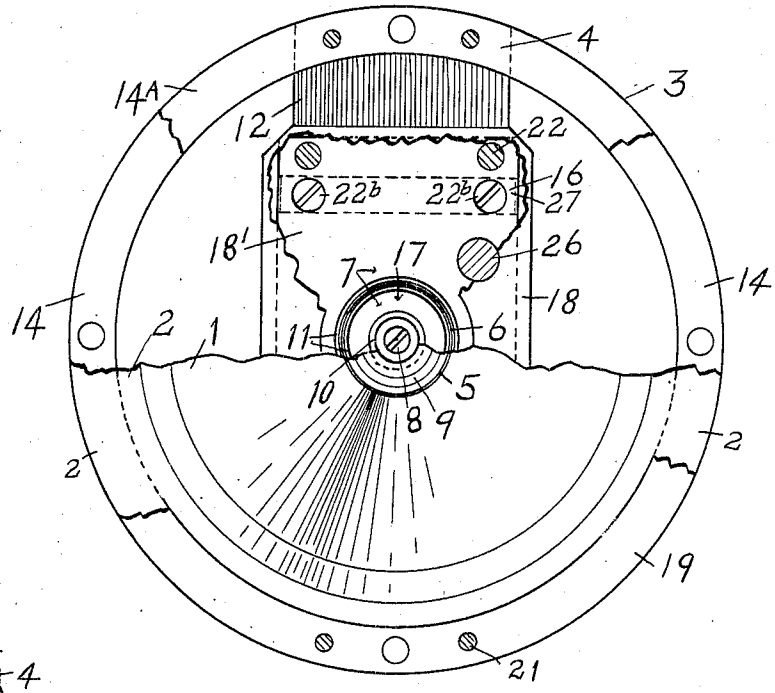
Oct. 31, 1939. R. E. BOWLEY 2,178,030

SOUND REPRODUCING APPARATUS

Filed June 9, 1937.

Fig-1-



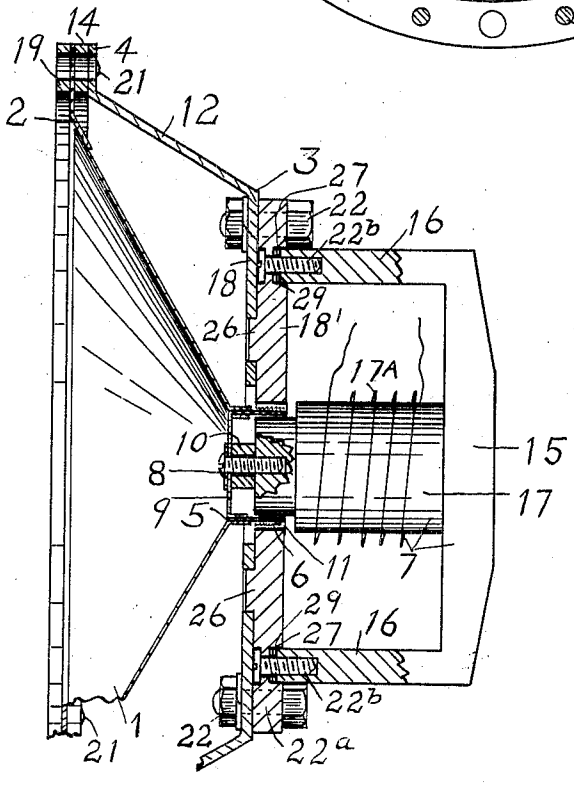


Fig-2-

INVENTOR

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UNITED STATES PATENT OFFICE

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SOUND REPRODUCING APPARATUS

Raymond E. Bowley, San Anselmo, Calif.

Application June 9, 1937, Serial No. 147,278

1 Claim. (Cl. 179—115.5)

This invention relates to sound reproducing apparatus employing a moving actuating coil type diaphragm and actuating means of electro-dynamic construction or similar actuating means, such as loud speakers adapted for use with radio receiving sets, phonograph record turntables with motor and electric pick-up, etc.; telephone devices, microphones and other devices in the class described.

An object of the invention is to provide co-operative shim means in the construction of a sound reproducing device having a moving actuating coil type diaphragm, such as a loud speaker having electro-magnetic means for actuating the diaphragm over substantially the entire frequency range to which the diaphragm will respond, whereby the response of the diaphragm is caused to be modified effecting improved resultant tones within the frequency range of the diaphragm; the said device comprising electro-dynamic means for actuating the diaphragm as described, a moving coil type diaphragm carrying an actuating coil and having a flexible rim, means for mounting the diaphragm and actuating means in operative assembly including means for supporting the rim of the diaphragm in a fixed position.

Other objects of the invention are to provide an improved loud speaker or sound reproducing device in the class described including shim elements adapted for adjusting or regulating the relative operative positions of the fixed position of the periphery of the diaphragm of the device and magnet elements of the device associated with the diaphragm, in either direction, forward or backward, on a plane parallel with the axis of the diaphragm, to compensate for contraction or expansion of the material composing the diaphragm due to atmospheric conditions and other causes during a period of operation while in service, or for other purposes, whereby the response of the diaphragm is caused to be modified effecting improved resultant tones.

For the sake of explaining the principles of the invention, I will now describe illustrative embodiments thereof. The drawing is for illustrative purposes only and is not drawn to scale. The details of mechanical construction being left to the skill of the experienced workman employing the apparatus herein described and claimed.

In the accompanying drawing:

Fig. 1 is a front view of apparatus embodying the invention.

Fig. 2 is a side view of another modification of the apparatus shown in Fig. 1.

Referring to the drawing:

In Figures 1 and 2 a sound translating device or a loud speaker 3 is shown having a moving actuating coil type diaphragm 1 including a flexible flanged rim 2 composed of soft leather or other flexible material adapted for improving the elasticity of the diaphragm at the rim or periphery thereof; a cylindrical sleeve 5 is attached to the center and rear portion of the diaphragm, an actuating coil 6 is wound upon sleeve 5 for coupling with electro-dynamic or other suitable actuating means 7 adapted for actuating the diaphragm 1 over substantially the entire frequency range to which the diaphragm will respond.

A flexible member 9 is applied to the diaphragm 1 and sleeve 5 and is also attached to the head of the inner pole portion 17 of the magnet unit 7; removable screw or bolt 8 is for attaching the flexible member 9 to the head of pole portion 17 by means of an aperture and screw threads 8A provided in the head of pole portion 17; a spacer or washer 10 is applied between the head of pole portion 17 and the flexible member 9 for locating coil 5 in the proper position in the air gap 11 formed by the magnet poles.

Mounting means 12 forms a mounting device for supporting the diaphragm 1 and the actuating unit 7 in operative assembly. Diaphragm 1 in the modification of the invention illustrated is shown as substantially conical but may take other forms. Annular members 14 and 19 may be metal or non-metal, composition or any suitable material; an annular member 14A may be used for reinforcement when the member 14 or the member 19 or both said members are composed of non-metal material. The flanged portion 4 of the mounting means is attached to the annular mounting portion 14A—14 and 19 by rivets, screws, bolts or other suitable means 21; the mounting portion 12 extends rearwardly toward the center and rear portion of the diaphragm 1 and includes a portion 18 for supporting the actuating means 7 in operative assembly with the diaphragm 1.

As illustrated in Figs. 1 and 2, the coil 6 and sleeve 5 are flexibly suspended movable in the air gap 11 substantially concentric with the air gap and the pole portion 17. Openings 22a are provided in plate 18' and the mounting portion 18 for fastening screws or bolts 22 provided for mounting the unit 7 on the portion 18 of the mounting means 12.

The magnet element of the actuating unit 7 is an improved adjustable arrangement embodying my invention, comprising the elements described,

a guideway or guideways 29 being provided in the outer pole plate 18' for guiding the magnet portions 16 into supporting position in assembly with plate portion 18' of the magnet; a screw or screws or bolts 22b fasten magnet elements 16 and 18' in operative assembly, portion 15 at the rear of the magnet is part of the connecting portions 16 of the magnet, the portions 15 and 16 of the magnet support the inner pole portion 17 of the magnet so that the outer end or head of the inner pole element is projected into the opening in the outer pole plate 18' forming air gap 11.

Shims 27 are provided in the magnet assembly for effecting adjustment of the magnet portion 15—16 whereby pole piece 17 may be adjusted in position in either direction parallel with the axis thereof, whereby expansion or contraction of the material composing the diaphragm 1 or the flexible rim or periphery 2 of the diaphragm may be compensated for by moving the center and rear portion of the diaphragm carrying the sleeve 5 and coil 6 in either direction, forward or backward, the flexible member 9 being attached to the head of the pole piece 17 by removable screw 8; the washer or spacer 10 at the head of the pole piece 17 is for locating the coil 6 in proper position in the air gap 11. By changing the dimensions of the shim means the said adjustment may be made.

Guideways are provided in the mounting portion 18 and in the plate 18' as shown by numeral 26 for centering the magnet poles and air gap substantially concentric with the fixed position of the diaphragm 1. The screws or bolts 22b tend to fasten the magnet elements firmly in operative assembly and are adapted for releasing said elements for effecting said adjustment thereof, whereby expansion and contraction of materials composing the apparatus may be compensated for and maximum operating efficiency maintained over a long period of time; a cavity 30 is provided in plate 18' for the head of screw or bolt 22b.

This arrangement is simple in construction and provides for rapid assembly of the various elements of the device and also provides for the device to be readily taken apart by an experienced workman without removing the diaphragm from its fixed position of support at the periphery of the diaphragm; the actuating coil, air gap and field coil may be easily examined for cleaning out filings from the air gap or for repairs to the voice coil or to the field coil. Servicing the device is simplified by the arrangement described. The head of the screw or bolt 22b is concealed between the plate 18' and the mounting portion 18 when the device is in operative assembly with the diaphragm 1 so that the adjustment is not likely to be tampered with by inexperienced persons. In the modification illustrated and described, the inner pole portion 17 is shown cast with portions 15 and 16 as a single element so that the head of the inner pole piece is maintained substantially concentric with the opening in the outer pole plate 18' by the guideways 29. I do not confine myself to the particular arrangement or modification herein described to illustrate the principle of the inventive concept.

The embodiments of the invention illustrated and described herein have been selected for the purpose of setting forth the principles involved. The invention is, however, susceptible to being further modified to meet different conditions encountered in its use without departure from the inventive concept disclosed.

I realize that other modifications of this invention are possible, therefore I say my invention is not limited to the particular constructions shown and described, and it is my intention to cover all other modifications which can be made without departing from the spirit of the invention or the scope of the claim.

Obviously my invention may be carried out in other ways than herein set forth by way of illustration. I desire it understood that the claim hereunto appended is to be considered in defining my invention rather than the exact disclosures herein made.

My co-pending application for U. S. Letters Patent, Serial No. 226,136, filed August 22, 1938, for Acoustical apparatus is a continuation in part of this application.

My co-pending Application for U. S. Letters Patent, Serial No. 247,865, filed December 27, 1938, for Sound reproducing apparatus is a continuation in part of this application.

I claim:

In combination in sound reproducing apparatus, an inner magnet pole piece, a pole plate having a circular opening therein substantially concentric with the pole piece, a magnet portion supporting the inner pole piece and connecting the pole portions of the magnet, means for fastening the magnet elements firmly in assembly, the head of the pole piece projecting into said opening in the plate forming an air gap, a moving coil type diaphragm composed of relatively flexible material having a flexible flanged rim, a cylindrical sleeve attached to the center and rear portion of the diaphragm, a voice coil mounted on the sleeve, the coil and sleeve projecting into the air gap substantially concentric therewith, a flexible member applied to the diaphragm and sleeve and also applied to the head of the inner pole piece for flexibly suspending the sleeve and coil movable in the air gap, removable screw means fastening the flexible member to the head of the pole piece, means provided in the head of the pole piece for receiving said screw, a field coil applied to the inner pole piece and magnet, a mounting structure for the diaphragm and actuating means, the actuating means attached to said structure, the rim of the diaphragm supported in a fixed position, the pole plate forming a support for the magnet, means for fastening the magnet to the mounting structure, removable shim means in the magnet assembly whereby changing the dimensions of said shim means effects a change in the operative position of the inner pole piece in either direction parallel with the longitudinal axis thereof.

RAYMOND E. BOWLEY.