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VACUUM TUBE CIRCUITS AS A SOURCE OF POWER FOR CONDUCTIVITY MEASUREMENTS

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At the present the possible sources of current for conductivity measurements are limited to the induction coil, the high frequency generator and the Vreeland oscillator. In the first two the oscillating current is produced mechanically and the noise from the mechanism is apt to interfere with the accurate balancing of the bridge when measuring the resistance of the conductivity cell. This may not be the greatest objection in the case of the induction coil as it has been shown that the current has an undirectional value. The Vreeland oscillator is the only apparatus in use which produces a tunable oscillating current by means of a rectifier and controlled by the capacity of the condenser and the inductance of the coils in the circuit. This circuit gives an oscillating current whose intregal value is zero, and there are no overtones or mechanical noise to interfere with accurate work.

The advantages of such a system led to the development of a similar circuit using the vacuum tube as an oscillator. Several circuits were found which would give an oscillating current of a degree most favorable for conductivity measurements, but it was difficult to control the frequency and to get the current in the secondary circuit of sufficient strength to be of practical value.

The circuit shown in figure 36 was found to be the most satisfactory. The bulb consists of the grid (G), the plate (P) and the filament (F). The filament was lighted by a six volt storage battery (A) and 0.6 ampere was necessary. The "B" battery (B) has a voltage of 25 to 70 volts, the latter giving a stronger current, and is made by connecting thirty flash light batteries in series. The inductances L_1 and L_2 have values of 100 and 1.3 millihenrys respectively. The variable condenser (C) has a capacity of .0005 micro-farad as a maximum and is shunted by a high ("grid leak") resistance of several megohms. The primary (P) and secondary (S) coils were put within the inductance coil L_1 which substantially increased the secondary current. The positive pole of the "B" battery was connected to the plate of the vacuum tube and in parallel with this the inductance L_2, the

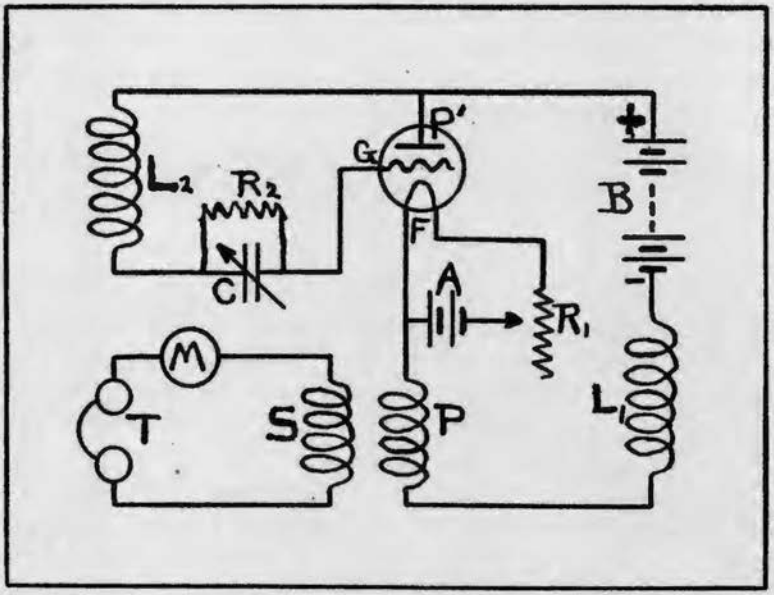
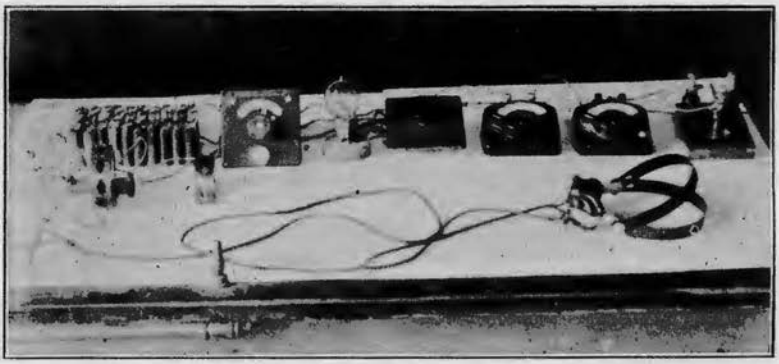


Fig. 36

condenser and the grid were connected in series. The negative pole was connected to the inductance L_1, the primary coil and the filament in series.

To measure any electrolysis due to any unindirectional component that the current might have, the secondary circuit was closed with a silver coulometer (M) in series with telephones (T). The current was passed through a 0.1 normal silver nitrate solution for a total of fifteen hours and there was no change of weight of the electrodes.



The frequency of the current was found to increase by decreasing the capacity of the condenser, decreasing the inductance L_2, increasing the inductance L_1 and as the filament current approaches the most favorable value for the filament.

Several makes of vacuum tubes were used. Only those where the plate is very close to the filament gave oscillations.

SUMMARY

The vacuum tube circuit shown in figure 36 will produce an oscillating current of sufficient frequency for conductivity measurements.

The advantages of the apparatus are:

1. The elimination of the noise accompanying mechanically produced oscillations.
2. The elimination of the heat developed by the mercury rectifier.
3. The simplicity of the apparatus.

The disadvantages of the apparatus are:

1. The changes of frequency due to external capacities and changes in the filament current.
2. The small current obtained by using the ordinary vacuum tube.

The work is being continued with the hope that the strength of the current can be increased.

In conclusion the authors wish to thank Dr. John L. Tilton whose coöperation made possible this work.

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