March 18, 1941. H. C. WILLSON 2,235,187

ELECTRODYNAMIC SOUND REPRODUCER

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Fig. 1.

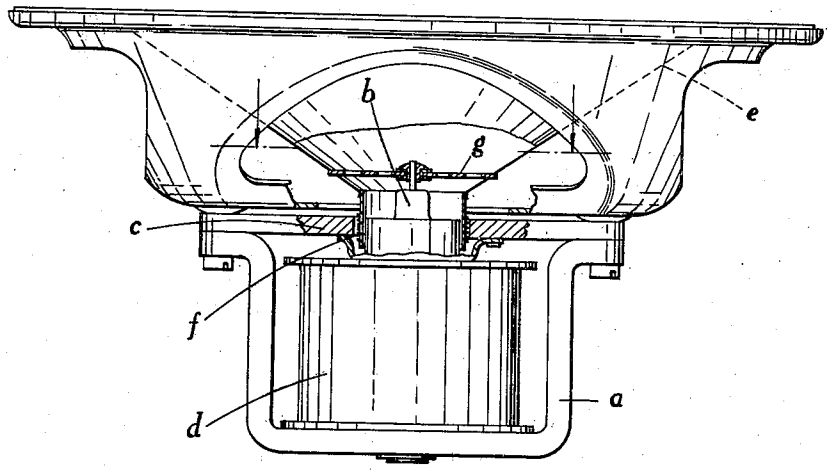


Fig. 2.

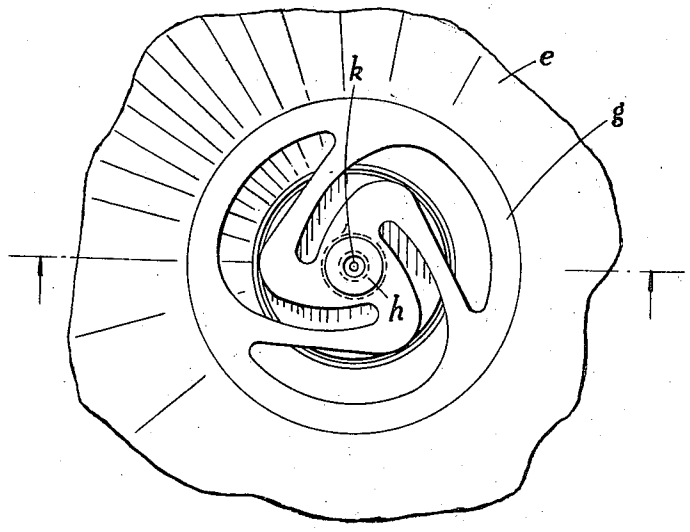
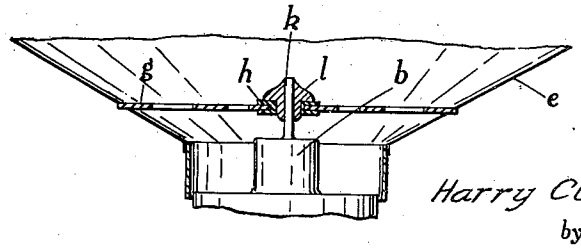


Fig. 3.



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Fig. 4.

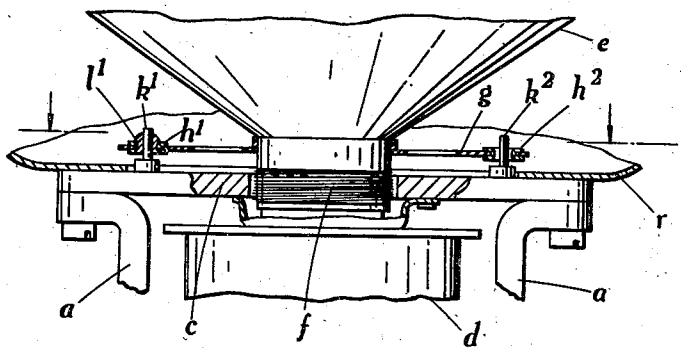


Fig. 5.

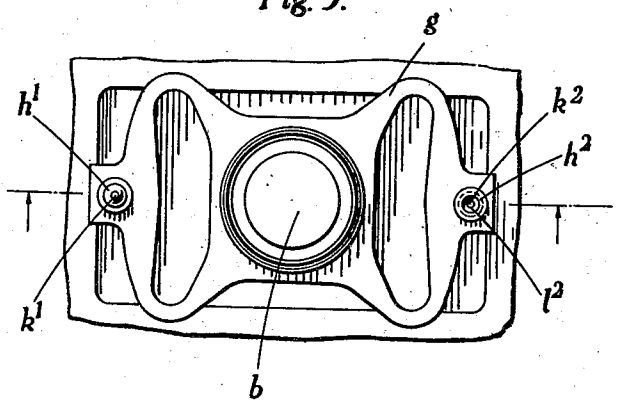


Fig. 6.

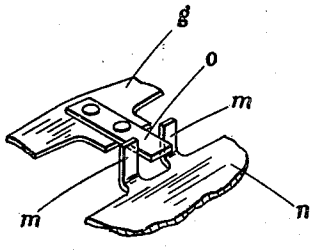
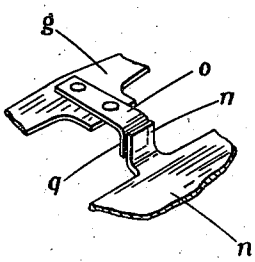


Fig. 7.



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UNITED STATES PATENT OFFICE

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ELECTRODYNAMIC SOUND REPRODUCER

Harry Claude Willson, Wolverhampton, England

Application November 3, 1938, Serial No. 238,660
In Great Britain November 9, 1937

9 Claims. (Cl. 179—115.5)

This invention relates to electro-dynamic sound reproducers, and is more particularly concerned with the centering of the voice coil in the gap between the central magnetic pole and the annular pole.

A number of methods have been suggested by means of which the voice coil, when located in its central position, is mounted correctly with respect to the central pole of the magnet. It is most desirable that, when the parts are assembled, the connecting parts shall not be under any stress, either in the direction of the axis of the central pole of the magnet, or in any other direction.

The object of the present invention, therefore, is to produce a method of mounting the voice coil, and the diaphragm to which it is attached, so that without any special skill, the resultant structure is entirely without stress.

According to the invention, therefore, a spider or other centering member for the moving coil assembly is provided with one or more parts which has a surface which, when the moving coil is centred and is therefore in the desired position, co-operates with or lies near to a surface of a corresponding stationary part fixed relatively to the stationary magnet system or the framework, one of the co-operating surfaces extending parallel to the axis of the moving coil so that when the moving coil is in the correct position, the spider or other centering member may be fixed without distortion by securing the co-operating surfaces together by a readily fusible alloy, such as solder or other suitable cement, in spite of substantial variation of the relative axial positions of the said two parts.

In perhaps the simplest case, the moving coil assembly consists of the coil carried by a conical diaphragm and the spider is mounted on the internal face of the diaphragm, the anchorage being at its centre. If the spider is metallic, it is formed with a central hole, or if non-metallic it is fitted with a central eyelet, or an eyelet and a pair of washers forming a central hole, and the anchorage is a pin of brass or similar material standing up centrally from the centre point of the magnet or an extension of it. The hole in the spider or in the eyelet is of sufficiently greater diameter than the pin to allow the voice coil to be brought into contact with the inner or outer poles of the magnet before the inner edge of the eyelet comes into contact with the pin. The latter is rigidly fixed to the inner pole and for this purpose may be screwed into a central bore in the inner pole or secured by being inserted in a moderately well-fitting hole in the pole and forcing the metal around the pin on to it.

The invention may, of course, also be applied to cases in which the spider or other centering member is external to the diaphragm. In that case, two or more fixed pins or other projections are provided to locate the spider at two or more points near its edge and these projections, after centering, are soldered to corresponding metal parts carried by the spider.

In any case the parts may be shaped so as to permit relative turning about the axis of the coil or relative angular motion in addition to axial and transverse movement before the parts are secured together.

Some forms of construction in accordance with the invention will now be described with reference to the accompanying drawings, in which

Figure 1 is an elevation partly in section, showing one form of construction,

Figure 2 is a plan of Figure 1, and

Figure 3 is a sectional view of part of Figure 1 to an enlarged scale,

Figures 4 and 5 are elevation and plan of an alternative form of construction, while,

Figures 6 and 7 are perspective views showing two alternative arrangements of projections for use in Figures 4 and 5.

In Figures 1 to 3, the general construction is on normal lines; the magnet is shown at *a*, the centre pole at *b*, the annular pole at *c*, and the magnetising winding at *d*. The conical diaphragm *e* carries the voice coil *f* as usual and, in this case, is provided with an internal spider *g* of non-metallic material. The spider has a central metallic eyelet *h* with a hole which is considerably larger than the diameter of a brass pin *k* driven into the end of the central pole *b*. The pin may be screwed into a central bore in the pole *b*, or secured by being inserted in a moderately well-fitting hole in the pole *b* and forcing the metal round the pin on to it.

In the process of assembly, the voice coil *f* is located correctly relatively to the inner pole *b* and outer pole *c* by any suitable means and a piece of solder *l* is allowed to run down the pin *k* and secure the eyelet *h* and therefore the centre of the spider *g* in the required position. Clearly, instead of the solder, other fusible metal or alloy or, indeed, other suitable cement may be employed instead. Also, if the spider *g* is of sheet metal, the pin *k* can be soldered direct to it and there is no need to provide the eyelet *h*.

It is obvious that no torsional nor any axial

stress can be permanently imposed upon the assembly because if the spider were depressed or otherwise deformed by the soldering iron, the solder is still liquid when the iron is removed and allows the spider to recover from any stress before the solder finally solidifies.

In Figures 4 and 5, the invention is shown applied to a moving coil assembly in which a spider *g* external to the diaphragm *b* is employed. As far as possible, the same reference numerals are applied to corresponding parts, as in Figures 1 to 3.

In this case, two fixed projecting pins k^1, k^2, are provided to locate the spider *g* near its two edges. Here again, the spider is non-metallic, although it can be made of metal and it is provided with two eyelets h^1, h^2, with holes larger than the pins k^1, k^2, so that as before the voice coil *f* can be centred and solder can be allowed to run down the pins k^1, k^2, to make the joint at l^1, l^2. It will be noticed that, in this case, the pins k^1, k^2, are supported from the outer pole *c* of the magnet. They could, however, be arranged to project from the framework *r* which supports the diaphragm *e*.

In Figure 6, the pins k^1, k^2 are each replaced by a pair of projections *m* extending from a plate *n* secured to the outer pole *c* and the spider *g* has on opposite sides, a short strip *o* riveted to it and passing freely between the projections *m* so as to allow the coil assembly to be centred. Then the strip *o* is soldered to the projections *m*.

Finally, in Figure 7, the spider *g* has the strip *o* riveted to it but turned down at its outer end at *q*. In this case, at each side there is a single projection *m* standing up from the plate *n* and arranged with sufficient gap between the co-operating surfaces to allow transverse movement as well as axial and angular movements during centering of the moving coil as in Figures 1 to 3. The parts *o* and *m* take up the relative positions substantially as shown in Figure 7 and can be easily soldered together.

It will be appreciated that in Figures 6 and 7, the plates *n* might quite well be secured to the framework supporting the diaphragm instead of to the outer pole of the magnet.

As already indicated above, the two parts of the anchoring means may be secured to each other either by suitable solder or by a suitable cement. Solder has the advantage over solvent cement in that there is no appreciable shrinkage in solder on solidifying, but there may be appreciable shrinkage upon drying of a solvent cement. In the appended claims, the term "cementing material" is to be interpreted broadly to apply either to solder or to cement, including solvent cement.

I claim:

1. In a moving coil sound reproducer having a flexible centering member secured to the diaphragm and anchored to the magnet, anchoring means comprising a part carried by the magnet and a part carried by the diaphragm, said parts being spaced apart to provide clearance between adjacent surfaces thereof in a direction at right angles to the direction of movement of said moving coil, one of said adjacent surfaces extending in a direction parallel to the direction of movement of said moving coil, and a body of hardened cementing material filling said clearance space between said two parts and joining said parts to each other.

2. In a sound producer, the combination of a magnet structure provided with inner and outer pole pieces arranged to form an annular air gap therebetween, a conical diaphragm having a movable coil mounted thereon, said coil being positioned within said annular gap and having a certain lateral clearance between said inner and outer poles, a flexible centering member secured to said diaphragm and extending from said diaphragm in a direction at right angles to the direction of movement of said coil, an anchoring member mounted upon said magnet structure and having a straight surface thereon extending in a direction parallel to the direction of movement of said coil, said anchoring member being positioned adjacent a portion of said centering member to provide lateral clearance between said straight surface and a portion of said centering member greater than the clearance between said coil and its inner and outer pole pieces, and means for securing said centering member to said anchoring member comprising a body of hardened cementing material filling the lateral clearance space between said centering member and said anchoring member.

3. In a moving coil sound reproducer having a conical diaphragm, in combination, a flexible centering member secured to the diaphragm, said centering member being formed of sheet material and being arranged in a plane at right angles to the direction of movement of the moving coil, said centering member having a hole formed in a part thereof remotely situated from the point of attachment of said centering member to said diaphragm, an anchorage pin mounted upon the magnet structure of said reproducer and extending through said hole in a direction parallel to the direction of movement of said moving coil, said hole being larger than the diameter of said pin to provide lateral clearance between said pin and the edge of said hole of the same order of magnitude as the clearance between said moving coil and its inner and outer poles, and means for securing said centering member to said pin comprising a body of hardened cementing material filling the space between the pin and the margin of said hole.

4. In a moving coil sound reproducer having a conical diaphragm in combination, a flexible centering member secured at its margin to the inner side of the diaphragm, said centering member having a central hole, an anchorage pin, of smaller diameter than said hole, secured to the central magnet pole and extending through said hole in a direction parallel to the direction of movement of said moving coil, and securing means consisting of a body of hardened liquid cement in and around the space between the pin and the margin of the hole.

5. In a moving coil sound reproducer having a conical diaphragm, in combination, a flexible centering member secured at its margin to the inner side of the diaphragm, said centering member having a central hole, a metal anchorage pin, of smaller diameter than said hole, secured to the central magnet pole and extending through said hole in a direction parallel to the direction of movement of said moving coil, said centering member being secured to said pin by solder filling the space between said pin and said central hole.

6. In a moving coil sound reproducer having a conical diaphragm, in combination, a flexible centering member secured at its margin to the inner side of the diaphragm, said centering member having a central hole, a metal eyelet secured to said centering member within the hole, a metal anchorage pin, of smaller diameter than

the aperture of the eyelet, secured to the central magnet pole and extending through said aperture in a direction parallel to the direction of movement of said moving coil, said eyelet being soldered to said pin by solder filling the space between said pin and said eyelet.

7. In a moving coil sound reproducer having a conical diaphragm, in combination, a flexible centering member secured to the outer side of the diaphragm and extending laterally therefrom, said centering member having at least one hole near its margin, at least one anchorage pin, of smaller diameter than said hole, secured to the outer magnet pole and extending through said hole in a direction parallel to the direction of movement of said moving coil, and securing means consisting of a body of hardened liquid cement in and around the space between the pin and the margin of the hole.

8. In a moving coil sound reproducer having a conical diaphragm, in combination, a flexible centering member secured to the outer side of the diaphragm and extending laterally therefrom, said centering member having at least one hole near its margin, at least one metal anchorage pin, of smaller diameter than said hole, secured to the outer magnet pole and extending through said hole in a direction parallel to the direction of movement of said moving coil, said centering member being secured to said pin by solder filling the space between said pin and said central hole.

9. In a moving coil sound reproducer having a conical diaphragm, in combination, a flexible centering member secured to the outer side of the diaphragm and extending laterally therefrom, said centering member having at least one hole near its margin, a metal eyelet secured to said centering member within the hole, a metal anchorage pin, of smaller diameter than the aperture of the eyelet, secured to the outer magnet pole and extending through said aperture in a direction parallel to the direction of movement of said moving coil, said eyelet being soldered to said pin by solder filling the space between said pin and said eyelet.

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