March 11, 1930. K. K. JENSEN 1,750,009

ELECTROMAGNETIC SOUND REPRODUCER

Filed Jan. 28, 1928

Fig. 1

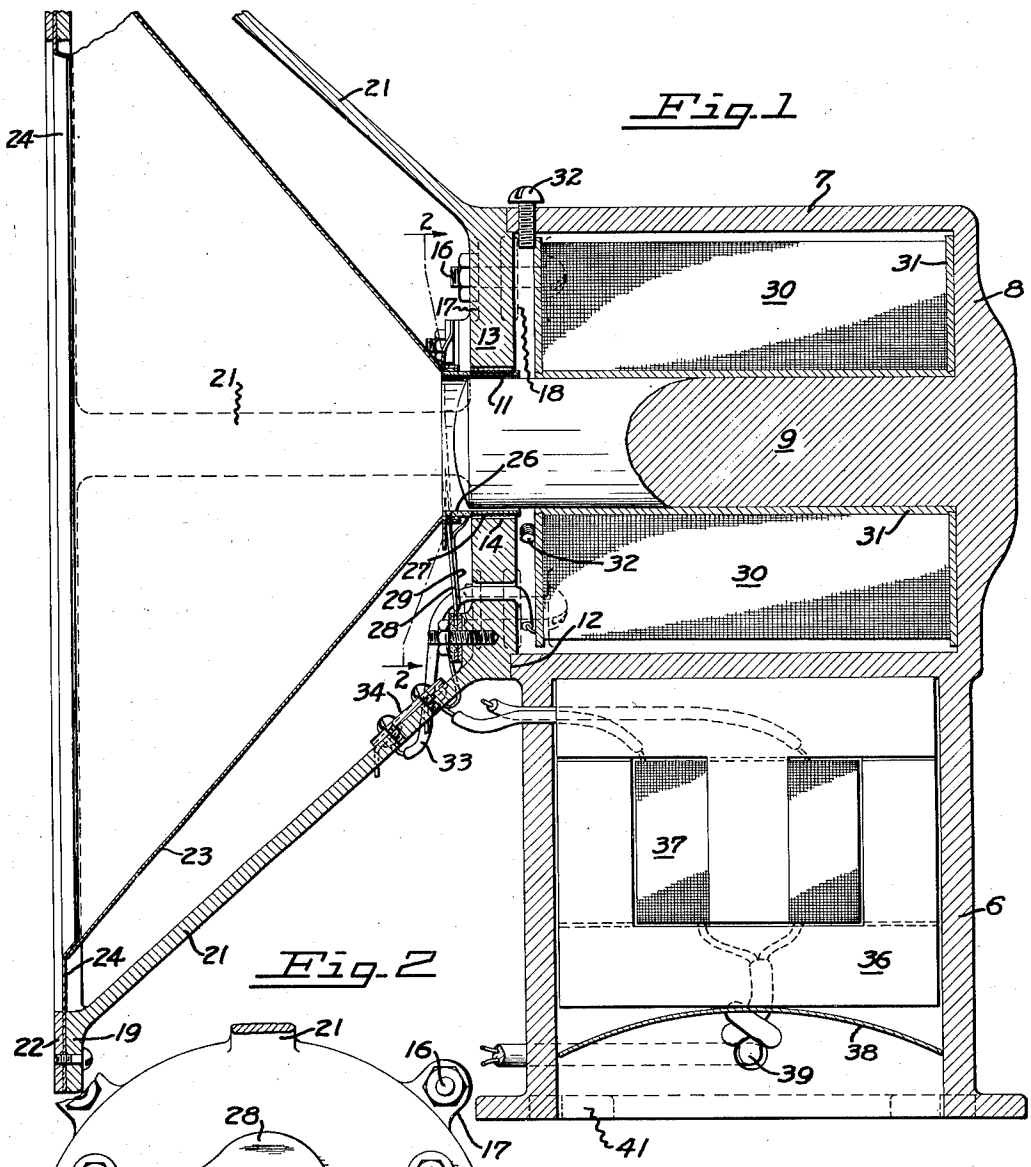


Fig. 2

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UNITED STATES PATENT OFFICE

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ELECTROMAGNETIC SOUND REPRODUCER

Application filed January 28, 1928. Serial No. 250,193.

My invention relates to sound reproducers of the moving coil or electrodynamic type, and its broad purpose is to supply a reproducer in which adjustments and manufacturing operations requiring high precision are reduced to a minimum, and which may be produced on a quantity basis with a high degree of uniformity.

An object of my invention is to produce a sound reproducer of the moving coil type requiring no special devices for centering or adjusting the air gap.

Another object of my invention is to produce a device of the character described which can compete on a price basis with the better grade of magnetic armature type reproducers.

My invention possesses other objects and valuable features, some of which will be set forth in the following description of my invention which is illustrated in the drawings forming part of the specification. It is to be understood that I do not limit myself to the showing made by the said description and drawings, as I may adopt varying forms of my invention within the scope of the claims.

Sound reproducers of the moving coil type are well known in the art. They comprise usually a cylindrical exciting coil having a central core and a shell of ferromagnetic material. A pole-piece mounted on this shell and surrounding the end of the core defines an annular air gap, in which is positioned a circular coil movable thru the gap parallel to the axis of the core.

To obtain a satisfactory degree of efficiency from the device the gap must be short and the clearances minimal. It is a matter of highest importance therefore to have core and pole-piece concentric. In order to do this it has been the practice to build up the magnetic circuit of a number of pieces of high-permeability iron or steel, with accurately machined and fitted contacting surfaces, and to provide special means for positioning the central core or pole within the annular pole-piece. This means has usually been either a non-magnetic ring fixed to the pole-piece and fitting around the pole, or else the pole has been made movable within the shell and has been positioned by means of a gage or fixture and then locked in place. My invention does away with the necessity for either of these expedients, and at the same time offers a simple method of mounting the reproducer itself and its auxiliary apparatus.

Referring to the drawings:

Fig. 1 is a view in axial vertical section of a preferred embodiment of my invention, and Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1.

Broadly considered, my invention comprises forming the central pole and the surrounding shell of a single casting, which may be heat treated to improve its magnetic qualities. The end of the pole and the rim of the shell are then machined with a forming tool at a single operation, surfacing a pole-face on the core, and a seat for the annular pole-piece on the shell, and the machined surfaces are necessarily concentric because of their method of formation. The pole-piece is machined in a similar manner to insure concentricity between the central opening forming its pole-face and the surface which engages the seat on the shell, and the mere assembly of the device assures the proper relationship of the parts.

The use of castings for the two parts of the magnetic circuit permits auxiliary parts to be formed integrally therewith. A hollow pedestal joined to the shell serves to support the reproducer, and also as a mounting and shield for a transformer located within it; and a flange for mounting the diaphragm of the reproducer, together with its supporting arms are cast as a single structure unitary with the pole-piece.

In more detailed terms, a preferred embodiment of my invention employs a casting of malleable iron or steel, comprising a cylindrical cup supported by a hollow pedestal or base 6. The axis of the pedestal is perpendicular to that of the cup, so that as usually mounted the latter is horizontal. The side walls 7 of the cup are preferably of uniform thickness, but its bottom 8 is of increasing thickness from its periphery toward the

center. Extending co-axially thru the cup from its point of attachment in the bottom thereof is a pole or core 9, also formed as part of the casting.

In the process of manufacture the end of the core and the rim of the cup are machined at a single operation, to provde a truly circular pole-face 11 on the core and an accurately concentric seat 12 on the cup.

An annular pole-piece 13 is fitted to the seat 12. It has a pole-face 14, concentric and parallel with the pole-face 11 of the core, which is preferably machined at the same operation as the surfaces which engage the seat 12, and therefore when the pole-piece is in place a concentric and uniform air gap is defined between the two pole-faces. The pole-piece is also a casting, and is retained in position by the screws 16 passing through lugs 17 on the pole-piece and corresponding lugs 18 on the cup. Integral with the pole-piece are the flange 19 and its supporting members or arms 21. A ring 22 secures the conical diaphragm 23 to the flange by means of the flexible membrane 24.

At its apex the diaphragm carries a cylindrical form 26 on which is wound the coil 27. The coil is preferably positioned in the gap by the spider 28, and the leads 29 to the coil brought out along the arm of the spider in the manner described in the co-pending application of Peter L. Jensen, Serial Number 229,575, filed October 29, 1927.

The cup, core and pole-piece constitute the magnetic circuit of an electromagnet which supplies the field in which the coil 27 moves. The field is excited by a coil 30, preferably wound on a brass bobbin 31 which is placed in the cup before the pole-piece is applied, and prevented from moving or vibrating by screws 32 which pass thru the walls of the cup and impinge on the head of the bobbin. Lead wires 33 for the coil are brought out through an aperture in the pole-piece, and terminate on a connection block 34 mounted on one of the arms 21. The lead wires 29 from the moving coil may also conveniently terminate on this block.

In order that the reproducer may work satisfactorily from the output of the usual type of amplifying vacuum tube or audion, a step-down transformer is necessary between the audion and the moving coil. A convenient location for the transformer is within the hollow pedestal of the reproducer. The recess within the pedestal is designed to conform rather closely to the core 36 of the transformer, with an enlarged portion in the center to admit the coil 37. A bowed spring 38 retains the transformer in place, its ends engaging the rough unfinished surface of the casting and effectively preventing movement unless deliberately disengaged. The input wires 39 to the transformer from the tube are brought thru an opening near the bottom of the pedestal, while another opening near the top allows the output leads to pass to their connection with the coil leads 29 on the terminal block.

Mounting lugs 41 at the foot of the pedestal permit the instrument to be screwed into place within a cabinet if desired, either upright, as shown, or in such other position as may be preferred.

The design here shown offers a remarkable economy of manufacture. The two castings which form its magnetic circuit, pedestal, and diaphragm mounting replace as many as 14 parts in the ordinary mode of construction, and as each of these parts must be machined and fitted, the saving in labor is apparent. The fact that the magnetic properties of the material may be somewhat inferior to those usually employed is more than offset by the reduction of junctures in the magnetic circuit and the fact that the circuit may readily be designed with constant cross-sectional area, thus eliminating the regions of saturation which reduce effectiveness in the old structure. Experience proves that using malleable iron for the magnetic circuit and the same exciting current, the reproducer of my invention gives equal if not superior performance to the older types. Moreover my construction provides unexcelled shielding and protection for the transformer, and the appearance of the finished instrument is neat and pleasing.

I claim:

1. In an electromagnetic sound reproducer, a ferromagnetic cup, a pole within the cup and concentric therewith, a base for said cup, and a transformer mounted within and supported by said base, said shell, pole and base being formed from a single casting.

2. In an electromagnetic sound reproducer, an annular pole-piece, an annular flange for supporting a diaphragm, and supporting members mounting said flange on the pole-piece, said pole-piece, flange and supporting members being formed from a single casting.

In testimony whereof, I have hereunto set my hand.

KARL K. JENSEN.