

anode circuit of the main valve. When variations take place in the control anode at speech frequency, very large surges are set up in that of the power valve, which may approximate to the original high-tension direct-current potential, and so sweep the output from nearly double its steady value to zero. The standard R.A.F. set is of the 20-watt size, with a high-tension supply of 600 volts direct current. A great advantage in the system for aeroplane work is that no critical adjustments are required. The arrangement of the apparatus is such that the set proper can be mounted in any convenient position, and only a very small control unit brought within reach of the user's hand. One switch makes or breaks the dynamo field, filament, and microphone circuits. A great deal of experiment was necessary before a suitable microphone was found, as it had to be almost insensible to sounds of "noise" intensity, but responsive to the powerful concentrated waves of a voice impinging upon it at a very short distance.

The receiving set depended upon high-frequency magnification, and was, in its first form, a three-valve arrangement. It consisted essentially of a detector valve with reaction and two note magnifications. The detector valve was not energised direct from the aerial, but through an aperiodic circuit, which was a circuit approximately syntonised by its self-capacity. The final adjustment for obtaining the best effect is made on a rheostat in the filament circuit carried on the "joystick" itself. These three-valve sets were employed to a considerable extent both before and after the armistice, but a five-valve receiver was developed later in which a choice was made of two high-frequency magnifications and two low, with a detector valve. This set was very much more sensitive than the three-valve arrangement, and enabled fixed aerials rigidly connected to the wings and fuselage to replace the trailing aerial, which latter was a great embarrassment in fighting. The normal safe range of the apparatus is about four miles from machine to machine, while the range to a ground station is from twenty to fifty miles or more. The author anticipates that in the future the wireless apparatus will be able to be plugged through on to the ordinary exchange lines, so that a man sitting in his office will be able to hold a conversation with a machine in the air.

Magnetic Storm of March 4-5.

THE Director of the Meteorological Office has been good enough to send us the subjoined communication from Dr. Chree concerning a magnetic storm which occurred on March 4 and 5. It may be mentioned that on these days the sky was mostly overcast in Scotland, though there was very fine weather in the South of England. We are informed that the only aurora observation reported so far was made at Aberdeen at 1h. 30m. on March 4, *i.e.* ten hours before the "sudden commencement" of the storm:—

"A considerable magnetic disturbance was recorded at Kew Observatory on the night of March 4-5.

"There was a well-marked S.C. (sudden commencement) at about 11h. 40m. on March 4. This was of an oscillatory character both in D (declination) and H (horizontal force). The first, smaller, movement was a fall in H and an easterly swing in D, the range of the oscillation being about 45 γ in H and 7' in D. H retained an enhanced value for four or five hours after the S.C., and no really large movements occurred until after 17h. on March 4. The most disturbed time was from 18h. on March 4 to 9h. on March 5. On the whole, H was falling from

17h. on March 4 until after 2h. on March 5, the maximum being recorded at about 16h. 20m. on March 4, the minimum at about 2h. 5m. on March 5, and the range being approximately 300 γ . The H curve had become quiet before 10h. on March 5, but still showed a depression of about 75 γ .

"The D trace was off the sheet, in the direction answering to easterly displacement, for fully twenty minutes between 22h. and 23h. on March 4; so the range recorded, 60', may have been considerably exceeded. The maximum westerly displacement occurred at about 18h. 35m. on March 4.

"From 12 $\frac{1}{2}$ h. to 17 $\frac{1}{2}$ h. on March 4 the D trace was practically normal except that the declination was 1' or 2' more westerly than usual. Thus the disturbance was rather a conspicuous example of the lull that not infrequently intervenes between the S.C. and movements that would be recognised as constituting a magnetic storm."

University and Educational Intelligence.

CAMBRIDGE.—Mr. E. V. Appleton, of St. John's College, has been appointed an assistant demonstrator in experimental physics.

It is proposed to confer the honorary degree of D.Litt. on the Abbé Henri Breuil, professor of the Institute of Human Palæontology at Paris.

It is proposed to create a readership in the morphology of vertebrates and a lectureship in zoology in place of the present readership in zoology.

Besides additions and improvements to the chemical laboratory and the erection of the Molteno Institute for Parasitology, other building schemes are in view for engineering, physics, and also for the University library. The last proposal to meet the difficulty of finding room for books was to excavate a large underground chamber. The cost of this has been found to be prohibitive, and the Senate has recently discussed a revival of an old scheme to erect a new building akin to the Senate House and on the south side of Senate House Yard. If this scheme is adopted a public appeal will be made for subscriptions towards the erection of the building.

LEEDS.—Mr. W. E. H. Berwick has been appointed lecturer in mathematics in the University. Mr. Berwick was assistant lecturer in the University of Bristol for two years, and afterwards became lecturer in mathematics in University College, Bangor. For two years he was engaged on the technical staff of the Anti-Aircraft Experimental Section of the Munitions Inventions Department at Portsmouth, where he made important contributions to the experimental and computational theory of gunnery. He has published a long series of papers in the Proceedings of the London Mathematical Society and elsewhere.

OXFORD.—Prof. R. A. Sampson, Astronomer Royal for Scotland, has been appointed Halley lecturer for 1920.

The governors and trustees of Tancred's studentships propose to elect a student in physic at Gonville and Caius College, Cambridge, at Whitsuntide. The annual value of the studentship is about 95*l.* Particulars are obtainable from Mr. E. T. Gurdon, 28 Lincoln's Inn Fields, W.C.2.

The sixth annual report of the Carnegie United Kingdom Trust is an account of the work done by the Trust in 1919, and contains a statement of income and expenditure for the year. The committee had hoped that the coming of peace would have brought with it a great opportunity for institutions which

exist for philanthropic purposes. But the first year of peace has been a disappointment. Building operations, which form a very large part of the activities assisted by the Trust, are kept back because building is now so costly. The outstanding obligations already undertaken by the Trust are sufficient to absorb the greater part of the available income during the next five years. It is evident that further sums will be required to supplement grants already made for building libraries. The committee is, therefore, disinclined to consider new requests for grants in aid of library building. The committee considers that the assistance given to rural library schemes is among the most important and satisfactory of the Trust's activities. Under these schemes a box containing fifty books is sent to a small town or village and there used as a lending library until, the books having been read, it is time to exchange them for a fresh supply. Reports from those in charge of rural centres show that the scheme really provides a means for spreading education in thinly populated districts. The Carnegie Trust has made a grant towards the maintenance of the School of Librarianship recently established at University College, London. The highly trained students who pass through this school should do much to make our libraries more useful. The committee of the Carnegie Trust also reports on the part it has taken in physical welfare schemes and in the promotion of music.

An appeal has just been issued by the University of London through its Military Education Committee inviting subscriptions to the war memorial which it is proposed to raise to the former officers and cadets of the University of London Officers Training Corps who have fallen in the war. The services rendered by the Officers Training Corps during the war are too little known or appreciated. When war broke out the cadets came forward practically as one man, and to their heroism and the unremitting labours (often in the teeth of great discouragement and difficulties) of their pre-war instructors we owe the fact that what might have proved a most dangerous gap in the supply of officers during the earlier part of the war was successfully bridged. The record of the University of London contingent appears to be second to none. The number of past and present officers and cadets who served in the war as officers is 4197, of whom we have to deplore the loss of no fewer than 657. The number of distinctions gained is 1650, including five V.C.'s (the only two surviving V.C.'s, Major Cloutman and Major White, both graduates of the University, are honorary secretaries of the appeal). In particular the gratitude of Londoners must go out to Major Sowrey, who brought down a Zeppelin in flames, and later a Gotha aeroplane. The scheme is to include a memorial in London, and, in addition, a permanent hall in connection with the new standing camp of the University of London O.T.C. at Great Kimble, near Princes Risborough, where special memorials to individuals may be put up, of which the first will commemorate Lt.-Col. Arthur Egerton, Coldstream Guards, the first adjutant of the contingent, whom all the original officers and cadets mourn as a personal friend. The appeal committee is a strong one, and includes many honoured names outside the University itself—in particular, those of Marshal Foch and of Field-Marshal Lord French and Sir Henry Wilson. It is to be hoped that every patriotic person who realises the part played by the British universities in the great national struggle and the importance of maintaining this splendid tradition will contribute generously towards the 30,000l. asked for. Contributions should be sent to the hon. treasurer at 46 Russell Square, London, W.C.1.

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Societies and Academies.

LONDON.

Royal Society, February 26.—Sir J. J. Thomson, president, in the chair.—L. F. Richardson: Some measurements of atmospheric turbulence. The eddy-shearing stress on the ground is deduced from pilot-balloon observations. Values on land in any consistent dynamical units are found to range from 0.0007 to 0.007 times the value of m^2/ρ , where m is the mean momentum per volume up to a height of 2 km. and ρ is the density. Evidence is given to show that the eddy viscosity across the wind at Lindenberg increases with height, and, except near the ground, is much greater than the eddy viscosity along the wind. In parts iv. and v. the spreading of a lamina of smoke is considered. Osborne Reynolds's eddy stresses are studied. For one occasion an attempt was made to measure simultaneously all six components of stress by observing the motion of thistledown. The three direct stresses are easily measured. Not so the shearing stresses; however, one was found to be 2.4 times its probable error. The theory of the scattering of particles is summarised, and numerical values are derived from scattering. The "turbulivity" ξ is estimated from the rising cumuli in calm weather and found to be 10^6 , applicable only in the sense of friction. Thus the whole range of ξ observed in the free atmosphere was from seven to a million, in contrast with 0.2 in perfectly still air. The eddy stresses observed have ranged in absolute value from 0.004 to 110 dynes cm^{-2} .—J. H. Hyde: The viscosities and compressibilities of liquids at high pressure. In the first place, experiments were made to determine the change in the value of the kinematical viscosity (η/ρ) of the various oils, and after this investigation was completed apparatus was designed for the determination of the change in density with pressure. The apparatus used for the determination of the kinematical viscosity consisted essentially of a system of two horizontal (the upper one of capillary dimensions) and two vertical tubes forming a closed circuit of liquor under pressure, the lower half of the circuit containing mercury and the upper half the liquid under test. One end of the tubular frame rests on a horizontal knife-edge, and the frame is supported in a horizontal position by a spiral spring. On the mercury being displaced by a given amount, flow will take place round the circuit owing to the difference of head, and it is evident that if the spring be so designed that its rate of extension is equal to the rate of change of head of the mercury, flow of the liquid under test will take place through the capillary tube under a constant pressure-difference and at a velocity which can be calculated from the rate of extension of the spring. In this way all the data required for the determination of the absolute kinematic viscosity of the fluid were determined. The determinations of the variation in density under pressure were made by measuring the decrease in volume of known quantity of the liquid enclosed in a steel cylinder sealed at one end and closed at the other by a long steel plunger. The cylinder and plunger were enclosed in a pressure vessel and the motion of the plunger for any particular pressure was measured. The density was calculated from the decrease in the volume thus measured. From the values of the density (ρ) and those of the kinematical viscosity (η/ρ) obtained for the oils, the values of the absolute viscosity (η) were calculated. The results show that the absolute viscosity of all the oils tested increases considerably with pressure.—A. Russell: The capacity coefficients of spherical conductors. It is proved that the capacity coefficient of a spherical