Letters to the Editor.

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A Simple Method of Investigating Wireless Echoes of Short Delay.

ONE of the two methods most commonly used in the determination of the equivalent height of the Kennelly-Heaviside layer is that involving the measurement of the time required for a brief wireless signal to travel upwards to the reflecting region and back. This quantity is most conveniently determined by causing an emitting station to send out very short pulses of radio-frequency energy, and measuring, at a point a short distance away, the difference between the times of arrival of a particular signal pulse via the ground and via the upper atmosphere.

Various methods of producing the short pulses required have been used,[1] but in all cases a somewhat elaborate modulating device has been necessary. We have found, however, that it is possible to dispense with any special modulating system for controlling the emission from the oscillator and still obtain pulses of satisfactory type. If the grid leak of an ordinary triode oscillator is increased to a relatively high value, the generator itself produces suitable short pulses of radio-frequency energy alternating between uniform periods of quiescence. By adjusting the grid circuit constants, both the duration of the pulse and the duration of the interval between successive pulses may be controlled. This peculiar property of a triode oscillator working with a high grid leak has been previously investigated in connexion with its use for providing a unidirectional time-scale for cathode-ray oscillography.[2]

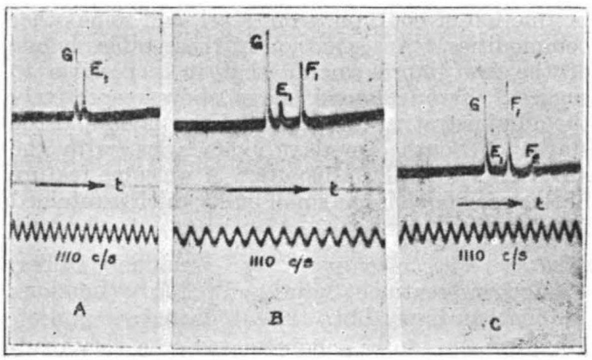

FIG. 1.

Using an emitting station at East London College, London, E.1, working on a wave-length of 80 metres, and emitting pulses of about 0·0003 sec. in duration, spaced 0·02 sec. apart, we have been able to record photographically at King's College, London, W.C.2, 3 miles away, the reception of these pulses and their echoes from the Kennelly-Heaviside layer. A satisfactory arrangement for studying the characteristics of such echoes is to use a dual observational system consisting of a cathode-ray oscillograph and a high-speed recording oscillograph (Duddell type). The received pulses can normally be watched as a recurring image on the cathode ray oscillograph, using a linear time-base of stroke frequency coinciding with the pulse frequency, but, when it is desired to obtain a permanent and more accurate record of any particular combination of echoes, the high-speed oscillograph with a suitable time-scale calibration can immediately be switched into use.

Some specimen records, taken on June 15, between 1800 and 2000 G.M.T. are shown in the accompanying diagrams (Fig. 1). In each case the first impulse (marked G) is that received direct via the ground, the subsequent pulses being due to waves reflected by the upper atmosphere. The records are of interest in confirming results previously obtained in England using the frequency-change method of measuring equivalent heights, in that they indicate reflections from two regions at different heights in the upper atmosphere. Record (a), taken at 1830 G.M.T., illustrates a singly-reflected pulse E_1 from the lower of these two regions (Region E). Record (b), taken at 1850 G.M.T., shows a singly-reflected pulse E_1 from the lower region and a singly-reflected pulse F_1 from the upper region (Region F). Record (c), taken at 1910 G.M.T., shows that, as sunset (2020 G.M.T.) was approached, the singly-reflected pulse E_1 from the lower region was less intense, while that from the upper region F_2 was much more marked. A pulse F_2 indicates double reflection from the upper region.

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June 17.

[1] Breit and Tuve, *Phys. Rev.*, **28**, p. 554; 1926: Tuve and Dahl, *Proc. Inst. Rad. Eng.*, **16**, No. 6, p. 794; 1918: and Goubau, *Phys. Zeit.*, **31**, No. 7, p. 333; 1930.
[2] *Proc. Roy. Soc.*, A, **111**, p. 672; 1926.

The Atomic Weight of Xenon.

BY the kindness of Dr. F. W. Aston, who placed at our disposal 235 c.c. of highly purified xenon, we have been enabled to redetermine the atomic weight of this element.

Using a highly accurate micro-balance, the design of which will be published shortly, we have measured the pressures of xenon and pure oxygen at which the densities of the two gases are equal. This has been done for two different densities, corresponding to pressures of xenon of about 80 and 153 mm. The two ratios PO_2/PXe when all corrections were made were found from two series of very concordant readings to be 4·1035 and 4·1049 respectively at 18° C.

The limiting density is obtained by extrapolating these two ratios linearly to zero pressure, and is 4·1020. At such a low pressure as 80 mm. a linear extrapolation is certainly legitimate, as any curvature would be quite beyond the limit of error of our measurements. Hence the atomic weight of xenon is $4 \cdot 1020 \times 32 = 131 \cdot 26(4)$. The error of measurement does not seem to be greater than $\pm 0 \cdot 005$. This agrees remarkably well with Dr. Aston's value, $131 \cdot 27 \pm 0 \cdot 04$, derived from the measurement of the intensities of the lines of the various isotopes in the mass spectrograph.[1]

The gas supplied to us was originally very pure. It was fractionated a number of times, until further treatment of the heaviest fraction gave no increase in density.