

May 6, 1924.

1,492,919

M. R. HUTCHISON
TELEPHONIC TRANSMITTER

Filed April 10, 1919

Fig. 1

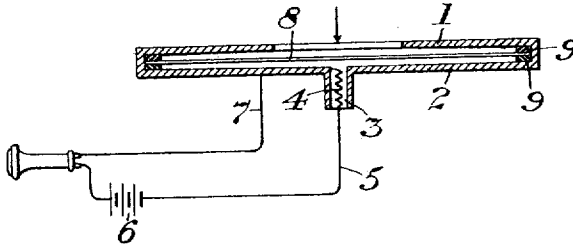


Fig. 2

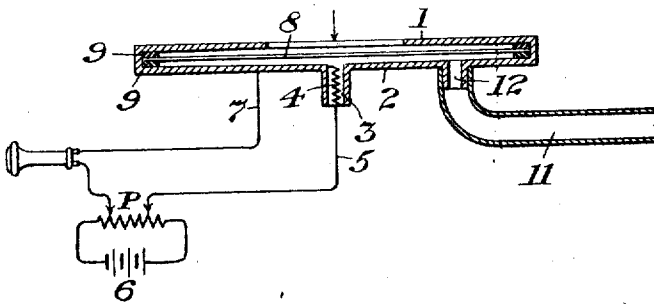
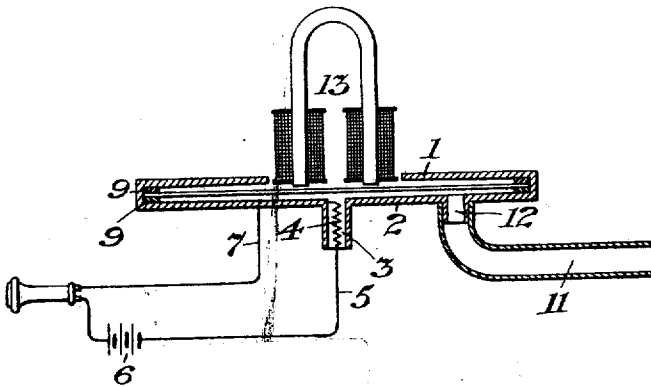


Fig. 3



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TELEPHONIC TRANSMITTER.

Application filed April 10, 1919. Serial No. 288,973.

To all whom it may concern:

Be it known that I, MILLER REESE HUTCHISON, a citizen of the United States, and resident of Llewellyn Park, Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Telephonic Transmitters, of which the following is a specification.

My present invention relates to devices for producing electrical variations corresponding to complex wave forms, particularly those characteristic of human speech and other audible sounds and it includes a new method and a new means for utilizing acoustic vibrations in the air to produce electrical variations in a circuit corresponding faithfully thereto.

The invention depends upon the change of resistance of the conductor by reason of the change or variation of the temperature of the conductor and upon possibility of making the conductor sufficiently sensitive to change its temperature by the acoustic wave movements of particles of air adjacent thereto. Every characteristic of an acoustic wave propagated in the air is accurately represented by alternate to and fro movements of the particles at varying rates. These movements vary in distance and rate according to the frequency and intensities of the constituent elements of the wave. In the case of a single frequency, pure sine wave, the velocities and the rates of change of velocities of each particle follow the law of the sine and in complex waves the component frequencies are represented by alternate accelerations, retardations or reversals superposed on the fundamental swing or movement. These variations of velocity and the variations of air pressure corresponding thereto are recognized by the ear and the brain which translate them in all the various ways and with all the varied significances that sounds can have.

By directing and preferably concentrating these movements of the air upon a sufficiently sensitive conductor their varied movements will produce corresponding varied fluctuations in a current passing through said conductor, and by making the conductor of sufficiently small mass as compared with

its radiating surface and by making its temperature very much higher than that of the surrounding air or other gaseous medium, the variation in cooling effects due to air or gas movements may be made to attain a maximum.

Other things being equal, the variations will be proportional to the length of the conductor. The conductor may be quite long provided it be coiled or otherwise arranged so that its projected length in a direction parallel to the waves is small as compared with the physical length of a quarter wave in the air. This is not difficult since waves of 1000 frequency are over a foot long and all of the vowel sounds are below that frequency. Even for frequencies or frequency components as high as 6000 the quarter wave length is more than half an inch.

Hence, while for some purposes I prefer to arrange the heat sensitive conductor in a plane exactly transverse to the waves, for ordinary purposes, a short coil having its axis parallel with the waves may be employed.

The waves in the air may be concentrated and their movements adjacent the conductor intensified in any desired way. A convenient way selected for purposes of illustration herein is to arrange the heat sensitive element in an opening communicating with a shallow closed space in the rear of an acoustic diaphragm. The waves impinging on the front of the diaphragm cause to and fro movements thereof which will produce a magnified to and fro forcing of the air into and out of the restricted opening in which the thermosensitive coil is arranged.

The coil is preferably of some non-oxidizing metal, as for instance, platinum. It is preferably of very small diameter and if desired, may be of the extremely minute diameters attained in Wollaston wire, which is made by encasing a fine platinum wire core in a massive silver coating, drawing down the composite wire to an extremely small diameter, and then dissolving off the silver to expose the reduced platinum core.

A more or less diagrammatic illustration of an embodiment of my invention is shown in the accompanying drawings, in which

Figure 1 is a diametric section through a

transmitter case with the thermo-sensitive coil, the heating battery, the telephone receiver and the circuit connections diagrammatically indicated;

5 Figure 2 is a similar view of a modification; and

Figure 3 is a similar view showing a relay embodying the invention.

10 In the drawings, the telephone transmitter casing comprises the front 1, back 2, and tubular opening 3 in the back. The thermo-sensitive element is shown as a coil 4 located in the tube 3, one end grounded on the back of the transmitter casing 2 and the other end
15 connected through wire 5, battery 6, telephone receiver wire 7, through the back casing to the first mentioned end of said coil. While not necessary, I prefer to arrange a diaphragm 8 supported by gaskets 9, 9 with
20 in the transmitter casing.

When the diaphragm is actuated by the sound waves, alternate compression and rarefaction of air takes place in the chamber between the diaphragm and the back of the
25 casing. The tube or orifice 3 in which the coil or grid of fine wire 4 is located, serves as a breather. Therefore, as the diaphragm vibrates the air is correspondingly expelled through and drawn into the chamber
30 through said breather. The battery 6 flowing normally through the coil 4 heats it to a temperature higher than that of the air, preferably very much higher and the alternate movement of the air produces a cooling effect varying by and in accordance with
35 the velocity of said movements, thus causing corresponding variations in the resistance of the coil 4. These variations flowing through the telephone receiver will cause movements of the receiver diaphragm which
40 will in turn impart to the air movements corresponding to the original sound.

In certain cases, I may supply to the space between the diaphragm and its casing a continuous, preferably gentle flow of air which
45 continually supplies fresh air at normal temperature and prevents local overheating of

the air adjacent the coil. The conduit 11 discharging through opening 12, Figures 2 and 3, may be employed for this purpose. 50

In Figure 3, I have shown a relay magnet 13 which may be energized from a telephonic circuit to cause vibration of the diaphragm instead of producing said vibration by direct action of the air waves. 55

Nickel and other metals and alloys as well as platinum may be used for the thermo-sensitive element and when platinum is used, it may, if desired, be heated to extreme incandescence short of melting. 60

It will be understood that the battery 6 represents any desired source of electrical energy and that any suitable means may be employed for controlling the voltage and amperage of the current. For instance, the
65 battery instead of being interposed directly in series with the circuit, may be associated therewith through the medium of an adjustable potentiometer P as diagrammatically indicated in Figure 2. 70

I claim:

1. A telephonic transmitting apparatus comprising an electric circuit, a thermo-sensitive element of extremely small cross-section interposed in said circuit, in combination with a telephonic transmitter diaphragm and casing and a restricted passage communicating with the transmitter and surrounding said thermo-sensitive element. 75

2. A telephonic transmitter comprising an acoustic diaphragm, a casing affording clamping support for the edges of said diaphragm and having a sound outlet of small cross-section at the rear of the diaphragm and a sound inlet of larger area at the front
80 of the diaphragm, in combination with a Wollaston wire grid or coil arranged in said sound outlet and a telephonic transmitting circuit including a battery in series with said coil. 85

Signed at New York city, in the county of New York, and State of New York, this 8th day of April, A. D. 1919. 90

MILLER REESE HUTCHISON.