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A NEW HIGH FREQUENCY TONE GENERATOR

C. W. HEWLETT

ABSTRACT

Ordinary telephone receivers will respond satisfactorily to alternating currents at frequencies as high as ten thousand vibrations per second, but above this frequency so much of the electrical energy is absorbed in hysteresis and eddy current loss that it becomes impracticable to supply enough energy to the receiver to enable it to serve as a satisfactory source of sound waves.

There are a number of interesting applications for a generator of sound waves of frequency above ten thousand vibrations per second. For instance the sensitiveness of the ear for sounds of definite intensity has not been satisfactorily investigated between the frequency of ten thousand and the so called upper audible limit. Another use is that such short waves will enable the phenomena of interference, diffraction and shadows to be demonstrated by the use of sound waves. There are other less obvious applications, and on the whole it seems to be worth while to try to develop a generator for high frequency sounds.

If the generator is to be driven electrically it is obvious from the foregoing statement in regard to the ordinary telephone receiver that some method must be adopted in which hysteresis and eddy currents are eliminated as far as possible. With this in mind a generator of the following design has been constructed and used:

Two flat pancake coils, each built of concentric coils with air spaces between are mounted facing each other with a thin aluminum diaphragm between. The coils and diaphragm are held in place by a framework of hard fiber or other insulating material. The method of connecting up the instrument and using it is shown below:

A three element vacuum tube is used in a circuit forming an oscillation generator. L_1 and L_2 are the coils of the tone generator and form part of the inductance of a tuned circuit of which C forms the variable capacity. The capacity C_1 allows the alternating current to pass through the coils without going through the 15 volt battery. This battery sends a direct current through the coils of the generator in such a way that

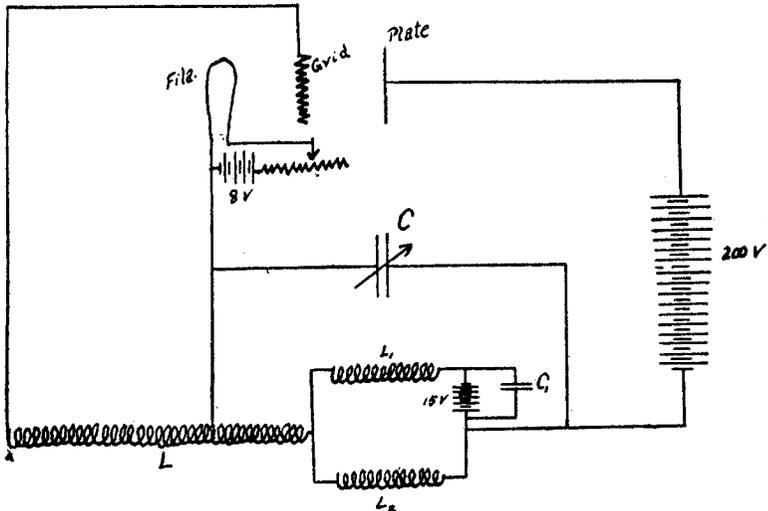


Fig. 45. L = Auto-transformer for feed back. L_1 and L_2 = Receiver coils. C = Tuning capacity. C_1 = Large capacity (2 m. f.) as path for high frequencies to avoid 15 V. battery.

the magnetic fields owing to this current oppose each other, and produce a radial field in the aluminum diaphragm. The alternating current produces a magnetic field which is axial and hence induces circular currents in the diaphragm which react with the radial field due to the direct current producing vibration of the diaphragm of frequency equal to that of the alternating current. The air spaces between the concentric cells forming the pancake coils are for the purpose of allowing the sound waves to leave the diaphragm. With this arrangement sounds from 5000 to 26000 vibrations per second have been produced. With intensity the sound may be altered by changing the value of the direct current flowing through the coils. With this apparatus a beam of sound may be reflected in any direction by a mirror made of a flat piece of board about a foot square.

Mr. C. E. Lane, a senior in this university, has worked with me throughout this piece of work and has been of much assistance with valuable suggestions and efficient and careful experimenting.

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