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B. A. ENGHOLM

1,891,404

LOUD SPEAKER

Filed May 30, 1930

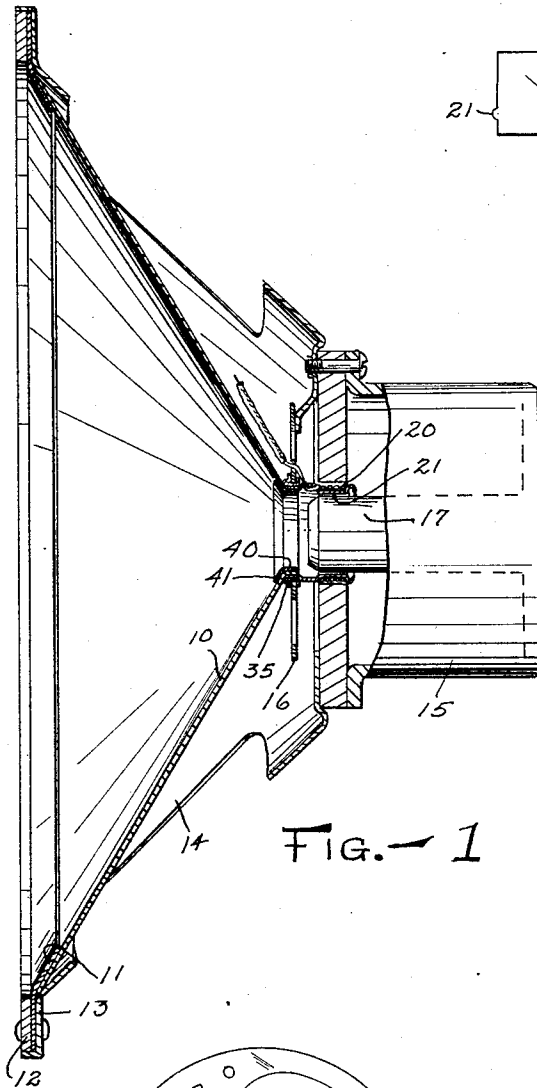


FIG. 1

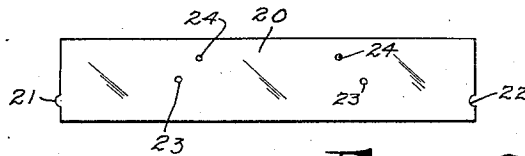


FIG. 2

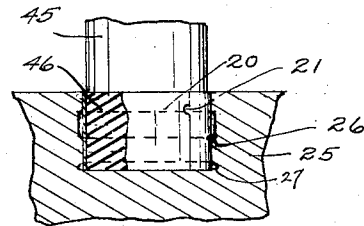


FIG. 3

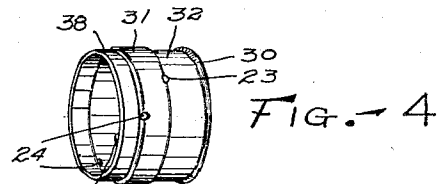


FIG. 4

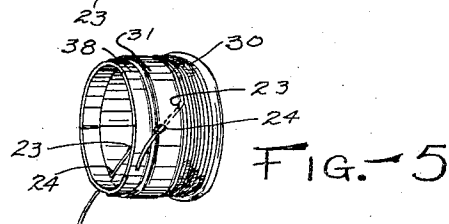


FIG. 5

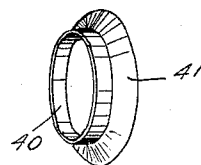


FIG. 6

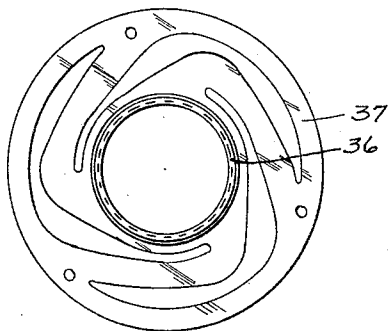


FIG. 7

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UNITED STATES PATENT OFFICE

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LOUD SPEAKER

Application filed May 30, 1930. Serial No. 457,552.

This invention relates to electro-dynamic loud speakers, which are used principally in connection with the operation of radio receiving sets. One form of loud speaker, which is in general use utilizes a tympanum in the form of a cone with a moving coil affixed to the apex end thereof. Considerable difficulty has been experienced in making a coil, which would have sufficient strength to withstand the necessary handling, incident to the assembling operations, and which at the same time would be sufficiently light in weight to keep the moment of inertia at a minimum.

One form of coil heretofore used has embodied a cylindrical core of paper on which the coil has been wound. To provide sufficient strength to permit attachment of the core to the cone and supporting spider, it has been necessary to reinforce the core with an additional layer of paper in the form of a collar. The core projected beyond the end of the collar and had the ends thereof serrated to provide tabs, which had to be glued onto the inner face of the cone. This form of construction is objectionable for it has been difficult to prevent the end turns of the coil from slipping off the core during the winding and subsequent handling operations. Furthermore, the use of an additional supporting collar increases the number of manufacturing operations while the connection between the core and cone has necessitated a delay in the assembling operation, until an adequate period of time has elapsed for the glue to dry.

Another core, which has been used, comprises a cylindrical member, which is nearly equal in thickness to the depth of the winding. The member is then turned down on a lathe to form a peripheral slot in which the coil may be wound. This obviously is an expensive procedure and is objectionable, as it does not overcome the difficulty of providing satisfactory means for connecting the core to the cone.

The principal object of the present invention is to simplify the core construction, so as to facilitate the winding of the coil, to protect the wires, and to make a rigid con-

nection between the core and cone. My invention also contemplates a novel method of assembly, as will hereinafter be brought out in the following description and in the appended claims.

Referring now to the drawing, Fig. 1 is a vertical section taken through a loud speaker assembly, embodying my invention; Fig. 2 is a plan view of a blank from which the core of the moving coil is formed; Fig. 3 is a section through a forming mould with the core blank positioned therein; Fig. 4 is a perspective view showing the shape of the core at the completion of the forming operation; Fig. 5 is a perspective view showing the core coil assembly; Fig. 6 is an end view of the coil attached to the supporting spider; Fig. 7 is a perspective of one of the collars, which are used for connecting the coil to the spider.

This invention is shown in connection with a loud-speaker, of the cone-type, wherein the tympanum 19 is in the form of a cone, which is fastened at the rim 11 between clamping rings 12 and 13 respectively. The ring 13 is in the form of a spider, having spaced arms 14 which extend beyond the apex end of the cone and terminate in a plate, which is clamped to the magnet housing 15, and to the cone spider 16. The magnet is indicated, as having a centrally disposed pole piece 17, which is usually cylindrical in shape, and which extends through the moving coil and terminates adjacent the apex end of the cone.

The present invention is more particularly concerned with the core constructed of the movable coil, and with the manner of connecting the core to the cone. Accordingly, I have shown the movable coil at 20, as being wound within a peripheral groove 21 in the core. The core in turn is attached to the cone and to the movable spider 16, in a manner that will hereinafter be described in detail.

To make the core, I take a strip of paper, having a thickness of from four to eight thousands of an inch, and having a length equal to the circumference of the core. The strip is then bent manually into the shape of a cylinder with the ends in abutting engagement, and is placed in a cylindrical mould 25.

To facilitate accurate alignment of the ends of the strip when bent to circular form, I provide a small tab 21 on one end, and a corresponding notch 22 on the other end. Thus, when the strip is bent into a cylindrical shape, the tab fits into or meshes with the notch. Furthermore, when the blank 20 is initially made, I provide pairs of openings 23 and 24, as is shown in Fig. 2. The openings 23 are in one longitudinally extending row, while those indicated at 24 are in a parallel row. These openings are utilizable for holding the ends of the wire in position, during and after the winding operation.

The mould 25 has an annular groove 26 formed on the inner surface and spaced above the bottom thereof. A second groove 27 is disposed below the groove 26, adjacent the region occupied by the lower edge of the blank 20. Thereupon a plunger having a head of soft rubber is forced into the cylindrical strip under considerable pressure, and as a result, the paper is stretched and formed into the contour of the mould. This therefore, provides a bead 30 at one end of the form and a rib 31 between the ends of the form. The space between the rib and bead constitutes a groove 32 into which the coil may be wound. The bead and the adjacent end of the rib act as limiting walls to keep the coil in place without requiring extra collars to be attached to the form. Furthermore, the position of the rib forming groove 26 in the mould is such that the openings 23 are disposed at one radial side of the rib, while the openings 24 are disposed adjacent the other radial side of the rib. Thus, when the ends of the coil are passed through the openings, the wire lies within the hollow of the rib, and are thus effectually insulated from the pole face of the magnet.

The openings through which the wires extend possess important manufacturing advantages. For example, one end of the wire may be quickly threaded through one pair of openings and then bent backwardly upon itself. It can thus be satisfactorily held against movement during the winding operation without requiring it to be looped or twisted around any member. When the winding is completed, the opposite end may be threaded through the remaining pair of openings and thereafter the coil will remain securely in place, notwithstanding the manner in which it is handled during subsequent assembling operations.

To provide an expeditious manner of connecting the coil and cone, I fasten a light metallic ring 35 onto the inner opening 36 of the spider 37. The end portion 38 of the core is then covered with cement or glue and is inserted into the ring 35. The apex end of the cone is split for a distance of about one-eighth of an inch to form segments or tabs. These tabs are then bent until they are paral-

lel with the axis of the cone and are inserted into the end of the core and are glued or cemented thereto. To hold such tabs firmly against the core, I use another metallic ring 40, which is slightly in excess of the inside diameter of the cone tabs. The ring 40 has a conical extension 41, which is tapered in conformity with the cone. After the surface of the ring 40 is glued or cemented, it is then pressed against the tabs, thus forcing them outwardly against the moving core, and in turn forcing the core against the ring 35. Thus, the entire assembly is securely locked together.

An important advantage of the present construction is the fact that the core can be formed almost instantly to the desired shape from a single strip of thin paper, and that when so formed it possesses all of the features of the more costly and complicated constructions heretofore used. Furthermore, the parts may be assembled quickly and expeditiously without waiting for the glue on any of the parts to dry. By making the core of a single strip of paper, I obtain a coil having exceptional strength and accuracy so that the air gap between the coil and magnet may be accurately maintained.

I claim:

1. An electromagnetic sound reproducer, comprising an electromagnetic driver, a sound reproducing diaphragm, a moving coil form connected to the diaphragm and comprising a single strip of material having spaced shoulders thereon defining a coil receiving groove, the form having perforations therein adjacent one end of the groove, and the material of the form being of substantially uniform thickness a coil wound in the groove, the leads of the coil passing through the perforations and serving to hold the coil in place.

2. An electromagnetic sound reproducer, comprising an electromagnetic driver, a sound reproducing diaphragm, a moving coil form connected to the diaphragm, and comprising a single strip of material having a bead formed therein adjacent one end thereof and having a shoulder formed therein intermediate the ends thereof, said shoulder and bead having the same thickness as the remaining part of the form and cooperating to provide a coil receiving groove, a coil mounted in the groove, and said form being provided with a perforation adjacent said shoulder, a terminal lead of said coil passing through said perforation.

3. An electromagnetic sound reproducer, comprising an electromagnetic driver, a sound reproducing diaphragm, a moving coil form connected to the diaphragm, and comprising a substantially cylindrical member of uniform thickness throughout, said form having spaced shoulders to provide a coil receiving groove and said form having a

perforation therethrough adjacent one end of the groove, a coil within the groove, said coil having at least one of its leads passing through said perforation, whereby said perforation and shoulder cooperate to provide a passageway within the form for locking one end of the coil to the form.

4. An electromagnetic sound reproducer, comprising an electromagnetic driver, a sound reproducing diaphragm, a moving coil form connected to the diaphragm and comprising a one piece substantially cylindrical member of uniform thickness throughout, a coil wound thereon, said form having raised portions thereon for limiting axial movement of the coil with reference to the form, one of the raised portions having openings at each end thereof, and the coil having one lead thereof passing through the openings whereby the openings and raised portion cooperate to provide a passageway within part of the form for one end of the coil, and whereby the extreme end of said lead is disposed outside the form and passes therethrough at a point remote from the end thereof.

5. An electromagnetic sound reproducer, comprising an electromagnetic driver, a sound reproducing diaphragm, a moving coil form connected to the diaphragm and comprising a single strip of material of cylindrical form, said form being of uniform thickness and having spaced shoulders provided therein, a coil surrounding the form and disposed between the shoulders, the form having pairs of spaced openings extending therethrough adjacent one end of the coil, said openings cooperating with the raised portions to provide passageways through which the leads of the coil may be passed into the form and then out of the form and bent back upon themselves to lock the coil against movement with relation to the form.

6. An electromagnetic sound reproducer including an electromagnetic driver, a sound reproducing diaphragm, a moving coil form connected to the diaphragm, and comprising a substantially cylindrical tubular member of substantially uniform thickness throughout, said form having a shoulder defining a coil positioning abutment, and said form being provided with a perforation therethrough adjacent to said shoulder, and a coil positioned on said form adjacent said shoulder, said coil having terminal leads at least one of which extends through said perforation.

7. An electromagnetic sound reproducer including an electromagnetic driver, a sound reproducing diaphragm, a moving coil form connected to the diaphragm, and comprising a substantially cylindrical tubular member, said form having means defining a coil positioning abutment including a shoulder upset from the material of the form, said form adjacent to the shoulder being provided with a perforation extending from the outer to

the inner face of said form, and a coil positioned on said form having one end thereof adjacent to said shoulder, said coil having a terminal lead extending through said perforation to the opposite face of said form, the upset shoulder providing a cavity on the inner face of the form to receive said terminal lead.

8. An electromagnetic sound reproducer including an electromagnetic driver, a sound reproducing diaphragm, a moving coil form connected to the diaphragm, and comprising a substantially cylindrical tubular member, said form having means defining a coil positioning abutment including a portion raised above the surface of the coil receiving portion of the form, said raised portion having a perforation at each end thereof, and a coil positioned on said form having one end thereof adjacent to said raised portion and having a terminal lead extending through one of said perforations to the opposite face of the form, the raised portion providing a cavity on the inner face of the form to receive said terminal lead, said lead passing out through said other perforation whereby to be disposed on the outer face of said form.

9. An electromagnetic sound reproducer comprising an electromagnetic driver, a sound reproducing diaphragm, a moving coil form connected to the diaphragm, and comprising a substantially cylindrical tubular member, means on one surface of said tubular member defining a coil positioning abutment, the opposite face of said tubular member being provided with a recess, the wall of said form adjacent to the abutment being apertured to afford communication to said recess from the opposite face of the tubular member, and a coil positioned on said tubular member with one end thereof adjacent to said shoulder, said coil having a terminal lead threaded through said aperture and lying in said recess.

10. An electromagnetic sound reproducer comprising an electromagnetic driver, a sound reproducing diaphragm, a moving coil form connected to the diaphragm, and comprising a substantially cylindrical tubular member, a coil mounted on said tubular member, means for fixing the coil against axial movement thereon, the inner face of said form being provided with a recess, said form being provided with an aperture adjacent to said recess, and a terminal lead on said coil passing through said aperture and lying in said recess.

In testimony whereof, I hereunto affix my signature.

BERNARD A. ENGHOLM.