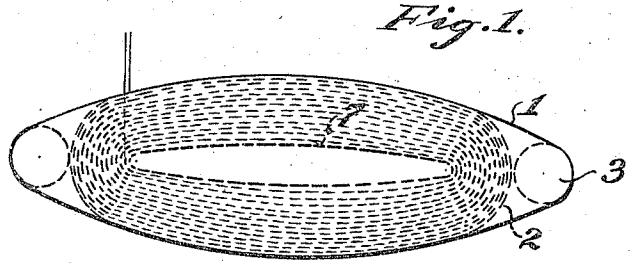
R. RUMMLER.

TELEPHONE FOR TRANSMITTING AND REPRODUCING SOUNDS.

APPLICATION FILED APR. 24, 1914.

1,238,439. Patented Aug. 28, 1917.

Fig. 1.



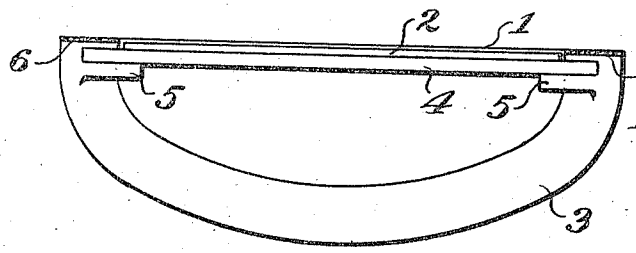
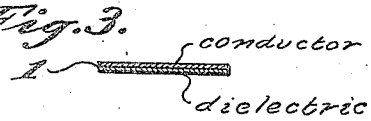


Fig. 2.

Fig. 3.



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UNITED STATES PATENT OFFICE.

RUDOW RUMMLER, OF WILMETTE, ILLINOIS.

TELEPHONE FOR TRANSMITTING AND REPRODUCING SOUNDS.

1,238,439. Specification of Letters Patent. Patented Aug. 28, 1917.

Application filed April 24, 1914. Serial No. 834,093.

To all whom it may concern:

Be it known that I, RUDOW RUMMLER, a citizen of the United States of America, and a resident of Wilmette, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Telephones for Transmitting and Reproducing Sounds, of which the following is a specification.

This invention relates to telephones wherein a diaphragm and coil of wire are so arranged that the coil may have a direct inductive action on the diaphragm, more or less independently of the magnet, but includes means for magnetically suspending the diaphragm in a magnetic circuit which may be independent of or not coextensive with the magnetic circuit of the coil.

The main objects of the invention are to provide a telephone receiver of refined construction having great accuracy in sound reproduction and adaptability for long distance transmission. To this end the receiver is provided with a coil having a direct action on the diaphragm independently of the magnet in order that the usual iron losses in the magnet and pole pieces may be avoided, and the device permitted to reproduce sounds of any desired frequency without distortion of the sound due to induced currents in the electric circuit, set up by molecular vibrations occuring in the magnet, and to provide a receiver permitting the use of a permanent magnet of any desired power without subjecting the diaphragm to a magnetic pull, which would interfere with its required vibrations. Further objects of the invention are to provide a magnetic receiver in which the permanent magnet is not subject to demagnetization by a current flowing in one direction in the coil.

An illustrative example or embodiment of this invention is shown in the accompanying drawings, in which—

Figure 1 is a plan view of a receiver constructed in accordance with this invention.

Fig. 2 is a side elevation of the same.

Fig. 3 is a detail in section of the diaphragm.

In the construction shown, an elliptical diaphragm 1 of magnetic material, such as soft iron, is shown located above a flat spiral elliptical coil of insulated wire 2, this coil being connected in any usual manner in the telephone line circuit. The diaphragm is shown supported at its ends on a permanent steel magnet 3, while the coil 2 is shown supported on a suitably formed plate 4 resting on and secured to inwardly extending lugs 5 of magnet 3. Gaskets 6, shown in section, are interposed between the ends of the diaphragm and magnet 3 for the purpose of preventing any interfering sounds due to engagement or relative movement between the diaphragm and magnet. The coil 2 is preferably coated with a dielectric of high inductive capacity adapted to cement the convolutions of the coil together and also close as much as practicable, the air gap between the coil and diaphragm.

In the above described device, vibrations of the diaphragm are the result of changing stresses induced in the diaphragm, causing the diaphragm to be flexed or vibrated bodily.

The magnet serves the usual purpose of permanent magnets in telephone receivers by more or less maintaining the diaphragm in what is termed magnetic suspension. This mechanically would be somewhat equivalent to mounting the diaphragm between springs so that it would vibrate in a sensitive manner to any slight disturbances. While all of the useful purposes of a magnet, as customarily employed in telephone receivers, are attained in this structure, the magnet is so arranged with respect to the coil and diaphragm as not to retard the vibration of the diaphragm by attraction, or prevent the full action of the current, carried by the coil, on the diaphragm without intermediate iron losses. When such losses amount approximately to one watt per cycle per pound of iron, it may be seen that they become very serious in instruments intended to produce vibrations up to and over 1,000 per second.

In telephonic work the frequency of voice currents is so high that the reactance of the coil becomes of a relatively high value when the coil has an iron core, so that there is considerable phase displacement between the voltage and the resultant current. When the iron is removed from the core, the reactance of the exciting coil is reduced, resulting in clearer transmission values.

The coil 2 may be provided with a soft iron core 7 if desired, but in that case the operation of the device is altered as the magnetic pull of the coil is increased, say about eighty times. The last mentioned arrangement, involving magnetic attraction between the diaphragm and the core of the

coil may be particularly useful in circumstances wherein the iron losses in the core and its retentivity may be neglected. For instance, when vibrations of high frequency and reproductions of great accuracy are not required. The diaphragm 1 need not be composed entirely of magnetic material but may be compounded with other materials having constituents including dielectrics, molecularly sensitive to the inductive effects of currents carried by coil 2. Fig. 3 shows a compound diaphragm made of a plurality of layers, one of which is a conductor and another a dielectric. These details are all embraced in the invention described.

As a transmitter the device provides a highly magnetized diaphragm of soft material and as a consequence its movement under the action of sound waves may induce currents or affect currents traversing the coil as required for transmission of sounds but still having little tendency to maintain some period of vibration due to its springy character, regardless of the sound waves, for instance as would take place if the diaphragm were made of steel.

In the operation of the device either as a transmitter or receiver, electromagnetic induction between a coil and diaphragm takes place either by movement of the diaphragm under sound waves or a variable current conducted by the coil. In each case, however, a magnet of any desired power is permitted to perform useful purposes without involving needless reactance in the coil or interference with the desired operation from the result of molecular vibrations in the magnet which occur when it is directly connected with the core of the coil. Because of the springy character of the material of permanent magnets, such vibrations when once set up persist for some time and interfere with the operation of the device.

Although but one specific embodiment of this invention has been herein shown and described, it will be understood that numerous details of the construction shown may be altered or omitted without departing from the spirit of this invention as defined by the following claims.

I claim:

1. A device of the class described, comprising a vibratable member, a coil of wire, and a magnet, said vibratable member being arranged in substantial magnetic suspension in the circuit of said magnet, said coil being so located that its magnetic circuit is not coextensive with the circuit of said magnet but includes the vibratable member therein.

2. A device of the class described, comprising a vibratable member without substantial permanent magnetic qualities, a coil of wire, and a magnet, said vibratable member being arranged in substantial magnetic suspension in the circuit of said magnet, said coil being so located that its magnetic circuit is not coextensive with the circuit of said magnet but includes the vibratable member therein.

3. A device of the class described, comprising a vibratable member, a coil of wire, a core for said coil, and a magnet, said vibratable member being arranged in substantial magnetic suspension in the circuit of said magnet, said coil being so located that its magnetic circuit is not coextensive with the circuit of said magnet but includes the vibratable member therein.

Signed at Chicago this 22nd day of April, 1914.

RUDOW RUMMLER.

Witnesses:
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