

July 22, 1952

R. D. CHARLESWORTH  
MAGNETIC UNIT WITH MAGNETICALLY POSITIONED  
POLE PIECE FOR LOUD-SPEAKERS

2,604,551

Filed Aug. 28, 1948

2 SHEETS—SHEET 1

FIG. 4.

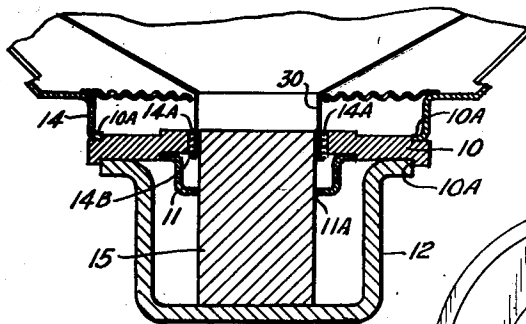


FIG. 2.

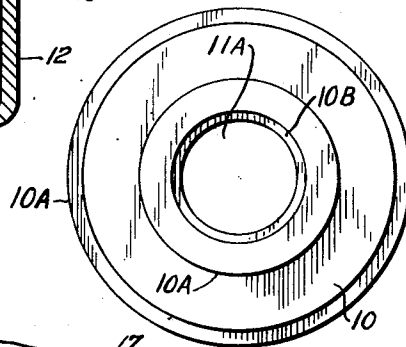


FIG. 1.

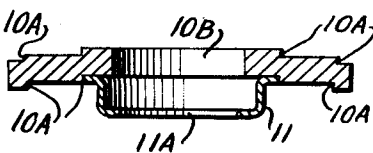


FIG. 5.

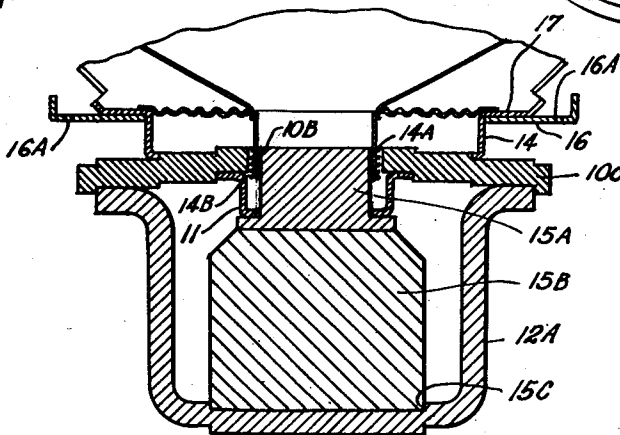
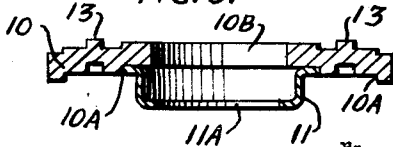


FIG. 3.



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2 SHEETS—SHEET 2

FIG. 6.

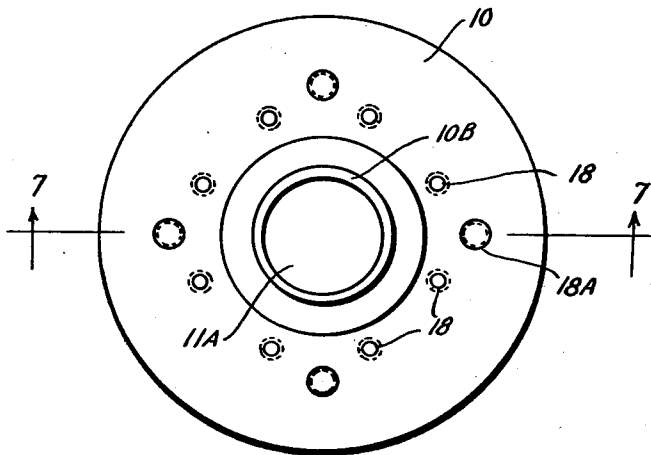


FIG. 7.

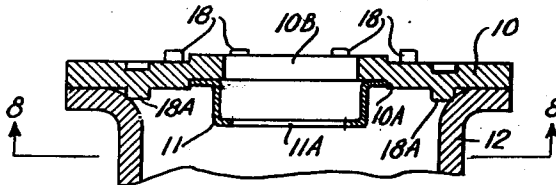
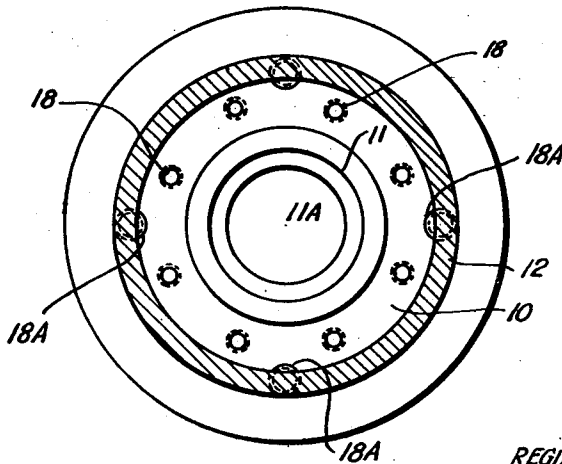


FIG. 8.



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# UNITED STATES PATENT OFFICE

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## MAGNETIC UNIT WITH MAGNETICALLY POSITIONED POLE PIECE FOR LOUD-SPEAKERS

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6 Claims. (Cl. 179—115.5)

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This invention relates to improvements in loud speakers of the type in which a diaphragm carries a voice coil that operates in a magnetic air gap, and, in particular, relates to improved means and methods for constructing and utilizing magnetic units that in themselves are independent of and contain no portion of a diaphragm unit to be used in forming the loud speaker, although these magnetic units are adapted to detachably co-operate with the diaphragm unit and particular locking means whereby an efficient loud speaker is produced, and has been devised to produce magnetic units that are complete in themselves and may be manufactured in various sizes and powers and used or stored for later use with particular diaphragm units and locking means also of independent individual construction whereby the units may be secured to each other in operative relation so that the individual units of a loud speaker may be demounted, inspected, cleaned, replaced or interchanged without the use of gauges, jigs, or special or precision equipment.

Hitherto designs and methods of assembly of loud speakers of the moving coil type include having at least one member of the magnetic section as an inseparable or integral part of the diaphragm head assembly—usually held by rivets or the like. This leaves much to be desired with respect to dismantling the speaker for cleaning and servicing because in these constructions the magnetic section has to be dismantled piecemeal in order to gain access to the voice coil and the magnetic air gap. This piecemeal dismantling breaks the magnetic flux locked up in the structure and on re-assembly the lost flux has to be replaced by re-charging before the speaker can function again efficiently. Furthermore the re-assembly calls for considerable skill even to those well practised in the art. Therefore one of the principal objects of this invention is to provide a magnetic unit complete in itself and so formed as to be readily detached from a complete loud speaker so that the voice coil and the air gap can be cleaned without further dismantling and to be accurately re-attached to any suitable diaphragm head assembly without the use of gauges, jigs, or the like.

Another object of this invention is to provide a complete removable magnetic unit for loud speakers in which the relevant parts of the unit are held in correct and secure alignment without the aid of assembly screws, rivets, adhesives or the like usually employed in the art.

A further object of the invention is to provide

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a complete detachable magnetic unit so formed as to be manufactured in various sizes or powers for storage or immediate use and to be capable of assembly at will to any suitable diaphragm head unit of the various sizes, thereby giving great flexibility of type and production speed by using units from stock or directly co-relating them on the production lines.

According to this invention I provide a magnetic structure comprising a top plate formed or provided with continuous or non-continuous steps, ledges, recesses, bosses or the like as positioning and nesting means on its upper and lower surfaces; an orifice for providing the outer boundary of an air gap to be formed therein said orifice positioned in strict relation to the said positioning and nesting means; a non-magnetic centering ring, nesting in the under surface of the top plate and secured thereto by riveting, peening or the like, so that the ring aperture is concentric with the top plate orifice. This ring aperture is adapted to present a neat sliding fit to a central floating pole piece of magnetic material that projects through the ring aperture and into the top plate orifice to form a concentric air gap, and a magnet pot encasing said floating pole piece and adapted to nest in positioning and nesting means on the lower face of the top plate.

The upper and lower surfaces of the top plate may be provided with one type of positioning and nesting means or different types of these means may be used simultaneously on the different surfaces.

The top plate is of any desired shape, size and thickness, and the steps, ledges, recesses, bosses or the like positioning and nesting means may be formed by extrusion, pressure or other suitable methods. They may be formed, for example, by securing to each surface of the top plate flat metal rings or the like that have continuous or non-continuous peripheral surfaces and so that the steps or the like are, preferably, at right angles to the top plate and function as automatic positioning and nesting means for applying detachable structures such as the lower end of a diaphragm assembly unit and the upper end of a magnet pot so that they are in correct operative positions.

In the preferred method of assembly of the magnetic unit the detachable floating pole piece is, preferably, a magnetisable cylindrical slug and may comprise the whole of the central pole piece. It is adapted to make a neat sliding fit within the non-magnetic centering ring.

When the slug comprising the whole of the cen-

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tral pole piece is assembled into the pot with the top plate in position it is charged magnetically and the working flux density is so high that the pull on the bottom of the pot is sufficient, in conjunction with the non-magnetic centering ring, to prevent any undesired movement of the floating slug and its position makes a correct and uniform air gap with the wall of the top plate orifice. Furthermore the top plate and the pot are held together magnetically, forming a complete magnetic unit.

In a modified form of the magnetic unit the central pole piece may consist of a detachable mild steel tip or pole piece that fits at its front end into the non-magnetic centering ring to form an air gap. It is constructed to contact magnetically at its bottom surface with a floating slug of magnetizable material that nests into a recess in the base of the pot said recess providing locating means for the slug and preventing lateral movement of the slug. When this assembly is charged magnetically it is held together as a unit by magnetic force, the mild steel tip being held to the surface of the slug, and together with the non-magnetic ring, prevents any undesirable movement of the mild steel tip and makes an accurate air gap with the wall of the top plate orifice.

The magnet pot is of known formation and material but may be provided about its upper end with an outwardly projecting metal flange that is adapted to be nested in positioning and nesting means on the under face of the top plate, and, in addition to its magnetic effects the flange may, in some forms of construction, function as means associated with locking members for detachably securing the magnetic unit to the diaphragm assembly unit of the loud speaker.

For use with magnet pots of larger than normal size the top plate is correspondingly enlarged and provided with its orifice in correct relation to the positioning and nesting means on the top plate, the positioning and nesting means are also enlarged to effect secure and detachable locking of the magnetic unit to the diaphragm assembly unit.

In the accompanying drawings which illustrate several forms of construction of my magnetic unit:

Fig. 1 is a central sectional elevation of a top plate with centering ring;

Fig. 2 is a plan of the same;

Fig. 3 is a central sectional elevation of a modified form of top plate;

Fig. 4 is a central sectional elevation of a complete magnetic unit;

Fig. 5 is a similar view of a modified form of construction;

Fig. 6 is a top plan of a modified form of top plate;

Fig. 7 is a part sectional elevation on line 7-7 of Fig. 6;

Fig. 8 is a section on line 8-8 of Fig. 7.

A top plate 10 is provided with positioning and nesting means in the form of continuous right angled steps 10A on its upper and lower surfaces, and with an orifice 10B located in relation to the positioning means 10A. An inner step on the under surface of the plate serves to locate and nest a non-magnetic centering ring 11 formed with an aperture 11A of smaller diameter than that of orifice 11B, but concentric therewith. An outer step on the under surface of the plate is adapted to locate and nest a magnet pot 12 (Fig. 4). A step on the upper surface

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of the plate is adapted to locate and nest a diaphragm assembly unit, such as those in Figs. 4 and 5.

In a modified form of top plate (Fig. 3) the upper surface of the plate, in place of the steps 10A of Fig. 1, is provided with positioning and nesting means in the form of circumferentially spaced bosses 13 that function similarly to the steps 10A of Fig. 1. The positioning and nesting means on the under surface in this form of plate are similar to those of the under surface of Fig. 1.

As illustrated in Fig. 4 a diaphragm assembly unit shown in part elevation has a housing extension member 14 the lower end of which is located and nested by a step 10A, the voice coil 14A passes concentrically through the orifice 10B of plate 10 and air gap 14B between the plate and central pole piece. The voice coil is spaced from both the plate and the central pole piece. A voice coil former 30 is indicated as receiving the voice coil 14A.

A central pole piece in the form of a cylindrical floating slug 15 of magnetic material makes a close or tight fit with the aperture 11A of centering ring 11 and at its lower end is held magnetically to the inner bottom surface of the magnet pot 12 when the unit is energized.

In a modified form of assembly as shown in Fig. 5 the voice coil 14A similarly fits within the orifice 10B of an enlarged top plate 10C. A pole piece 15A projects at its upper end through the centering ring 11 and into the orifice 10B in the top plate to form the air gap 14B for the voice coil. The lower end of pole piece 15A makes magnetic contact with a magnetic slug 15B that is nested in a recess 15C in the base of the enlarged magnet pot 12A. An outer circular flange 16 on the diaphragm housing 17 is provided with a series of spaced slots 16A to serve as part locking means when the diaphragm assembly unit is locked on the magnetic unit.

In the modified form of top plate (Figs. 6, 7 and 8) the plate 10 has the orifice 10B, and in place of the positioning and nesting steps 10A of the earlier figures has positioning and nesting means in the form of spaced bosses 18 on its upper surface; bosses 18A on its lower surface nest the magnetic pot. This pot plate also nests the centering ring 11, with aperture 11A in the step 10A.

The types of positioning and nesting means illustrated may be replaced in whole or in part by equivalent means of the type described.

Having now particularly described and ascertained the nature of this said invention, and in what manner the same is to be performed I declare that what I claim is:

1. In a loud speaker of the moving coil type, a magnetic assembly unit comprising in combination, a top plate with its surfaces broken to form positioning and nesting means and containing an air gap orifice accurately located in relation to said positioning and nesting means, a non-magnetic centering ring mounted on the lower surface of the top plate in concentric relation to the air gap orifice, a magnet pot having an outwardly extending circular flange on the upper end thereof engaging the lower surface of the top plate and located by the positioning and nesting means on the lower surface of the top plate, and a magnetic slug contained within said pot and movable laterally thereof and positioned therein by means of said centering ring through which the slug snugly extends.

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2. In a loud speaker of the moving coil type, a magnetic assembly unit comprising in combination, a top plate with its surfaces broken to form positioning and nesting means and containing an air gap orifice accurately located in relation to said positioning and nesting means, a non-magnetic centering ring mounted by the positioning and nesting means on the top plate in concentric relation to the air gap orifice, a magnet pot engaging the top plate, and a magnetic slug contained within and movable laterally of said pot and positioned therein by means of said centering ring through which the slug extends.

3. In a loud speaker of the moving coil type, a magnetic assembly unit comprising a top plate with its surfaces broken to form positioning and nesting means and containing an air gap orifice located in relation to the positioning and nesting means, a non-magnetic centering ring mounted in concentric relation to the air gap orifice, a magnet pot engaging the lower surface of the top plate and located by positioning and nesting means in the lower surface of said top plate, said pot containing a magnetic slug nested in and held magnetically in the base of the pot, said slug terminating below the surface of the said centering ring and surmounted with a mild steel pole piece terminating within the air gap orifice and to be disposed concentrically therein by the said centering ring to form a concentric air gap and to be held at its base magnetically to the upper surface of the said magnetic slug.

4. A magnetic assembly unit according to claim 1 in which an air gap is formed by the top plate

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orifice having a portion of the magnetic slug held in concentric relation with the wall of the orifice, said air gap being accurately located in relation to positioning and nesting means in the said top plate so that the positioning and nesting means may locate and removably position a diaphragm assembly unit in such a manner that a voice coil associated with the diaphragm unit is located concentrically and in correct operative position in the magnetic air gap.

5. In a loud speaker according to claim 2, a magnetic top plate in which the positioning and nesting means are in the form of circumferentially spaced bosses.

6. In a loud speaker of the moving coil type according to claim 2, a magnetic unit formed of the magnet pot and slug, the unit being held together in operative relation by its own magnetic force when the slug is energized.

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