

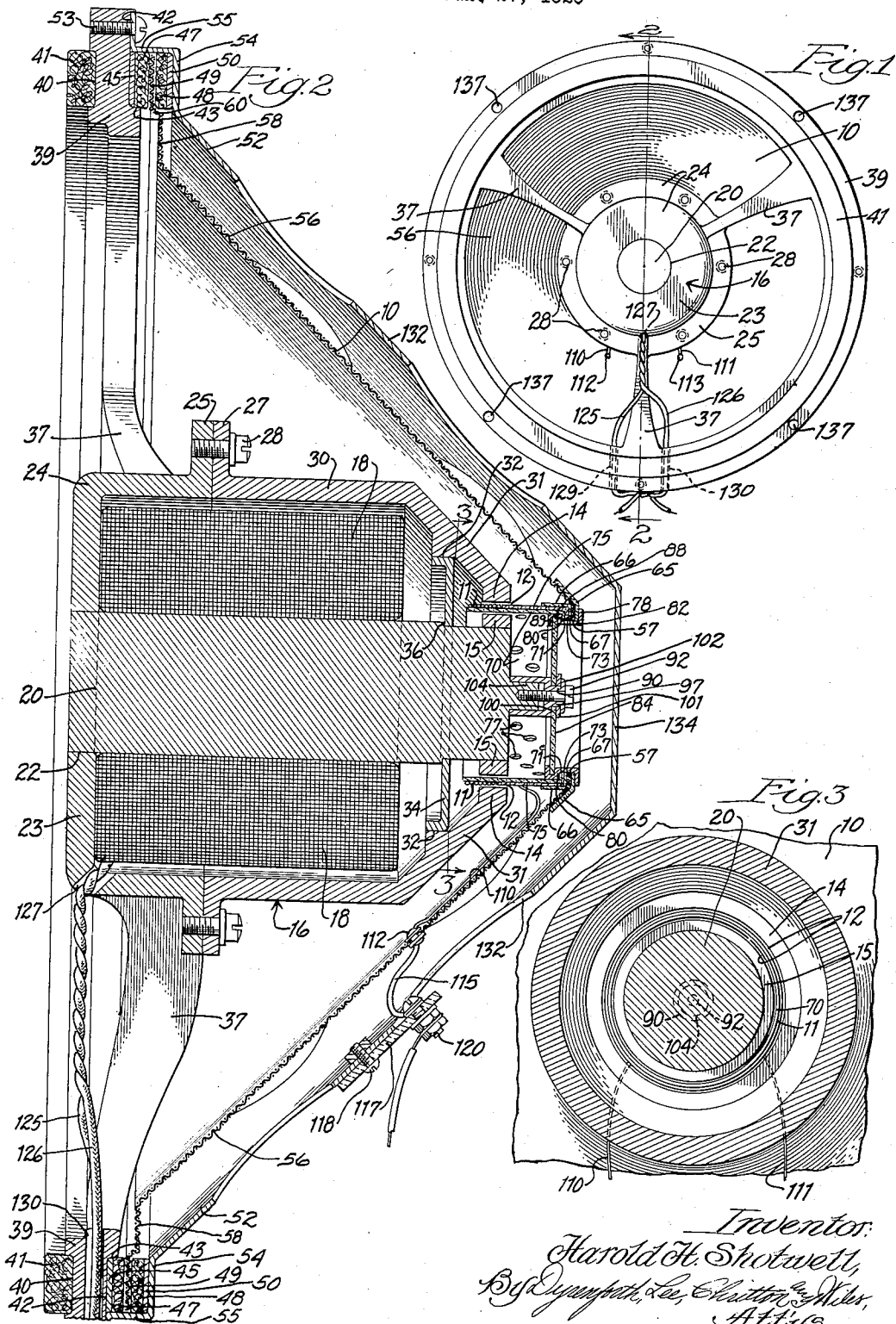
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LOUD SPEAKER

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LOUD SPEAKER

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My invention relates to loud speakers, and particularly to loud speakers adapted to be employed in connection with radio-receiving sets, or the equivalent.

5 The invention has among other objects, the production of devices of the kind described that are compact, efficient, durable and simple in construction.

10 Particular objects of the invention are to provide an improved loud speaker comprising parts which may be quickly and easily assembled with each other and which will remain in alignment after being assembled; to provide an improved diaphragm for a loud speaker; to provide an improved speaker comprising an improved magnetizing structure, and to provide improved means for supporting a diaphragm, and the means for actuating the diaphragm, in a loud speaker of the type that comprises a winding, or the equivalent, disposed in an annular magnetic field.

Many other objects and advantages will appear as this description progresses, reference being had to the accompanying drawing, wherein:

25 Figure 1 is a front elevation of a loud speaker embodying my invention;

Fig. 2 is an enlarged section taken on line 2—2 of Fig. 1, and

30 Fig. 3 is a section taken on line 3—3 of Fig. 2. Referring to the drawing, wherein I have shown a loud speaker which embodies a preferred form of the invention, the reference character 10 designates a diaphragm which is operatively connected to a winding 11 disposed in an annular magnetic field 12 provided between outer and inner pole pieces 14 and 15, respectively, of an electro-magnet which is designated generally by the reference character 16. The electro-magnet 16 comprises a winding 18 which may be connected to any suitable source of electrical energy so that it will cause the annular magnetic field 12 to be relatively intense.

40 The winding 18 is disposed around a pole 20 which carries the inner pole piece 15, the pole piece 15 being preferably a ring secured to one end of the pole 20. The other end of the pole 20 is secured, preferably by a press-fit, in an aperture 22 provided in the bottom or end wall 23 of a cup-shaped magnet member 24 provided with an outwardly extending annular flange 25.

50 The outer pole piece 14 is preferably tubular in form, and is preferably provided with an outwardly extending flange 27 which is preferably secured to the annular flange 25 by bolts 28, or the equivalent. As shown, the outer pole piece 14 preferably comprises a substantially cylindrical wall 30 formed integral with a frusto-conical wall 31 which is provided on its inner surface with an annular shoulder 32. Disposed between the 60 annular shoulder 32 and the pole 20 is an apertured disc 34 which holds the pole 20 in a position wherein its longitudinal axis is coincident with the axis of the annular magnetic field 12. This construction insures that the pole piece 15 will be correctly spaced from the pole piece 14 at all times and means, hereinafter described, for supporting the winding 11 will not frictionally engage either of the pole pieces. It will be noted that the apertured disc 34 is mounted on an end of the pole 20, which end is of reduced diameter, the apertured disc 34 being preferably positioned against an annular shoulder 36 formed on the pole 20.

5 It may be mentioned that the pole 20, the magnet member 24 and the outer and inner pole pieces 14 and 15 may be made from any suitable magnetic metal, but I preferably form the magnet member 24 and the pole piece 14 from malleable iron, or the equivalent.

15 Preferably formed integral with the magnetic member 24 are a plurality of radially extending arms 37 which constitute a spider for supporting a ring preferably formed integral with the arms. The front surface of the ring 39 is preferably provided with an annular recess 40 to hold a ring 41 formed of felt, or the equivalent.

20 In practice, the improved loud speaker is preferably positioned against a baffle, or the equivalent, and the ring 41 is preferably provided to engage the baffle. The rear surface of the ring 39 is preferably cut away, as at 42, to provide an annular shoulder 43, and engaging the shoulder 43, and seated against the rear surface of the ring 39 is a ring 45 preferably formed from cardboard. Secured by adhesive, or any other suitable means, to the cardboard ring 45 is a ring 47 formed of felt, or the equivalent, and interposed between the felt ring 47 and a similar ring 48 is the marginal edge 49 of the diaphragm 10. The felt ring 48 is secured by adhesive, or any other suitable means, to a cardboard ring 50.

30 The felt and cardboard rings are retained in place by the annular shoulder 43, the rear surface of the ring 39 and a housing member 52 which is preferably formed from sheet metal, and is preferably rigidly secured to the ring 39 by screws 53, or the equivalent.

45 It will be noted that the housing member 52 preferably comprises an outwardly extending flange 54 against which the cardboard ring 50 abuts, and that an annular flange 55 formed integral with the annular flange 54 engages the outer edges of the cardboard and felt rings and holds the cardboard and felt rings concentrically disposed with respect to the longitudinal axis of the pole 20.

55 The diaphragm 10 preferably comprises a conical portion 56 having an aperture 57 at its apex. Formed integral with the conical portion 56, at its base, is an outwardly extending annular flange 58

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which is preferably formed integral with the marginal portion 49 of the diaphragm. However, it will be noted that the annular flange 58 is offset with respect to the marginal portion 49 so that an annular shoulder 60 is provided. The shoulder 60 is of such diameter that it fits loosely within the felt ring 48 and thereby co-operates with the felt ring 48 to hold the diaphragm in its correct position within the housing member 52. The offset portion of the diaphragm providing the shoulder 60 is advantageous in that it lends flexibility to the diaphragm at this point and permits the conical portion 56 to vibrate freely when actuated by the winding 11, as hereinafter described.

The material immediately surrounding the aperture 57 provided in the conical portion 56 of the diaphragm 10 is clamped between an apertured metallic disc 65 and a collar 66 preferably provided with an inwardly extending annular flange 67, the collar 66 and flange 67 being preferably formed from paper, or the equivalent. The winding 11 is preferably mounted upon a sleeve 70 which is preferably formed from paper, or the equivalent, the sleeve 70 being provided with an inwardly extending annular flange 71. Clamped between the annular flange 71 and the annular flange 67 is an annular flange 73 preferably formed integral with a sleeve 75 disposed around one end of the sleeve 70. The sleeve 75 is preferably formed from paper, or the equivalent. The sleeves 70 and 75 are preferably provided with a plurality of apertures 77 for a purpose which will presently appear.

The annular flanges 71, 73 and 67 and the disc 65 are preferably clamped between a flange 78 and an annular shoulder 80 formed upon a metallic sleeve 82 which is carried by a flexible disc 84, the flexible disc 84 being preferably formed from leather, although other flexible materials may be employed if it is so desired. The marginal portion of the disk 84 is clamped between a shoulder 88 and a flange 89 formed upon the sleeve 82, and the disc 84 is preferably apertured to accommodate a tubular member 90 which is preferably secured to the core 20 by a bolt 92.

It will be noted that the aperture in the disc 84 engages a portion 97 of the tubular member 90, which portion 97 is of reduced diameter, the material surrounding the aperture in the disc being clamped between an annular shoulder 100 formed upon the tubular member 90 and a washer 101 which is held in place by an annular flange 102 formed integral with the tubular member 90. It is readily understood that when the tubular member is being assembled with the flexible disc 84, the flexible disc may be positioned upon the reduced portion 97 of the tubular member, after which the washer 101 may be placed in position upon the reduced portion 97. The end of the tubular member 90 is then upset to provide the annular flange 102. The tubular member 90 may then be positioned upon an outwardly projecting cylindrical lug 104, preferably formed integral with the pole 20, the tubular member 90 being secured to the pole 20 by the screws 92, as explained above.

The winding 11 preferably comprises enameled wire, although any other suitable conductor may be employed in place of the enameled wire. The wire is preferably wound around the sleeve 70 and a coating of lacquer, shellac, or any other suitable adhesive is applied thereto so that it will adhere to the sleeve. Some of the adhesive flows through the apertures 72 and aids in securing the winding to the sleeve. The sleeve 75 is preferably

secured to the sleeve 70 by applying some of the adhesive thereto, the adhesive flowing through the apertures 77 to secure the sleeves to each other. The terminals of the winding 11 are preferably connected by electrical conductors 110 and 111 to tubular binding posts 112 and 113, respectively, secured to the conical portion 56 of the diaphragm 10. Other electrical conductors, one of which is shown at 115, connect the tubular binding posts 112 and 113 with suitable binding posts mounted upon an insulating plate 117 which is rigidly secured to the housing member 52 by bolts 118, or the equivalent. One of the binding posts carried by the plate 117 is illustrated at 120 in Fig. 2.

The binding posts 120 are connected by suitable electrical conductors to the output circuit of a radio-receiving set, a phonograph pick-up device, or any other suitable source of telephonic current, or the equivalent.

The terminals of the winding 18 are connected by insulated electrical conductors 125 and 126 to any suitable source of electrical energy (not shown). It will be noted that I have provided an aperture 127 in the magnet member 24 to accommodate the electrical conductors 125 and 126, and that I have provided apertures 129 and 130 in the ring 39 through which the electrical conductors 125 and 126 may be threaded to lead them to the source of electrical energy.

The housing member 52 preferably comprises an apertured frusto-conical portion 132 which has an end wall 134 formed integral with it. Holes 137 in the ring 39 are provided so that the ring may be secured to a baffle, or the like, by suitable bolts so that the loud speaker will be supported from the baffle.

The improved diaphragm 10 preferably comprises a fabric which has been impregnated with a suitable mixture or compound to stiffen it, thus in a preferred embodiment of the invention, I apply pyroxylin lacquer to the fabric to stiffen it. Of course, other suitable substances, including other nitro-cellulose products may be employed in place of the pyroxylin lacquer. After the diaphragm has been stiffened, it is preferably coated with aluminum paint.

In some instances the entire diaphragm is coated or impregnated with the stiffening substance to the same extent, but in the preferred embodiment of the invention, I preferably impregnate or coat the rear half of the conical portion of the diaphragm with a larger amount of the stiffening substance so that the rear half or smaller end of the conical portion will be relatively stiff as compared with the front end or larger portion of the diaphragm. This construction is advantageous in that in translating the higher audio-frequency, the rear end or the part of the diaphragm nearest the aperture 57 in the apex, will not yield, even though the front end of the diaphragm yields. Then the smaller end of the conical portion will vibrate bodily to translate the higher audio frequencies into sound. In practice, about half of the conical portion 56 is rendered relatively stiff with respect to the remaining portion thereof.

The annular portion 49 of the diaphragm 10 is not held rigidly between the felt rings 47 and 48. The construction being such that if the screw 92 is disengaged from the pole 20 the diaphragm may be rotated bodily around the longitudinal axis of the pole, as there is relatively little or no frictional engagement between the annular portion 49 and the felt rings 47 and 48. The primary

function of the rings 47 and 48 is to co-operate with the baffle (not shown), or the equivalent, to which the loud speaker is secured so that the sound waves propagated by the front or interior surface of the conical portion 56 will not be neutralized by the sound waves propagated from the rear or exterior surface of the conical member 56, it being understood that the sound waves which issue from the interior surface of the conical member are opposite in phase to those that issue from the exterior surface thereof.

Briefly, the operation of the above described apparatus is substantially as follows: The winding 18 is preferably connected to a suitable source of direct current and the winding 11 is connected through the above described conductors to a source of telephonic current. The telephonic current flowing through the winding 11 will react with the relatively intense annular field 12 and cause the winding, together with the sleeve 70, to vibrate. As the sleeve 70 is rigidly secured to the diaphragm 10, the vibration is imparted to the diaphragm which translates it into sound.

A feature of the invention is the provision of the flexible disc 84 which accurately centers the winding 11 and the sleeve 70 in the magnetic field 12. This construction is exceedingly advantageous in that an extremely small clearance is allowed between the winding 11 and the outer pole piece 14, and an extremely small clearance is allowed between the inner cylindrical surface of the sleeve 70 and the pole piece 15. Obviously, it is not necessary to employ a gage to position the sleeve and winding concentrically in the magnetic field.

Another feature of the invention is the method whereby a loud speaker embodying the invention may be assembled. Thus, when the loud speaker is constructed in the manner illustrated in the drawing, the felt ring 41 may be secured by adhesive, or the like, to the front face of the ring 39, whereupon the ring may be positioned face downward upon a suitable support. However, in some instances, I prefer to secure the felt ring 41 to the ring 39 after the remainder of the apparatus has been assembled with the ring.

Assuming that the ring 39 has been placed face downward upon a suitable support, it is readily understood that the core 20 may be pressed into place and the winding 18 may be positioned upon the core. Then I preferably place the apertured disc 34 upon the reduced end of the core 20, the apertured disc 34 being positioned so that it abuts the annular shoulder 36. The outer tubular pole piece 30 is then secured to the cup-shaped member 24 by the screws 28, the pole piece 30 being centered by the apertured disc 34 with respect to the core 20. The inner pole piece 15 may be pressed upon the reduced end of the core 20 either before or after the outer pole piece 30 has been secured to the cup-shaped member 24. The felt ring 47 with its cardboard backing 45 is then placed upon the rear surface of the ring 39, after which the diaphragm 10, together with the winding 11 and its supporting means are placed upon the assembled parts in the manner indicated. Obviously, as the cylindrical lug 104 is concentrically disposed with respect to the reduced end of the core 20, the winding 11 and the sleeve 70 will be concentrically disposed in the annular field 12. The tubular member 90 is then rigidly secured to the core 20 by means of the screw 92 and the felt ring 48, together with its cardboard backing 50 is then placed upon the rear surface of the mar-

ginal flange 49 of the diaphragm 10 and the housing member 52 is placed over the assembled parts and secured to the ring 39 by the screws 53. Then after the conductors 115 have been provided for electrically connecting the binding posts 112 and 113 to the binding posts 120, the loud speaker is completely assembled, it being readily understood that the conductors 125 and 126 are preferably threaded through the aperture 127 when the winding 18 is placed upon the core 20.

While I have shown and described certain embodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims, in which it is my intention to claim all novelty inherent in my invention as broadly as possible, in view of the prior art.

What I claim as new is:

1. A device of the kind described comprising a ring, a cup-shaped magnet member having an end wall disposed substantially in the plane of said ring, said magnet member having a central pole projecting from said end wall, a pole piece secured to said magnet member and co-operating with said pole to provide an annular magnetic field, a winding disposed in said field, and a diaphragm having a frustro-conical portion, the outer edge of said diaphragm being supported by said ring and the smaller end of the frustro-conical portion being secured to vibrate with said winding.

2. A method of assembling a loud speaker, which method comprises placing a ring member and a magnet member thereof on a suitable support, assembling a tubular pole piece therewith from the rear thereof, assembling a winding and a diaphragm therewith from the rear thereof, and assembling diaphragm supporting means with said ring from the rear thereof.

3. A device of the kind described comprising a magnetizing structure provided with an annular magnetic field, a voice coil sleeve mounted in said field, a voice coil carried by said sleeve, a conical diaphragm apertured at its apex, and an annular metallic member for securing the small end of said diaphragm to said sleeve, said metallic member being formed with an annular groove in which one end of said sleeve and the small end of said diaphragm are secured.

4. A device of the kind described comprising a magnetizing structure providing an annular magnetic field, a voice coil sleeve disposed in said field, a voice coil carried by said sleeve, a flexible disk supporting said sleeve, a conical diaphragm apertured at its apex and secured to said sleeve, and an annular metallic member for securing said sleeve to said flexible disk, said annular metallic member being formed with an annular groove in which the marginal portion of said disk is clamped.

5. A device of the kind described comprising a magnetizing structure providing an annular magnetic field, a voice coil sleeve disposed in said field, a voice coil carried by said sleeve, a flexible disk supporting said sleeve, a conical diaphragm apertured at its apex and secured to said sleeve, and an annular metallic member for securing said sleeve to said flexible disk, said annular metallic member being formed with annular grooves in which the small end of said diaphragm and the marginal portion of said flexible disk are secured.

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