Aug. 16, 1932. B. A. ENGHOLM 1,872,261

METHOD OF MAKING LOUD SPEAKERS

Original Filed May 30, 1930

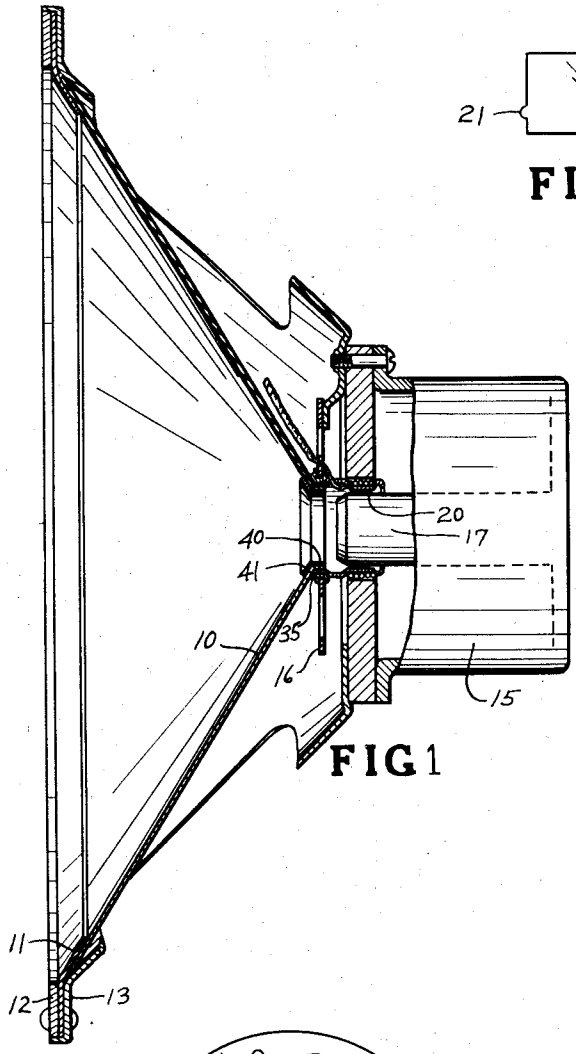


FIG 1

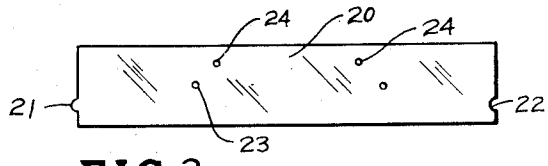


FIG 2

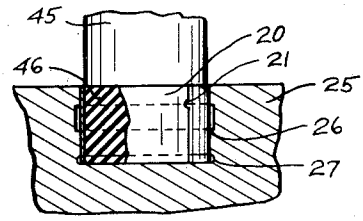


FIG 3

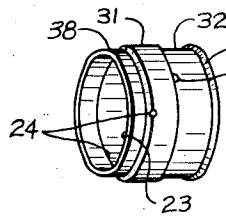


FIG 4

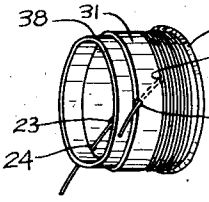


FIG 5

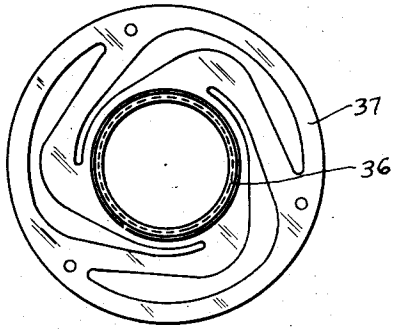


FIG 6

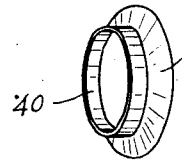


FIG 7

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UNITED STATES PATENT OFFICE

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METHOD OF MAKING LOUD SPEAKERS

Original application filed May 30, 1930, Serial No. 457,552. Divided and this application filed September 29, 1931. Serial No. 565,724.

This invention relates to methods of making electro-dynamic loud speakers, which are used principally in connection with the operation of radio receiving sets. The present application is a division of my prior application Serial No. 457,552, filed May 30th, 1930.

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.

A principal object of the present invention is to provide a method of core construction whereby the entire core may be formed quickly and economically from a single strip of paper. Another object of the invention is to provide a simplified method of core construction, so as to facilitate the winding of the coil, to protect the wires, and to make a rigid connection 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 typanum 10 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 construction 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 51 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 parallel 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 method disclosed herein lies in 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, by my method 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, and by the method disclosed herein, I obtain a coil having exceptional strength and accuracy, and as a result the air gaps between the coil and magnet may be accurately maintained.

I claim:

1. A method of making a core for an electro-magnetic coil, comprising taking a substantially rectangular strip of paper having spaced perforations therein, bending a strip into the form of a cylinder with the ends in continuous relationship, deforming the cylinder so as to provide a recessed outer surface thereof, passing a wire through a perforation and then winding the coil in the recess.

2. A method of making an electro-magnetic coil, comprising taking a substantially rectangular strip of paper having spaced perforations therein, bending the strip into the form of a cylinder with the ends in contiguous relationship, deforming the cylinder so as to provide a recess in the outer surface thereof, and in such manner that one of the perforations is adjacent said recess, passing a wire through such perforation and then winding the coil in the recess.

3. A method of making an electro-magnetic coil comprising taking a substantially rectangular strip of paper having spaced parallel rows of perforations therein and a tab on one end and a corresponding notch in the other end, bending the strip into a cylinder with the ends in abutting relationship and with the tab engaging the notch, deforming the cylinder to form a bead on one end

of the cylinder and a rib intermediate the ends thereof, the respective rows of perforations being adjacent the edges of said rib, thereby providing a coil receiving groove between the bead and the rib and thereafter passing a wire through two of such perforations, winding a coil of the wire in the recess and passing the wire through two other perforations.

In testimony whereof, I hereunto affix my signature.

BERNARD A. ENGHOLM.