The same driver causes a drum carrying paper to pass under a pen which is moved by hand along guides parallel to the axis of the drum so that it follows the deflection of the galvanometer spot. The curves in Fig. 1 were obtained in this way: the ordinates, being the deflections of the galvanometer, measure the intensity of the reflected X-rays and the abscissæ give the rotation of the crystal.

The curves were obtained by passing molybdenum $K\alpha$ radiation, filtered through zirconium metal, through a thin plate of gypsum so that orders (400), (800), (1200) could reflect at angles of 8°, 16°, 24° approximately. The crystal turns through 1° in 1·6 minutes and this corresponds to the paper moving forward by 2·8 cm. This enables measurements to be made much more quickly than was possible with the earlier arrangement. The steadiness of the zero is indicated by the line *ab*, which was obtained with the X-rays cut off, and the sensitivity may be estimated from the fact that the X-rays used for the curves shown produced a barely visible fluorescence in a darkened room on a barium platinocyanide screen.

The apparatus is simple to set up and very reliable. Precautions must be taken to shield the valve electrostatically but the galvanometer need not be so protected. The total cost of the apparatus is less than that of the usual electrometer systems used for the same purpose.

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Feb. 25.

IN NATURE of February 25, Mr. J. A. C. Teegan proposed to apply the 'electrometer valve' now produced commercially by the G.E.C. to an X-ray ionisation spectrometer for the amplification of ionisation currents. It may interest him to know that such a valve has been in use for this purpose in this Laboratory for the past eighteen months with success, using a circuit identical in all essentials with that which he describes.

The G.E.C. valve is simpler in construction than the F P 54 pliotron described some years ago by Messrs. Metcalf and Thompson for a similar purpose in the *Physical Review*; I think, however, that it is not quite so sensitive as the American valve.

To take full advantage of the G.E.C. valve used with an ionisation spectrometer, the indicating galvanometer should have a quick period (1 sec.) and sensitivity of the order of 100 divisions per microampere. I do not know whether such a galvanometer can be obtained cheaply; one can be made quite easily, since high resistance in the galvanometer coils (25,000 ohms) is of no particular disadvantage in this circuit.

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High-Frequency Electric Discharge in Gases

IN October 1929, while using a radio-frequency oscillator of the tuned-plate/tuned-grid type (Fig. 1) for exciting the capacitive electrodeless discharge photographed by J. and W. Taylor[1] in gases at low pressure, I observed phenomena which have not, I believe, been elsewhere described.

The frequency employed ranged from 11·1 megacycles sec.$^{-1}$ to 21·4 megacycles sec.$^{-1}$; the valve was a power-oscillator of the *VO* 150 type with 1,800 volts anode potential supplied by accumulators, and the anode current ranged from 150 milliamperes to 160 milliamperes at these frequencies respectively. The anode inductance comprised three to four turns of 12 gauge wire, and to excite the discharge two wires were attached by clips to turns at opposite ends of the coil and their other ends were tightly bound round the ends of an ordinary positive column tube of about 18 cm. cylindrical length by 1·3 cm. internal diameter filled with neon with but slight traces of unknown admixture at approximately 8·0 mm. mercury pressure. The cylindrical sheath electrodes fused into the frusta-conical bulbs at the ends of the tube (Fig. 2) were not connected.

Originally, excitation of luminosity by the method used by Prof. R. W. Wood and A. L. Loomis[2] was in view, but in certain conditions, discharges were obtained of a curious nature: when the plate and grid circuits of the oscillator were closely in tune, a single streamer ran longitudinally through the tube,

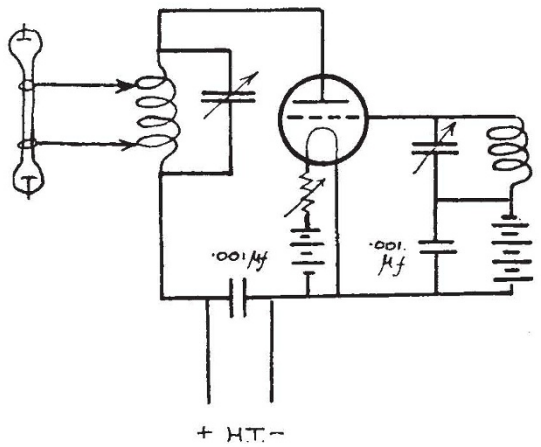

FIG. 1.

but instead of being straight and lying approximately along the axis of the tube, the streamer appeared bent somewhat into the shape of an elongated sine-wave of one complete cycle. When the frequency to which the grid circuit was tuned was slowly caused to diverge from that of the anode circuit, the streamer began to rotate at an accelerating rate about the axis of the tube, the sense of rotation depending upon the direction of divergence. At the same time, the streamer took on a helical conformation of one turn. With increasing divergence the speed of rotation increased until the whole tube appeared filled with glowing gas; with further divergence the discharge resolved itself into two inter-twined helical streamers revolving together but in the opposite sense to that of the single streamer. As the divergence continued to increase the angular velocity of the inter-twined streamers decreased to zero (Fig. 2), reversed and increased again until the tube was filled with a blur of light, and this cycle of phases was repeated with the periodic intercalation of an additional strand to the multiple streamer up to sixteen or seventeen strands, when they became difficult to count.

This discharge was exceedingly difficult to produce at will: usually the form was that shown in Fig. 3, in J. and W. Taylor's article, but by breaking and