discharge tube and into the lower tube. When the discharge is running properly a bright beam of canal rays may be seen extending almost the entire length of the lower tube. The discharge is run at a voltage of 50 to 80 kv and a current of about 15 m.a. The pressure in the discharge is of the order of 10^{-3} mm Hg, and in the canal-ray chamber of the order of 0.5 mm.

Starting with pure deuterium in the discharge we have drawn out samples after running different lengths of time under various conditions. The samples have then been turned over to Drs. Smith, Lozier and Bleakney for mass analysis in their new apparatus (see their letter in this issue). Three samples, each of which consisted of gas that had been treated about an hour, have been analyzed by them. The procedure was the same as that used in their study of ordinary deuterium. They conclude that $_1H^3$ (or T) is present to about one part in five thousand of D. This is in contrast to the one part in 200,000 present before treatment.

Obviously the experiment would have been impossible without the cooperation of the Department of Chemistry, which furnished the deuterium, and of our colleagues in the Department of Physics who analyzed the products.

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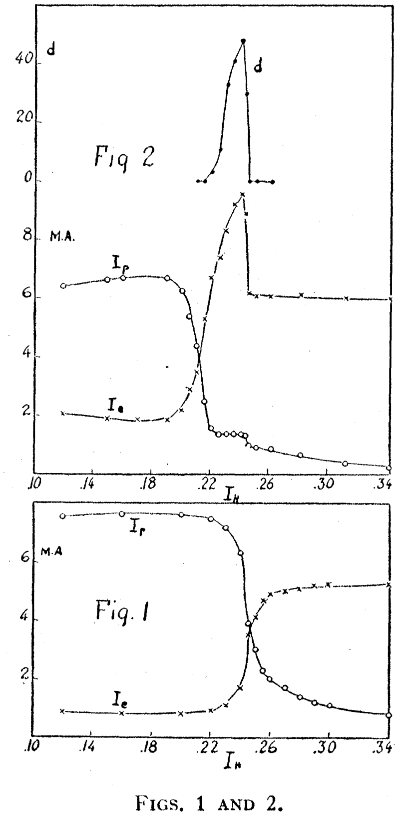
April 21, 1934.

Improved Magnetron Oscillator for the Generation of Microwaves

It has been observed[1] that to obtain maximum output from magnetron oscillators (both the split anode and the non-split anode types,[2, 3] it is necessary to incline the axis of the anode with respect to the direction of the magnetic field. The angle is usually from 3° to 6°. The effect of this inclination is to give some of the electrons travelling between filament and plate, a component of velocity parallel to the anode axis. The electron trajectories in a magnetron consisting of a cylindrical anode and concentric filament, have been shown by Hull[4] and Langmuir to be cycloids when the magnetic field is parallel to the filament. Hollmann,[5] considering a simplified case, has shown that with tilting of the tube they become cycloidal spirals whose axes are parallel to the magnetic field. Without tilting, a similar effect can be obtained by electrostatic methods, for example, end plates may be placed near the ends of the cylindrical anode, and maintained at a potential such as to draw electrons towards them. Under these conditions, also, the electron paths will be spirals, and the behavior of the magnetron should be similar to that observed with tilting.



Figs. 1 and 2.

Numerous such magnetrons have been constructed and investigated by the writer at wave-lengths of from 7.5 to 12 cm. They show a distinct improvement over the older type, the efficiency being from two to three times greater. Outputs of about 2.5 watts at a wave-length of 9 cm have been obtained.

The static characteristic of a typical end plate magnetron is shown in Fig. 1. It will be observed that when the field magnet current I_H reaches the critical value the anode current I_P is cut off, as in the usual Hull type magnetron. Simultaneously, the end plate current I_e increases. As the critical point is passed through the electrons cease passing directly from filament to anode and describe longer, spiral paths to the end plates.

The effect of oscillations is shown in Fig. 2. The characteristic is essentially as before, except for peaks in the oscillation region. The increase in filament emission above the previous saturation value is apparently due to electron bombardment of the filament which causes additional heating and possibly some secondary emission.[6] Curve *d* indicates energy radiated from an antenna connected to the tube.

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RCA Victor Company,
Camden, New Jersey,
April 16, 1934.

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