A METHOD FOR PRODUCING FEEBLY DAMPED HIGH-FREQUENCY ELECTRICAL OSCILLATIONS FOR LABORATORY MEASUREMENTS.

By L. W. Austin.

The problem of producing high frequency oscillations of sufficient constancy for accurate laboratory experiments has always been a difficult one. Even with large induction coils and high-potential transformers the fluctuation in intensity amounts frequently to from ten to twenty per cent. The problem becomes especially difficult in the experimental testing of sensitive receivers, as in these experiments the use of any except the smallest induction coils is impossible unless they are separated from the receiving apparatus by a very great distance. Besides lack of constancy,

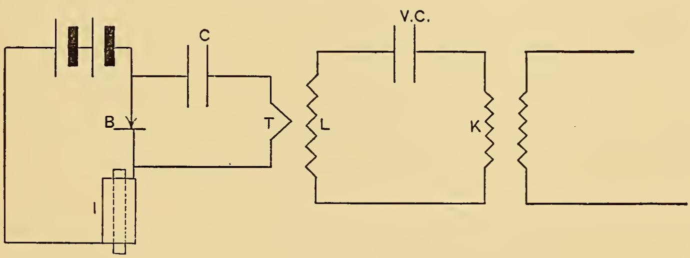

Fig. 1.

another difficulty which is always met with in the case of small coils is the rapid damping of the oscillations.

With the view of overcoming these difficulties I have experimented with various schemes for producing slightly damped oscillations of small intensity, and have finally decided upon the following arrangement as giving the most satisfactory results:

The general scheme of the apparatus is shown in Fig. 1. Here B is a circuit interrupter, I a reactance coil, C a paper condenser of from 0.1 to 1 microfarad, T a single turn of wire placed around a large inductance L[1], $V\ C$ a variable air condenser, and K a coupling coil for connecting this oscillating circuit with the circuit on which the measurements are to be made. The action is as follows: When the direct circuit is broken at B, the self induction current charges the paper condenser to a sudden high potential. This gives rise to a strongly damped pulse through the single turn of wire T, which starts the second circuit $L\ VC$ to oscillating in its own period, producing waves which are very feebly damped on account of its large inductance and negligible resistance. These can then be made use of for any experiments desired.[2]

If very great constancy in the intensity of the oscillations is not desired, the reactance and interrupter may be in the form of the

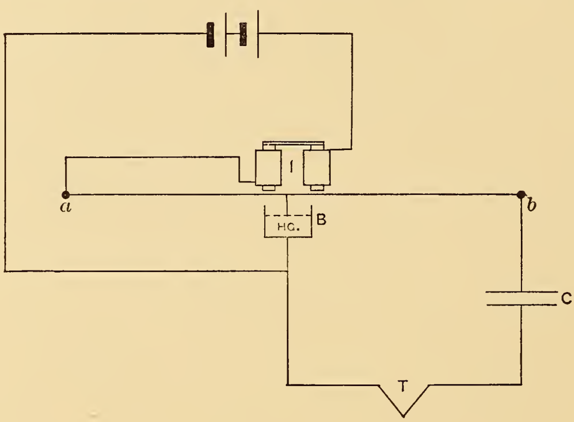

Fig. 2.

ordinary buzzer. With this carefully adjusted, the variations in the oscillations may be kept as low as three to six per cent. For stronger oscillations a mercury turbine interrupter with a separate reactance coil may be used. For the greatest constancy of working I have obtained the best results with the vibrating wire mercury interrupter, a plan of which is shown in Fig. 2.[3] For showing

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[1] From 0.3 to 1 millihenry.

[2] A somewhat similar arrangement of interrupter and reactance coil is used by the Telefunken Co., and also by the Amalgamated Radio Telegraphic Co. in their wave meter sets, except that there the tuned circuit is connected directly to the interrupter and not excited inductively.

[3] The magnet is from a watch case buzzer, a, b, is a No. 26 steel wire, 10 cm. long. The diameter of the H_g cup is 1 cm.

the degree of constancy easily obtainable with this exciter, I give a series of galvanometer deflections taken exactly ten seconds apart while the vibrator was running continuously.

Galvanometer Connected to Si Rectifier in Third Circuit.

DEFLECTION.
831 mm
830 "
830 "
830 "
830 "
829 "
831 "
833 "
832 "
832 "
830 "
830 "

This form of interrupter is troublesome when used with any but very small currents on account of its tendency to throw out the mercury from the cup. This can be minimized by using a liquid amalgam made by dissolving bits of solder in the mercury, and also by using a cover provided with an opening for the platinum contact. The energy imparted to the oscillating circuit by this type of exciter can amount to at most a few milliwatts. This of course implies, if the necessary loose couplings between the circuits are to be used, that the detecting instrument must be of great sensitiveness.

For telephonic reception any of the receivers ordinarily used in commercial wireless telegraphy are suitable. For damping experiments, or any experiments in which deflection measurements are necessary, I have found the most constant and satisfactory results with the silicon rectifier.[4]

The buzzer form of exciter is of great value in wireless stations for testing the condition of the receiver and for adjusting and making measurements on the receiving circuits. For testing the receivers it is greatly superior to the ordinary form of untuned buzzer, the use of which often leads to incorrect adjustment on

[4] This Bulletin, 5, p. 133.

account of the difference in behavior of many receivers to single pulses and to slightly damped wave trains.[5]

If it is possible to insert an inductance in addition to the coupling inductance in the antenna, the single turn of the exciter circuit may be placed about this (see Fig. 3), thus exciting waves of the natural antenna frequency. This gives a convenient means of bringing the antenna circuit and the closed circuit to the same tune and of testing the receiver for the actual wave lengths which

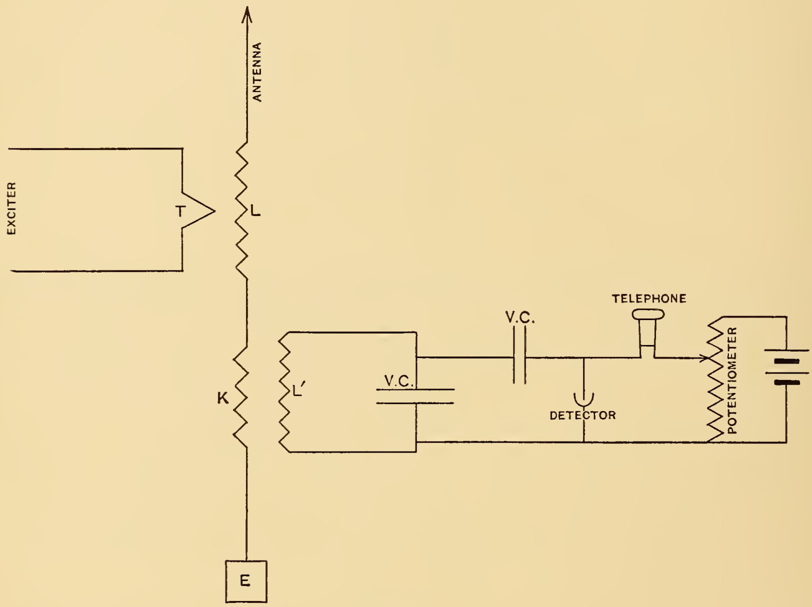

Fig. 3.

are to be used. It is obvious that this arrangement may be used also for determination of antenna damping, of wave length, and other measurements if the constants of the second circuit are known. If it is not thought desirable to use an extra inductance in the antenna, a separate circuit can be set up, tuned to one of the wave lengths ordinarily employed, and this may be used as a source of oscillations.

[5] For example, the electrolytic receiver always appears most sensitive to the buzzer when the small electrode is just touching the acid, while for feebly damped waves of considerable wave length a greater immersion gives the best results.