Jan. 8, 1935. A. S. RINGEL 1,986,856

SOUND TRANSLATING DEVICE

Filed Jan. 28, 1933 2 Sheets-Sheet 1

Fig. 2.

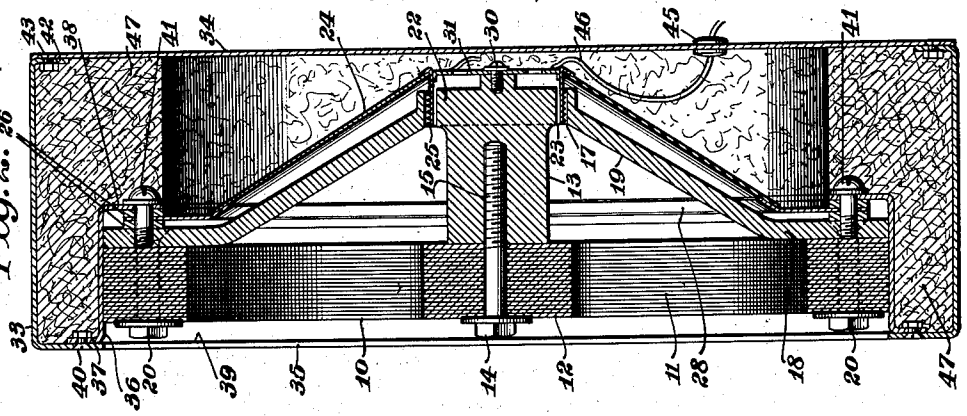
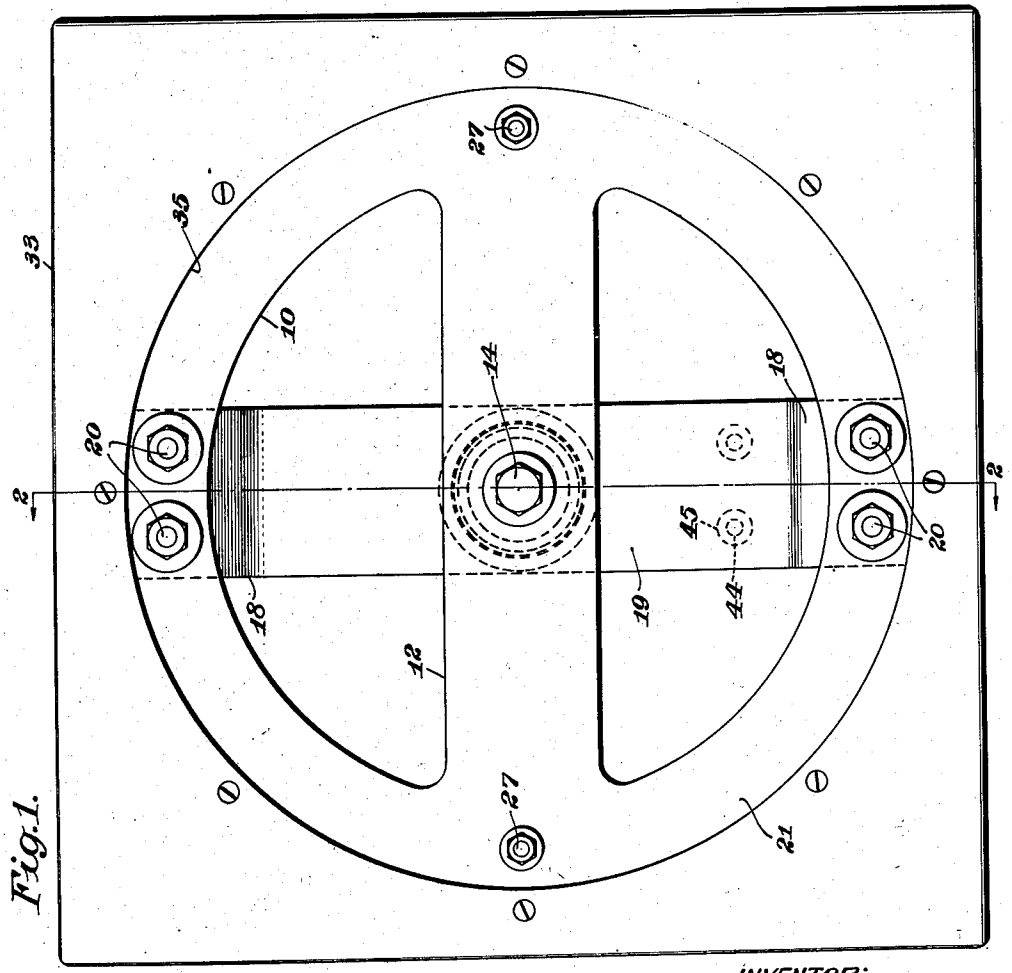


Fig. 1.



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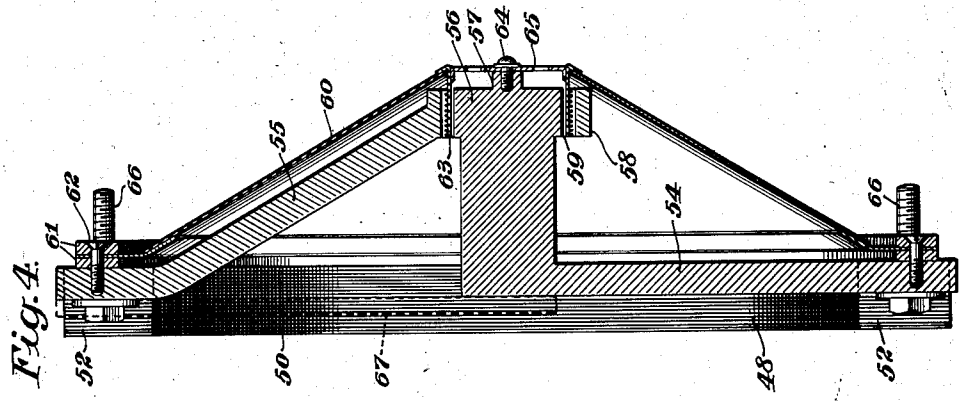


Fig. 4.

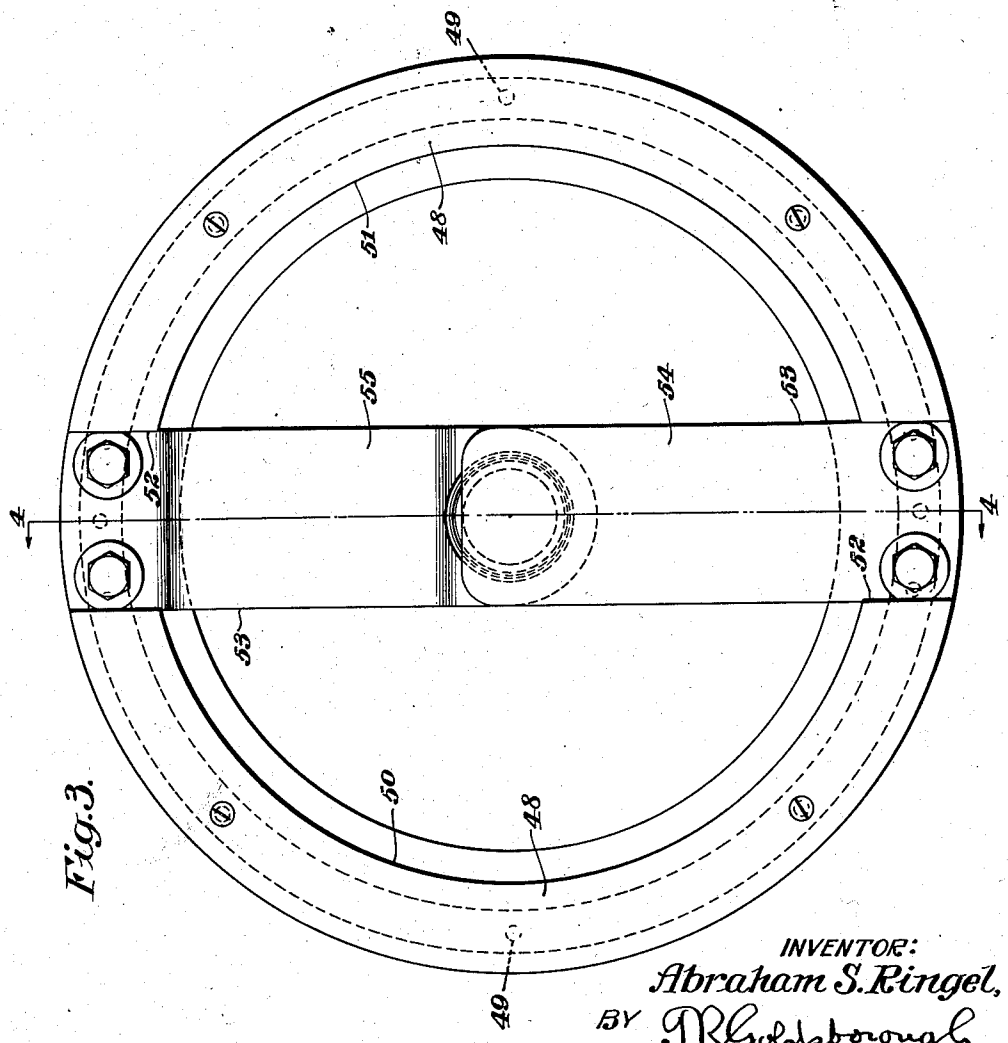


Fig. 3.

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UNITED STATES PATENT OFFICE

1,986,856

SOUND TRANSLATING DEVICE

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Application January 28, 1933, Serial No. 653,953

8 Claims. (Cl. 179—115.5)

The present invention relates to sound translating devices and, more particularly, to loudspeakers of the movable coil type having a permanent magnet field and a large direct-acting diaphragm.

In known sound translating devices of the moving coil type, for example, the magnetic system extends rearwardly of the cone or diaphragm, to such an extent that considerable space is required for the proper installation thereof in connection with various types of radio receivers.

In certain forms of loudspeaker installations, such as, for example, centralized radio for hotels and the like, automobile and "midget" radio receivers, excessive bulk is objectionable. This is especially true in automobile and centralized radio receiver installations where it is highly desirable that the distance which the loudspeaker projects from a supporting surface therefor be as short as possible, or the depth of a recess therefor, as in a wall or the like, be as shallow as possible. In such cases, it is necessary, therefore, that loudspeakers of the character specified shall have a minimum front to back dimension without exposing any of the moving parts thereof to injury.

It is, accordingly, an object of my invention to provide a sound translating device that shall occupy a minimum amount of space.

Another object of my invention is to provide a loudspeaker of the movable coil type having a minimum front to back dimension.

A further object of my invention is to provide a loudspeaker of the movable coil type which is adapted to be mounted as a unit in a shallow depression or recess formed in a wall or the like.

Another object of my invention is to provide a loudspeaker of the character specified having a diaphragm of appreciable active area and depth, which is compact in form and particularly adapted for use in connection with automobile radio receiver installations.

A further object of my invention is to provide, in a device of the character described, a conical diaphragm having a voice-coil form attached thereto which shall have a front to back dimension which does not exceed the normal depth of the diaphragm.

Another object of my invention is to provide a sound translating device of the character specified wherein the magnet system constitutes a support for the diaphragm.

A further object of my invention is to provide a loudspeaker of the movable coil type which, when mounted in a suitable enclosure casing therefor, shall have a minimum front to back dimension.

Another object of my invention is to provide a sound translating device of the character specified, wherein a magnet system and diaphragm driving means are mounted as a unit forwardly of and substantially within the concave side of the diaphragm.

A still further object of my invention is to provide a device of the type described, wherein the objectionable effects of resonance phenomena shall be minimized.

With the above and other objects in view, my invention resides in the novel construction, combination, and arrangement of parts, the novel features of which are set forth with particularity in the appended claims, the invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, being best understood from the following description of specific embodiments thereof when taken in connection with the accompanying drawings, in which

Fig. 1 is a front elevational view of my invention;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a front elevational view of a modified form of my invention; and

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3.

Referring more particularly to the drawings, wherein similar reference characters indicate corresponding parts throughout, a permanent magnet loudspeaker, of the movable coil type, constructed in accordance with my invention, preferably comprises a ring shape permanent magnet 10 which is constituted by a plurailty of magnetized laminations 11 of suitable sheet metal. Each of the laminations 11 is formed with an integral diametrically disposed cross bar, which bars are disposed in parallel and serve as an anchorage or support 12 for a central pole piece 13. The pole piece is secured to one side of the cross-bar assembly 12 by means of a screw or bolt 14 which extends through the support 12 and into a central threaded bore 15 formed in one end of the pole piece 13, as clearly shown in Fig. 2.

An outwardly bent yoke plate of ferro-magnetic material, having a relatively large circular opening 17 formed therein intermediate its ends 18, constitutes a second pole piece 19. The second pole piece is also secured to the magnet 10, on the same side as the pole piece 13, transverse of

the support 12, by means of a plurality of bolts 20 which pass through the rim portion 21 of the magnet 10 at diametrically opposite points thereon and through the free ends 18 of the pole piece 19, whereby the opening 17 is caused to cooperate with the free end 22 of the pole piece 13 to form a pair of concentric pole pieces separated by an annular air-gap 23, in a manner well known in the art.

In order to establish a physical low reluctance connection between the several abutting laminations, constituting the permanent magnets, and the respective pairs of pole pieces and secured thereto (Figs. 1, 2, 3 and 4) a low reluctance iron is preferably applied to the edges of the magnet 10, at the juncture between the pole pieces 13 and 19 and the magnet 10, in any approved manner, such as by spraying or plating.

Means whereby a substantially conical diaphragm 24, or a diaphragm of some other desired configuration, having a cup-shape voice coil-form 25 attached to the smaller end thereof and which projects inwardly of its concave side, is secured to the magnet 10, and comprises a pair of clamping rings 26 of non-magnetic material, such as brass, for example. One of the rings 26 is secured to the rim portion 21 of the magnet 10, on the side to which the pole pieces 13 and 19 are secured, concentric with the axial center of the pole piece 13 by means of suitable bolts 27.

The peripheral edge portion of the diaphragm 24 or a mounting ring 28 of flexible material affixed to the peripheral edge portion thereof, is clamped between the rings 26. With the diaphragm 24 so mounted, the open end of the coil-form 25 projects into the air-gap 23, defined by the pole pieces 13 and 19. In order to maintain the coil-form 25 properly centered in the air-gap 23, a centering screw 30, which extends through a central opening formed in the bottom 31 of the coil-form 25, is threaded into the reduced free end portion 32 formed concentrically with the pole piece 13.

A suitable housing for the loudspeaker mechanism hereinbefore described comprises a shallow rectangular casing 33 provided with a detachable back plate 34. It is to be understood, however, that a shallow casing of any other suitable configuration may be utilized. The front face of the casing 33 is provided with a central opening 35 of a size sufficient to permit the entry therein of the herein described loudspeaker mechanism as a unit. Means for supporting the said mechanism within the casing 33 comprises an annular shell 36, having a radial outwardly extending circumferential flange 37 formed on one end thereof and a similar inwardly extending circumferential flange 38 formed on the opposite end thereof, which is secured to the inner side of the front wall 39 of the casing 33 by means of suitable screws, rivets, or the like, as indicated at 40, with the inner diameter of the shell 36 in registration with the opening 35.

The length of the shell 36 is such that the flange 38 is spaced rearwardly from the front wall of the casing 33 a sufficient distance so that the front face of the magnet structure 10 will lie substantially within the front wall 39 of the casing 33, when the loudspeaker mechanism is disposed in the opening 35 and secured to the flange 38 by means of the screws indicated at 41.

The rear marginal edge portions of the casing 33 are bent at right angles to provide radial inwardly extending flanges 42 whereby the back plate 34 may be secured to the casing 33 as by means of the screws indicated at 43. The back plate 34 is provided with a plurality of small openings 44 in which suitable rubber bushings 45 are disposed and which serve as outlet passages for the terminal wires 46 leading from the rear of the voice coil-form 25.

The space within the casing 33, not occupied by the loudspeaker mechanism, is partially filled with suitable acoustic absorbing material 47, such as felt or the like, for the purpose of substantially damping out the low frequency resonance peak resulting from the compliance of the air chamber formed by the casing and the mass of the diaphragm when the loudspeaker is in operation. The felt 47 also serves to prevent the formation of acoustic standing-waves within the casing and their harmful reaction on the sound output from the diaphragm.

In the modified form of my invention illustrated in Figs. 3 and 4, the magnet structure comprises a pair of substantially semi-circular permanent magnets which may be either solid in cross section or composed of a plurality of laminations 48 suitably secured together in stacked relation by means of rivets 49, or the like, as shown in Fig. 4, to provide two separate permanent magnets 50 and 51. Although I have shown the magnets 50 and 51 as being laminated, semi-circular magnets, which are solid in cross section are preferable owing to the manner in which I secure the pole pieces, shown in Fig. 4, thereto.

The magnets 50 and 51 are assembled with their free ends 52 in abutting relation with the side walls 53 of a pair of cooperable, oppositely disposed, parallel pole pieces 54 and 55 at points adjacent each outer end of said pole pieces as clearly shown in Fig. 3, the union between the free ends 52 of said magnets and said pole pieces being effected by suitably welding the respective parts together.

The opposite free end portions of the pole pieces 54 and 55 extend inwardly of the annulus formed by the magnets 50 and 51 and laterally therefrom, as clearly shown in Fig. 4. The free end portion of the pole piece 54 terminates in a cylindrical portion 56 having a reduced end portion 57 which is provided with a small central bore threaded for the reception of a suitable screw, while the free end portion of the pole piece 55 terminates in an annular sleeve 58 which encircles the cylindrical portion 56 in spaced relation thereto and concentric therewith whereby an annular air-gap 59 is formed.

Means whereby a conical diaphragm 60, similar to the diaphragm 24 described in connection with Figs. 1 and 2, is secured to the pole piece members 54 and 55, comprises a pair of clamping rings 61 of non-magnetic material. One of the rings 61 is secured to one side of the outer end portions of the pole pieces 54 and 55, concentric with the axial center of the cylindrical portion 56, as by means of fillet welding, screws, or the like. The flexible peripheral edge portion of the diaphragm 60 is clamped between the rings 61, the outer ring being secured to the inner ring by means of suitable screws 62.

With the diaphragm 60 mounted in this manner, the open end of a voice coil-form 63, a similar to the previously described coil-form 25, projects into the air-gap 59 defined by the inner free ends of the pole pieces 54 and 55. In order to maintain the voice coil-form 63 properly centered in the air-gap 59, a centering screw 64, which extends through a central opening formed in the bottom 65 of the coil-form 63, is threaded into

the reduced end portion 57 formed concentrically with the cylindrical portion 56 of the pole piece 54.

The loudspeaker mechanism described in connection with Figs. 3 and 4 is also adapted to be housed and secured in a casing, by means of the screws 66, except that its front to back dimension may be less than the casing shown in Fig. 2. The reason for this is that the front to back dimension of the loudspeaker mechanism, shown in Fig. 4, is appreciably less due to the novel construction and assembly of the laminated magnets 50 and 51 and the pole pieces 54 and 55.

In order that the rigidity of the pole pieces 54 and 55 may be increased, I may connect a bracing bar 67 of any suitable non-magnetic material in any approved manner to the pole pieces, as indicated by the broken lines in Fig. 4.

Although I have shown certain specific embodiments of my invention, I am fully aware that many modifications thereof are possible. My invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

I claim:

1. In a sound-translating device, a laminated permanent ring magnet including a pair of pole pieces defining an annular air-gap, means providing a path of low magnetic reluctance between said magnet and pole pieces, a frustro-conical diaphragm having a reentrant coil form attached thereto carried by said magnet co-axially therewith whereby said coil-form is disposed in said air-gap, means carried by one of said pole pieces for centering said coil-form in said air-gap; a hollow casing including a shouldered annular recess for the reception of said magnet and diaphragm, and means for securing said magnet within said recess and casing.

2. In a sound-translating device, a laminated permanent ring magnet including a pair of pole pieces defining an air-gap, means providing a path of low magnetic reluctance between said maget and pole pieces, a conical diaphragm having a reentrant coil-form attached thereto carried by said magnet co-axially therewith whereby said coil-form is disposed in said air-gap, means carried by one of said pole pieces for centering said coil-form in said air-gap, a casing having an annular flanged recess therein for the reception of said magnet and diaphragm, means for securing said magnet to the flanged portion of said casing, and acoustic damping means within said casing whereby resonance peaks are minimized.

3. In a sound translating device, a ring-shape permanent magnet having a transverse portion, an apertured pole-piece supported from diametrically opposed portions of the periphery of the magnet, and a central pole-piece supported from the transverse portion and extending into the aperture to provide an air-gap.

4. The invention as set forth in claim 3 characterized in that the permanent magnet is constituted by a plurality of relatively thin laminations.

5. The invention set forth in claim 3 characterized in that material having low magnetic reluctance is disposed between the opposed portions of the ring-shape magnet and at least one of the pole-pieces.

6. The invention set forth in claim 3 characterized in that material having low magnetic reluctance is disposed between the opposed portions of the ring-shape magnet and both of the pole-pieces.

7. In combination, a ring-shape permanent magnet, an L-shape element affixed to and supported from said magnet, the longer portion of said member extending radially inward from the periphery of the magnet and the shorter portion of said member extending axially of said magnet to constitute a pole-piece, a yoke-plate cooperating with said pole-piece to define an annular air-gap, said yoke-plate being affixed to and supported by said magnet at a point substantially diametrically opposite to the point at which the L-shape member is affixed.

8. The invention set forth in claim 7, characterized in that the ring-shape permanent magnet is constituted by a plurality of semi-circular elements the ends of which are disposed in abutting relation adjacent the points at which the L-shape member and the yoke-plate, respectively, are supported.

ABRAHAM S. RINGEL.