemistry.

Smith's prizes have been awarded to the following candidates: K. Mitchell, of Peterhouse, and A. J. Ward, of Emmanuel College.

Rayleigh prizes have been awarded to M. S. Bartlett, of Queen's College, and C. G. Pendse, of Downing College.

Grants from the Worts Fund have been made as follows:—£50 to N. Bachtin towards the expense of a journey to North Thessaly, £50 to I. H. Cox towards his expenses as geologist in the Parry Islands, £50 to J. J. Keigwin towards the expenses of an expedition to the Zambezi Valley, £50 to P. W. Richards towards the expense of a botanical expedition to South Nigeria, £40 to W. Graham-Smith for palaeontological investigations in Canada, £25 to C. W. Borgmann for metallurgical research in Sweden, £25 to J. W. S. Pringle towards the expenses of the Cambridge Freshwater Biological Expedition to South Morocco, £10 to J. W. Welch for expenses in connexion with his study of the Qaoko tribe.

The managers of the Balfour Fund have made a grant of £50 to C. Forster-Cooper, of Trinity Hall, for researches on the fauna of the Achenarass Quarries.

J. H. Lochhead, of Christ's College, has been nominated to use the University's table at the Zoological Station at Naples from April 1 until September 30, 1934.

LEEDS.—The Vice-Chancellor, on behalf of some two hundred subscribers, presented on March 9 to Prof. Walter Garstang a radiogramophone and a cheque, as a token of appreciation from colleagues,

pupils and other friends at Plymouth, Oxford, Lowestoft and Leeds. Prof. Garstang retired from the chair of zoology last year.

LONDON.—The following degrees have recently been awarded: D.Sc.(Econ.) to A. E. Feavearyear (private study) for two published works entitled "The Pound Sterling. A History of English Money", and "Spending the National Income"; and D.Sc. in physics to W. E. Williams (recognised teacher at King's College) for ten works on interferometry.

SHEFFIELD.—The following appointments have been made: Dr. E. J. Wayne, to the chair of pharmacology; Dr. James Clark, to the lectureship in infectious diseases; Mr. H. Laithwaite, as junior research assistant in the Department of Glass Technology.

THE Board of Education is prepared to consider applications for full-time studentships from teachers with at least five years' teaching experience who desire financial assistance to follow courses of advanced study at universities or other institutions at home or abroad. Particulars of the awards and application forms are obtainable from the Board of Education, Whitehall, S.W.1.

Science News a Century Ago

Capt. John Ross Honoured

In 1829, thanks to the generosity of Sheriff Felix Booth, Capt. John Ross had been able to fit out the steam vessel *Victory* for arctic exploration. Ross sailed in May 1829 and returned home in October 1833 in the *Isabella*, the *Victory* having had to be abandoned in the ice. On March 27, 1834, at a Court of Common Council, Ross was presented with the freedom of the City of London. In making the presentation, Sir James Shaw, the Chamberlain of the City, said: "Captain Ross—The City of London have ever been forward in bestowing the honour of their freedom on eminent men who have distinguished themselves in the service of the public. In your person science has been largely and specially indebted for the zeal, public spirit and disinterestedness shown by you in fitting out and taking charge of an expedition, with the patriotic view to the solution of the problem whether a north-west passage existed to the Pacific. For the courage and perseverance which have marked the whole of your proceedings in this hazardous enterprise, and for the admirable skill and address manifested by you, with the blessing of Heaven, in preserving life and health and harmony amongst your brave companions, amidst the privations and hardships of four years' navigation in the Arctic regions;—for these services the Corporation of London have recorded their grateful thanks by presenting you with the freedom of their ancient city in a box of British oak."

J. D. Forbes at Edinburgh

When J. D. Forbes in 1833 was appointed to succeed Sir John Leslie as professor of natural philosophy in the University of Edinburgh, he was not twenty four years of age and had held no appointment before. When preparing his lectures, he wrote

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. SOPWITH: 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