

making the anode supply circuit many times in succession, rotary streamers generally appeared. The distance between the capacitive electrodes was immaterial to inception and appearance, and orientation of the tube with respect to the coil or to a permanent magnet appeared to be without sensible effect. Once started, the discharge was extremely stable, and the envelope temperature was of the order of 40°-50° C.

Occasionally, only about half the distance between the external electrodes would exhibit rotary streamers while the remainder would contain a stationary, co-axial, thicker column (Fig. 3). A rotary discharge also occurred more frequently between the bright rings immediately within the capacitive electrodes and the unconnected sheath electrodes in the bulbs, always with a large number of strands (Fig. 4).

In explanation, I tentatively suggest that the

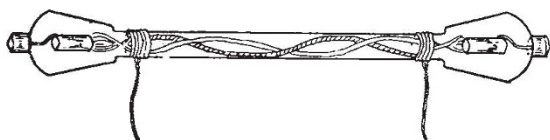


FIG. 2.

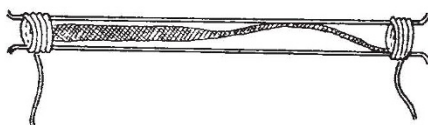


FIG. 3.

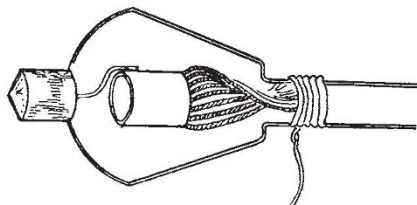


FIG. 4.

electronic displacement current and the corresponding equivalent accelerating potential difference between two points in the gas (between which the displacement current is drifting) are out of phase to an extent depending upon the divergence of natural frequencies of tuned-grid and tuned-anode circuits of the oscillator, and the result is that an electron if it were originally at rest within the tube would describe, in the absence of collisions, a zig-zag path round an annulus inside the walls; the net effect of a large number of electrons doing this gives in general a rotary helical locus of maximum electronic velocity (and therefore of ionisations-by-collision). The suggested effect of phase difference, though a purely *ad hoc* supposition, would appear to be substantiated to a certain extent by equations (7) and (8) given by Darrow in a recent paper on "High Frequency Phenomena in Gases"².

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¹ *Exp. Wireless and Wireless Eng.*, 5, 60, 503; 1928.

² *NATURE*, 120, 510, Oct. 8, 1927.

³ *B.S.T.J.*, 11, 4, 584; 1932.

Hydraulic Seismographs

PROF. KAPITZA has described¹ a balance for the measurement of magnetisation in which he makes use of hydraulic magnification and damping in a very ingenious manner and suggests that the same method may be adopted for the construction of seismographs. In order to explore the possibilities of this type of instrument for the recording of earthquakes a series of comprehensive experiments was carried out by us in the Colaba Observatory.

The apparatus for the recording of the vertical component consists of an inverted cylindrical cup, its lower horizontal face being closed by a thin metal diaphragm and a narrow open tube being attached horizontally fitting a hole in the side in which a mirror is suspended from a horizontal axle. A cylindrical jacket covers the cup all round except the diaphragm at the bottom. A highly viscous oil is then poured into the double chambers, so as to fill up completely the inner chamber, and the diaphragm is then loaded by attaching a weight of 1 kgm. or more to a rod fixed at its centre. The vertical component of the ground movements sets up oscillations in the diaphragm and forces the oil to move to and fro through the narrow tube, and this gives a large oscillatory angular motion to the mirror which is recorded photographically. With a tin diaphragm of thickness 0.019 cm. and diameter 15 cm. loaded with 1 kgm., a period of 2.3 sec. and a damping ratio of 5:1 were obtained when the instrument was filled with castor oil.

The low free period of the system does not make the instrument very sensitive to earthquake waves. It is, however, highly sensitive to artificial vibrations of the ground and gives also good records of the sustained vibrations, such as microseisms. Being a compact and fully assembled portable instrument it should form a valuable equipment for geophysical prospecting.

If the chambers be so arranged that the membrane is in the vertical plane and is loaded with two symmetrical weights fixed at both ends of a horizontal rod passing through its centre, the instrument records the horizontal component of the ground movements. The sensitiveness to earthquakes of the instruments for horizontal and vertical components is increased if the free period of the system is increased by using membranes of very large diameters. A leather or rubber membrane slightly increases the sensitiveness, but generally produces an unstable 'zero'. A detailed account of the investigation will be published in due course.

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¹ *Proc. Roy. Soc.*, A, 131, 224-242; 1931.

Reversal of Current in Rectifier Photo-Cells

WE have noted with interest Mr. Guild's observations on this effect, as recorded in *NATURE* of March 4. In reply to his query, the values given for the relative sensitivities were for an "equal energy spectrum", being obtained by direct comparison with a Moll vacuum thermopile for the different spectrum regions. Any other method of presentation would obviously be valueless, as the energy flux reaching