July 31, 1923

1,463,372

E. A. REYNOLDS ET AL

SOUND REPRODUCING INSTRUMENT

Filed July 28, 1917

Fig. 1

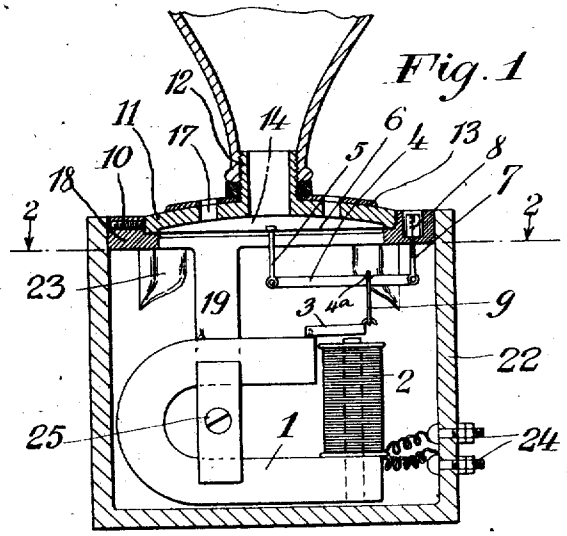
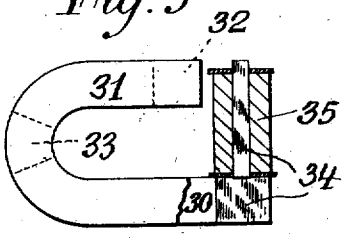


Fig. 5



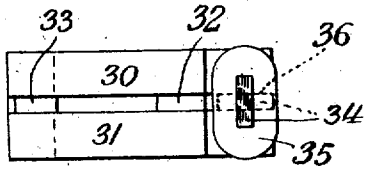


Fig. 6

Fig. 2

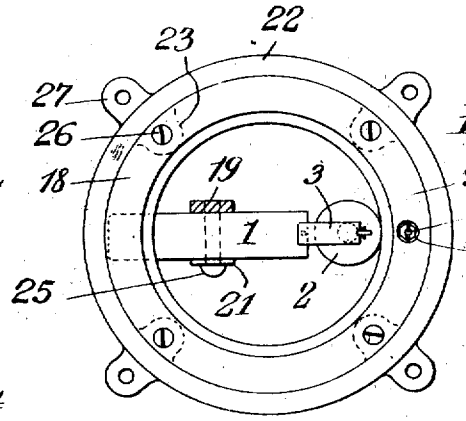


Fig. 3

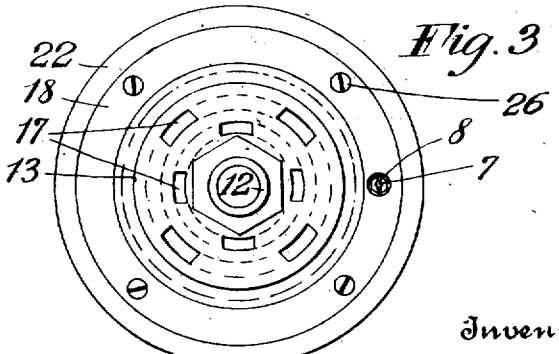
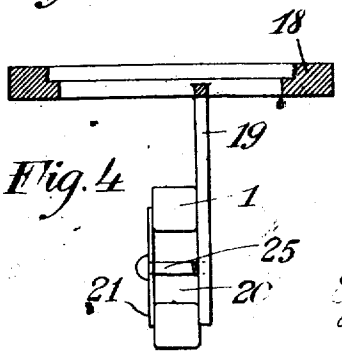


Fig. 4



Inventors

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By their Attorneys

Henry J. Lucas

atented July 31, 1923. 1,463,372

UNITED STATES PATENT OFFICE.

EGBERT A. REYNOLDS, OF YONKERS, NEW YORK, AND DE ELBERT A. REYNOLDS, OF WEST HOBOKEN, NEW JERSEY, ASSIGNORS, BY MESNE ASSIGNMENTS, TO AUDIPHONE COMPANY OF AMERICA, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE.

SOUND-REPRODUCING INSTRUMENT.

Application filed July 28, 1917. Serial No. 183,215.

To all whom it may concern:

Be it known that we, EGBERT A. REYNOLDS and DE ELBERT A. REYNOLDS, citizens of the United States of America, residing at Yonkers, county of Westchester, State of New York, and West Hoboken, county of Hudson, State of New Jersey, have invented certain new and useful Improvements in Sound-Reproducing Instruments, of which the following is a specification.

An object of this invention is to provide an improved, simple and effective means for magnifying the vibration of a diaphragm within an appropriate sound chamber under proper acoustic conditions to mechanically and electrically reproduce speech or sound waves electrically conveyed to the instrument, delivered in a magnified or amplified volume, with means for regulating the volume and intensity of the sound reproduced, controlling its quality, timber and rotundity and adapted to control or modulate both mechanically and electrically, sound waves emanating from a telephone, phonograph, violin, horn or other instrument.

To accomplish this purpose, we prefer to use an electro-magnet attached to one pole of a permanent magnet, so arranged as to bring the free end of the core of the electro-magnet in close proximity with the free pole of the permanent magnet, that the flow of magnetic flux may always be as free and strong as possible, attaching by means of a pivot or pin, a short thick armature to the free end of the permanent magnet, allowing it to extend over and become actuated by the electro-magnet.

On the free end of the armature, we prefer to place a hook or attachment for engaging a lever held substantially parallel to such armature, by means of a link or rod, one end of such lever being pivotally connected with a diaphragm, and the other end with an adjustable screw for regulating the proximity of the armature to the core of the electro-magnet, by means of a link or rod and lever, the latter being provided with a notch or groove to prevent the link or rod from slipping, and for the further purpose of keeping the working parts permanently in alignment.

We prefer to encase the diaphragm in a non-magnetic metal case with a large opening beneath, rigidly attached to the permanent magnet by means of a standard, provided with a lug, fitted between the two prongs or legs of the permanent magnet, and held rigidly by means of a clamp and screw. The sound chamber above the diaphragm is preferably made by the attachment of a front plate, with the inner surface plain, corrugated or recessed to suit the purpose for which any particular instrument may be intended, such variations being made to serve as a muffler, an air-cushion in the reproduction of harsh articulations, or for such modifications as may be found desirable in the transmission and amplification of speech or music, the front plate being also provided with openings, over which we place an adjustable plate, lined with felt, or other sound proof material with similar openings, held in place by a ferrule or nut. Such chamber can be conveniently formed by screwing the front plate into the flanges of the diaphragm case, clamping the periphery of the diaphragm between suitable washers or cushions and holding the front plate at the desired tension upon the diaphragm by means of a set screw. We have discovered that the form of the sound chamber with its adjustable openings, in connection with a diaphragm however actuated, affords a wide range of modulation in both timber and rotundity, whether in connection with a diaphragm operated mechanically, as with a stylus as in a phonograph, or electrically as with an electro-magnet as in a receiver or vibratory, as in the ordinary transmitter.

We find that a short, thick armature, with one end resting upon one leg of the permanent magnet and the other adjustable to the closest proximity of the pole of the electro-magnet, so nearly completes the magnetic circuit as to make the electro-magnet unusually powerful and well adapted to electro-mechanical amplification.

Further features and objects of the inven-

tion will be understood from the following description and the accompanying drawings, in which—

Fig. 1 is a central longitudinal section of one form of our invention;

Fig. 2 is a transverse section on line 2—2 of Fig. 1, viewed in the direction of the indicating arrows;

Fig. 3 is a top plan view of Fig. 1, with the horn or other external sound passage means omitted;

Fig. 4 is a detail side elevation of certain parts of Fig. 1; and

Figs. 5 and 6 are side and top plan detail views of a modified form of permanent and electric magnets.

In the drawings forming a part of our specification, 1 represents a permanent magnet of the horse-shoe variety, with one pole considerably longer than the other, to which is permanently attached the core of an electro-magnet 2, the core extending from the long leg of the permanent magnet into close proximity with the short leg of the permanent magnet. 3 represents a short, thick armature of soft iron held firmly to the short leg of the permanent magnet by magnetic force, and prevented from dislocation by a small pin preferably attached to the armature and working freely in an opening in the upper surface of the short leg of the permanent magnet.

4 is a lever connecting with a screw rod 5, leading to a diaphragm 6, and connecting with the adjustable screw rod 7. 8 is a counter-sunk screw-nut attached to the screw rod 7, designed to regulate the armature 3 through the lever 4 and link or rod 9. The lever 4 is provided with a notch 4^a or groove to prevent the link or rod 9 from slipping, and also whereby the link 9 actuates the lever 4 through a lever arm which is substantially constant for different positions of adjustment set by the adjusting means comprising the screw rod 7 and the nut 8. It will be further noted that the direction of adjustment effected by the adjusting means is in the direction, i. e., parallel thereto, of the direction of actuation of the diaphragm. In the specific form of the invention shown in the drawings, the actuating mechanism comprises a minimum number of parts, movably connected to one another at substantially constant points; in such preferred embodiment, the parts of the actuating mechanism are arranged substantially in a common plane and the adjusting means constructed to provide movement of adjustment in such common plane, whereby adjustment is positively and directly effected, thereby practically attaining delicate regulation of volume or intensity, without destroying the quality, timber and rotundity of the sounds emitted.

10 is a set-screw for holding the face-plate 11 at a proper tension upon the diaphragm, the face-plate being provided with a screw extension 12 to receive a horn attachment or other device, and upon which is held the adjustable plate 13. The face-plate is also provided with arcuate openings 17, 17, 17, 17 connecting with the sound chamber 14, and carries an adjustable plate 13 lined with a felt or other sound-proof material, and having similar arcuate openings, which upon arcial adjustment of more or less register, constitutes means for regulating the extent of opening of the openings in the face-plate in whole or in part.

18 is a non-magnetic metal case, rubber or fibre composition, containing a recess for receiving the diaphragm 6, and the face-plate 11 rigidly attached to the permanent magnet 1, by means of a standard 19, lug 20, clamp 21 and screw 25. 22 is a box or receptacle of insulating material or composition, with interior lugs 23, 23, 23, 23, for fastening the diaphragm case to the receptacle, and terminal screws 24, 24, for connecting the wires of the electro-magnet 2 with induction coils, relays, line wires or such other exterior sources of current as may be found desirable.

Means are also provided for securing the non-magnetic metal case 18 to the box or receptacle 22, such as screws 26 passing through the rim of the case 18 into lugs 23, 23, etc. Any desired number of external lugs 27, 27, may be employed for fastening the case 18 to a wall, desk, or other support.

In Figures 5 and 6, we have shown a modification in the construction and arrangement of the permanent magnet and the electro-magnet, employing for simplification in manufacture a set (two being shown) of permanent magnets 30, 31, disposed side by side with the block 32 of soft iron between the short legs of the permanent magnets and block 33 between the curved portions of the permanent magnets. The core 34 of the electro-magnet 35 is cut away or recessed at 36 to be received between the long legs of said permanent magnets 30, 31, thereby forming a substantially integral connection with the poles and legs of said permanent magnets 30, 31.

From the above it will be observed that the device is especially adapted to loud speaking receivers for announcing trains, paging, for equipment on trains for announcing stations, transmission of music, advertising and other uses. In the use of the invention in connection with a sensitive transmitter, as in the equipment in churches, theatres, and large halls, a plurality of such devices is distributed in suitable parts of the auditorium for the purpose of equalizing articulation, whereby amplified reproduction

is obtained at any point in such auditorium, simultaneously from all such devices.

Whereas we have described our invention by reference to specific forms thereof, it will be understood that many changes and modifications may be made without departing from the invention.

What we claim as our invention and desire to secure by Letters Patent of the United States is:—

1. A sound reproducing instrument comprising a diaphragm and means for operating said diaphragm, comprising a permanent magnet, an electro-magnet, an armature magnetically attached to one pole of said permanent magnet, a lever, said lever having a substantially constant lever arm and means actuated by said armature and actuating said lever through such substantially constant lever arm.

2. A sound reproducing instrument comprising a diaphragm and means for operating said diaphragm, said means including a permanent magnet, an armature pivotally connected with said permanent magnet, a lever having one end connected with said diaphragm, means for supporting the opposite end of said lever, said supporting means including an adjustable element, means for connecting said armature with said lever intermediate said ends, the lever arm of said connecting means being substantially constant for different adjustments of said adjusting element.

3. A sound reproducing instrument comprising in combination a diaphragm, means for operating said diaphragm, hollow mounting means for said diaphragm, said hollow mounting means including a face provided with a sound passage opening and a plurality of openings adapted to communicate directly with the atmosphere disposed laterally of said sound passage opening, and means for varying the effective extent of opening of said plurality of openings.

4. A sound reproducing instrument comprising in combination a casing of non-magnetic and electrically insulating material, and having an open end, a plate for said open end, a diaphragm mounted in said plate, magnetic means carried by said plate, an armature for said magnetic means, a lever, a link connecting one end of said lever with said diaphragm, a link connecting said armature with said lever, and means for supporting the opposite end of said lever from said plate, said supporting means including an adjustable element, said armature connecting link being related to said one end of said lever to have a substantially constant lever arm for different adjustments of said adjustable element.

5. A sound reproducing instrument comprising in combination a casing of non-magnetic and electrically insulating material and having an open end, a plate for said open end, said plate being provided with openings, means for regulating the effective extent of opening of said openings, a diaphragm mounted in said plate, magnetic means carried by said plate, an armature for said magnetic means, a lever, a link connecting one end of said lever with said diaphragm, a link connecting said armature with said lever, and means for supporting the oppcsite end of said lever from said plate, said supporting means including an adjustable element, said armature connecting link being related to said one end of said lever to have a substantially consta: lever arm for different adjustments of said adjustable element.

6. A sound reproducing instrument comprising in combination a diaphragm, an arm carried by said diaphragm, a lever, pivotal means for an end portion of said lever, adjustable means for carrying said pivotal means, means for pivoting the opposite end portion of said lever to said arm, a link connected to an intermediate portion of said lever, the portion of said lever between said second mentioned pivoting means and said link being of constant length for different positions of adjustment of said adjustable means, an armature connected to said link and electromagnetic means controlling said armature, said electromagnetic means including a coil.

7. A sound reproducing instrument comprising in combination a diaphragm, an arm carried by said diaphragm, a lever, a member pivotally connected to an end portion of said lever, means for adjustably supporting said member, means for pivoting the opposite end portion of said lever to said arm, the distance from the pivotal connection of said member at said end portion of said lever to the pivotal connection of said pivoting means at said opposite end portion of said lever being constant for different positions of adjustment of said adjustably supporting means, a link connected at its one end to a portion of said lever intermediate said end portions of said lever, an armature controlling said link and electromagnetic means controlling said armature, said electromagnetic means comprising a coil.

8. A sound reproducing instrument comprising in combination a diaphragm, a casing supporting said diaphragm, an arm carried by said diaphragm, a lever, a member pivotally connected adjacent an end portion of said lever, means for adjustably supporting said member from said casing, means for pivoting the opposite end portion of said lever to said arm, the distance from the pivotal connection of said member at said end portion of said lever to the pivotal connection of said pivoting means at said

opposite end portion of said lever being constant for different positions of adjustment of said adjustably supporting means, a link connected to said lever at a portion thereof intermediate said end portions, an armature controlling said link and electromagnetic means controlling said armature, said electromagnetic means including a coil.

9. A sound reproducing instrument comprising in combination a diaphragm, a ring carrying said diaphragm, an arm carried by said diaphragm, a lever, means for pivoting an end portion of said lever to said arm, means for adjustably positioning the opposite end portion of said lever, the distance from the pivotal connection of said pivoting means at said end portion of said lever to the pivotal connection of said adjustably positioning means at said opposite end portion of said lever being constant for all positions of adjustment of said adjustably positioning means, said adjustably positioning means comprising an adjustable element carried by said ring, a link movably connected at its one end to an intermediate portion of said lever, an armature controlling said link, electromagnetic means controlling said armature, said electromagnetic means including a coil and a casing carrying said ring and enclosing said lever and said armature and said electromagnetic means.

In testimony whereof we have signed this specification, this 26th day of July 1917.

EGBERT A. REYNOLDS.
DE ELBERT A. REYNOLDS.