

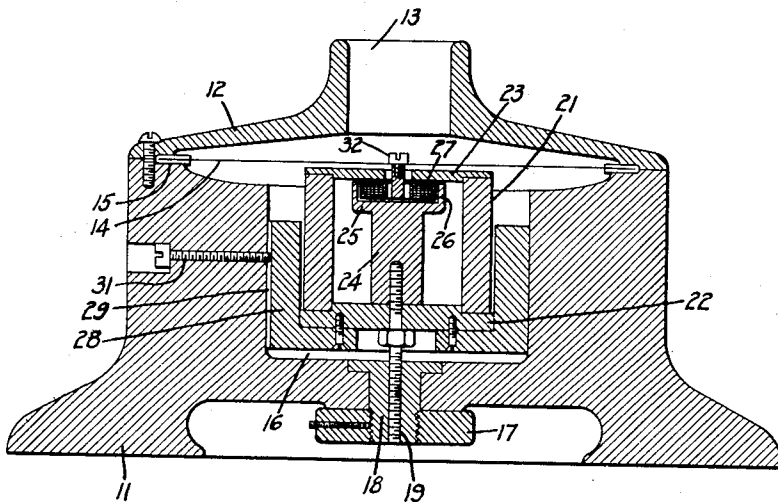
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C. J. MORTON

SOUND REPRODUCTION APPARATUS

Filed May 17, 1926



Inventor:
Cecil J. Morton,

by

Myranda S. Lunt.
His Attorney.

UNITED STATES PATENT OFFICE.

CECIL J. MORTON, OF COVENTRY, ENGLAND, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

SOUND-REPRODUCTION APPARATUS.

Application filed May 17, 1926; Serial No. 109,654, and in Great Britain June 12, 1925.

This invention relates to sound reproducing instruments, such as telephone receivers or loud speakers, (which instruments, as is well known in the art, will also serve as sound transmitters, i. e., to convert sound waves into corresponding electric oscillations) and has for its object the provision of an instrument of simple design which will reproduce sound faithfully.

In one well known type of such instruments the diaphragm is formed of magnetic material and is located in a magnetic field, the flux of which is varied in accordance with the electric oscillations received in operating coils. In another well known type a magnetic reed, which may be flexibly or pivotally supported, is adapted to be vibrated responsively to receive electric oscillations and is connected to transmit its vibrations to a diaphragm.

In contra distinction to these known arrangements, according to one feature of the present invention, a plunger of magnetic material is axially vibratable in a magnetic field within the sphere of influence of an operating coil.

According to another aspect of the invention a magnetic plunger is vibrated within the sphere of influence of a coaxially arranged operating coil which is located adjacent to one of the poles of a magnetic circuit.

The plunger may be formed integrally with a diaphragm, but preferably it is secured thereto in any suitable way, as by a screw, rivet or the like. This latter arrangement has the advantage that the diaphragm itself need not be made of magnetic material.

The invention further comprises the combination of a pot-shaped magnet with a magnetic plunger located within an operating coil. The term "pot-shaped" is used to denote the type of magnet which has a central limb within a surrounding shell, tube, cup or open-work cage, the central limb being connected at one end to the surrounding shell and having an air gap left adjacent to its other end. Such a magnet may be excited when in use by direct current, or alternatively, it may include one or more permanent magnets in its structure. For instance, the outside shell may be a single ring magnet or a battery of bar magnets of cobalt steel.

A construction according to the present

invention involves the use of a central limb which does not extend the whole length of the magnetic structure, and the operating coil is fixed upon the face of this limb.

With this construction a further feature of the invention consists in the use of a magnetic shunt between the central limb and the surrounding shell, which is formed by an annular extension on the central limb and around the operating coil. The object of this magnetic shunt is to provide a high permeability magnetic path for the varying flux produced by the actuating coil.

Any suitable type of instrument casing may be used, which preferably includes means for adjusting the magnetic structure toward or away from the plunger.

It has been found that a small coil is sufficient and this feature assists in reducing manufacturing cost. Another advantage in arrangements according to the invention resides in the small dimensions of the magnetic plunger, in which the flux variations occur, with the resultant reduction of the hysteresis loss.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, will best be understood from reference to the following specification taken in connection with the accompanying drawing, in which the figure shows in vertical cross section a construction embodying the features of my invention.

The instrument here shown comprises a casing 11 which may be formed of cast iron or other suitable material and which has fastened to it the cover plate 12 provided with an opening 13 for receiving the end of the sound horn. The diaphragm 14 may have its periphery embedded in a sheet of india rubber 15 and clamped between the cover plate 12 and the casing 11, as shown. The magnet assembly is located in the hollowed out portion 16 of the casing and is arranged to be operable toward or away from the diaphragm by means of the nut 17 swivelled in the opening 18 in the casing and having threaded engagement with the stem of the bolt 19 secured to the magnet assembly.

The magnet assembly comprises an annular or ring magnet 21, preferably of cobalt steel, which is magnetically connected at its lower end with the magnetic disk 22

and at its upper end with the annular member 23 of magnetic material. Secured centrally to the disk 22 is a central pole piece 24, which is here shown as being clamped by means of the bolt 19. The upper end of the central pole 24 is enlarged to form a recess as shown at 25 and provided with an upwardly extending annular rim 26, the end of which terminates just short of the underside of the annular member 23. An annular operating coil 27 is located within the rim 26 at the end of the central pole piece and the whole magnet assembly is mounted in the cup shaped member 28 which may be made of aluminum and which is provided with a longitudinal groove 29 engaged by the screw 31 in the casing 11, whereby rotation of the magnet assembly is prevented.

When the instrument is used as a loud speaker, operation of the diaphragm is effected by means of the magnetic plunger 32 which is here shown as secured by a screw to the diaphragm and which passes through the opening in the annular member 23 and terminates adjacent the end of the central core 24. It will readily be understood that, when the operating coil 27 is energized by fluctuating electric currents corresponding to the impressed sound waves, the plunger will alternately be drawn further towards or forced away from the central pole piece, thus vibrating the diaphragm in accordance with the impressed oscillations.

The upwardly extending rim 26 forms an annular shunt for the fluctuating flux produced by an oscillating current in the operating coil 27.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In an apparatus for sound reproduction, a core having its end recessed to form a magnetic shunt, a diaphragm adapted to be vibrated, a plunger of magnetic material attached thereto, a stationary annular coil mounted in said recess and adapted to actuate said diaphragm, said plunger being axially movable within said coil.

2. In an apparatus for sound reproduction, a core having its end recessed to form a magnetic shunt, a substantially flat diaphragm, a plunger of magnetic material secured thereto, a stationary coil mounted in said recess and surrounding said plunger for

actuating said diaphragm, said plunger being movable axially within said coil.

3. In an apparatus for sound reproduction, a core having its end recessed to form a magnetic shunt, a vibrating diaphragm, a plunger of magnetic material attached thereto, a stationary annular coil mounted in said recess and adapted to actuate said diaphragm, said plunger being axially movable within a magnetic field produced by said coil, and means for adjusting the position of said core with respect to said plunger.

4. A ring shaped permanent magnet, magnetic disks cooperating with each end of said magnet, one of said disks being provided with a central opening, a pole piece located centrally within the permanent magnet, said pole piece having a recessed portion adjacent said central opening, a coil located in the recessed portion, a diaphragm, and a magnetic plunger mounted on the diaphragm and movable axially within said central opening and said coil.

5. In an apparatus for sound reproduction, a diaphragm, a magnetic plunger attached thereto, a permanent magnet substantially U shaped in vertical cross section, a magnetic disk mounted on said permanent magnet and having a central opening, a pole piece positioned centrally within said permanent magnet, said pole piece having a recessed portion, an annular coil within said recessed portion, said coil having an opening in alignment with the opening in said disk, said plunger being axially movable within the openings of said disk and coil.

6. In an apparatus for sound reproduction, a diaphragm, a plunger of magnetic material attached thereto, a permanent magnet cooperating with said diaphragm, said magnet being substantially U shaped in vertical cross section, a magnetic disk mounted on the open end of said magnet, said disk having a central opening, a pole piece positioned centrally within said magnet and beneath said disk, said pole piece having a recessed portion at one end thereof and a coil within said recessed portion adapted to operate said plunger to vibrate said diaphragm.

In witness whereof, I have hereunto set my hand this twenty-seventh day of April, 1926.

CECIL J. MORTON.