May 2, 1933. P. L. JENSEN 1,906,379

ELECTRODYNAMIC SOUND REPRODUCER

Filed Oct. 29, 1927

Fig. 1

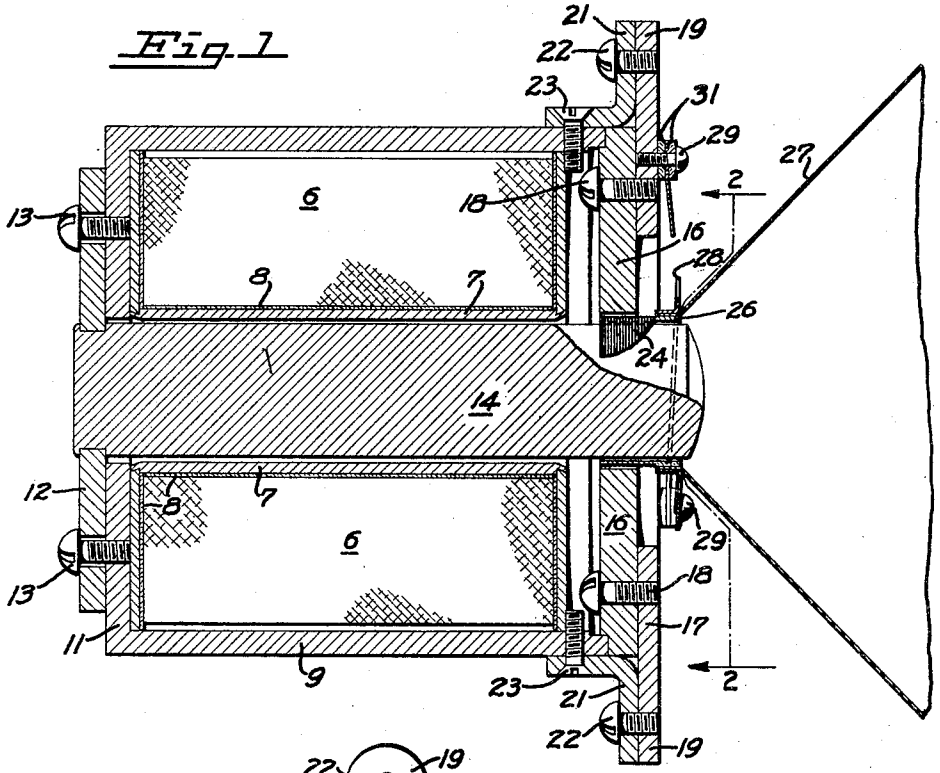


Fig. 2

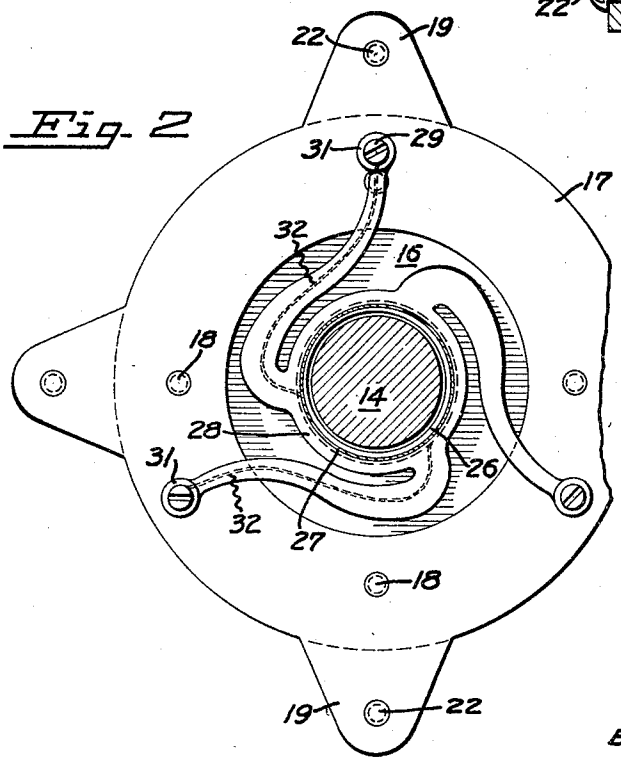
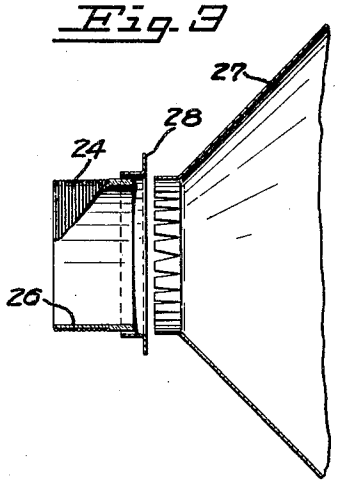


Fig. 3



INVENTOR
PETER L. JENSEN
BY Charles S. Evans
HIS ATTORNEY.

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UNITED STATES PATENT OFFICE

PETER L. JENSEN, OF ALAMEDA, CALIFORNIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO JENSEN RADIO MANUFACTURING COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF NEVADA

ELECTRODYNAMIC SOUND REPRODUCER

Application filed October 29, 1927. Serial No. 229,575.

My invention relates to magnetic sound reproducers, and particularly to those of the electrodynamic or moving coil type.

An object of my invention is to provide a means for positioning a coil in an air gap.

Another object of my invention is to provide a means of attaching a coil to a diaphragm.

A further object is to provide a supporting means for a moving coil which will position the coil definitely in its own plane while permitting free movement normal to said plane.

Still another object of my invention is to provide a means for preventing the breakage of the leads carrying current to the moving coil.

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 drawing 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 drawing, as I may adopt varying forms of my invention within the scope of the claims.

Referring to the drawing:

Fig. 1 is a sectional view of a sound reproducer embodying my invention, the plane of section including the longitudinal axis of the device.

Fig. 2 is a view of the same partly in section on the line 2—2 of Fig. 1.

Fig. 3 is a detail view, partly in axial section, showing the elements of the coil mounting in separated position.

Broadly considered my invention comprises a coil wound on a form. A portion of a diaphragm conforming to the form is clamped thereto by a collar. Spokes projecting from the collar are attached to the body of the reproducer to position the coil relative thereto, and the leads to the coil are cemented or otherwise fixed to the spokes to prevent their breaking as a result of the vibratory motion.

Sound reproducers of the electro-dynamic or moving coil type comprise a magnet which provides a powerful magnetic filed. Lying within this field, and at right angles to the lines of force forming it is suspended a coil which carries the telephonic current representing the sound to be reproduced. This telephonic current sets up a magnetic field of its own which reacts with the main field to urge the coil in a direction normal to both field and coil.

If the coil be fixed to a suitable radiating system its energy will be delivered to the air. The design of such a device is directed to the end that this energy be so delivered as efficiently as possible, and that it follow, as closely as may be, the exact wave form of the electrical energy supplied.

The force acting on the coil at any instant is proportional to the product of the constant field times the current in the movable coil. It is evident therefore that other things being equal, the sensitivity of the device is directly dependent upon the strength of the field.

If the magnet is properly designed only a very small proportion of the magnetomotive force is expended in the ferro-magnetic portions of the circuit, the major part of the force going to maintain the field in the air-gap.

The magnetomotive force necessary to produce a given strength of field in the gap is directly proportional to the gap length. It can therefore readily be seen that it is desirable to make the part of the gap not actually occupied by the coil, just as short as possible, i. e., to reduce clearances to a minimum. At the same time the coil must be wholly free from the sides of the gap, for friction at this point will produce serious distortion if it does not entirely prevent the reproducer from functioning. Hence a reproducer of this character, to be commercially practical, must be so designed that the parts may be held to tolerances of the order of one thousands of an inch, and means must be provided for accurately positioning coil and air gap so that the coil is freely movable in its designed direction of motion, but is positively prevented from motion in other dimensions. How I accomplish this in a preferred embodiment of my invention will now be set forth in detail.

The main or constant field is provided by a winding 6 which I have shown insulated from a brass bobbin 7 by a layer 8 of fibrous material. Surrounding the winding is the ferro-magnetic casing 9, provided at its lower end with the inwardly projecting flange 11 which constitutes one portion of the yoke. A plate 12 constituting the remainder of the yoke is attached to the flange by the screws 13 which are threaded into the flange. The holes in the plate thru which these screws pass are sufficiently large to allow an adjusting movement of the plate in its own plane of several thousandths of an inch when the screws are loose.

Riveted or otherwise rigidly fixed to the plate 12 is the core 14 which is loosely encircled by the flange 11 and projects completely thru the coil. The free end of this core or stud forms one of the pole pieces defining the air gap. The other pole piece is formed by the ring 16 which is accurately positioned on the casing by a groove or rabbet formed in its periphery.

A frame 17, preferably of cast aluminum, is secured to the ring pole piece by the screws 18. Lugs 19, cast integral with the frame are fastened to the brackets 21 by the screws 22, and the brackets, in turn, are screwed to the casing, thus holding the pole piece, together with the frame and the parts attached thereto, firmly in place. It is advantageous to have the screws 23, which secure the brackets to the casing, pass completely thru the latter, and impinge upon the flange of the bobbin 7, thus preventing it from shifting in shipment or otherwise.

Mounted upon the frame are the movable elements of the reproducer. These comprise the coil 24 which is wound upon and cemented to the form 26. This form may be turned from a suitable material such as bakelite or wound from paper, with a thickened portion provided at its outer end. The conical diaphragm 27 is truncated and is serrated from the plane at which its inner diameter is equal to the outer diameter of the form, the serrations being bent outward to form a projecting flange which embraces and conforms to the thickened portion of the form.

Over the junction thus formed is pressed a spider 28 which comprises a collar with projecting spiral spokes. The spider preferably is punched from thin sheet metal, the portion forming the collar being drawn perpendicular to the plane of the spokes. Before assembly the adjacent surfaces of collar, form and diaphragm are coated with laquer or cement, which holds the parts permanently in place.

The spider is secured to the frame by screws 29 passing thru the outer ends of the spokes and clamping them between the washers 31, which are preferably of fibrous material. The leads 32 from the coil 24 are secured to the spokes, preferably by cementing them thereto between layers of thin insulation, this construction preventing the breakage of the leads from the constant vibration to which they are subjected, which is a serious source of failure in reproducers of this type.

Suitable means are provided at the distal portion of the frame 17 for flexibly supporting the diaphragm 27. Since this is no part of the present invention, it need not be shown or described herein.

The construction just described permits the ready and accurate positioning of all of the parts. The magnet structure is first assembled without the diaphragm or moving parts. All of the screws fastening the assembly are set up tightly with the exception of the screws 13, which are left loose. An annular gage is then slid over the stud pole piece and into the orifice of the ring pole piece, the yoke portions 11 and 12 sliding to allow the stud to center accurately to permit this. Screws 13 are then tightened and the gage withdrawn.

The ring pole 16 and frame 17 are drilled in jigs, so that when the spider 28 is screwed in place the coil 24 is centered in the gap without further adjustment. The spokes of the spider, being spirally disposed, allow a considerable movement of the coil thru the gap, but effectually prevent motion across the gap which would permit the coil to strike the pole pieces.

It is of course to be understood that in claiming the magnetic circuit comprising the stud pole 14, yoke 11, 12, casing 9 and ring pole 16 as being ferro-magnetic I do not limit myself to iron, but include any of the metals or alloys having a permeability materially higher than air.

I claim:

1. A sound reproducer comprising a cylindrically formed coil, a diaphragm having a projecting flange, a collar securing the coil to the flange, spiral spokes on the collar, and means for rigidly mounting the ends of the spokes to position the coil.

2. A sound reproducer comprising a cylindrically formed coil, a diaphragm having a projecting flange, a collar securing the coil to the flange, spokes on the collar, means for rigidly mounting the ends of the spokes to position the coil, and leads for the coil secured to the spokes.

3. A sound reproducer comprising a cylindrical form, a coil mounted on the form, a diaphragm having a projecting flange, a collar between which and the form said flange is secured, spokes fixed to the collar, and means for rigidly mounting the ends of the spokes to position the coil.

4. A sound reproducer comprising a cylindrical form having a thickened edge, a coil mounted on the form, a diaphragm having a projecting flange, and a collar between which

and said thickened edge of the form said flange is secured.

5. A sound reproducer comprising a cylindrically formed coil, a diaphragm having a serrated edge bent to form a projecting flange, and a collar securing the coil to the flange.

In testimony whereof, I have hereunto set my hand.

PETER L. JENSEN.