

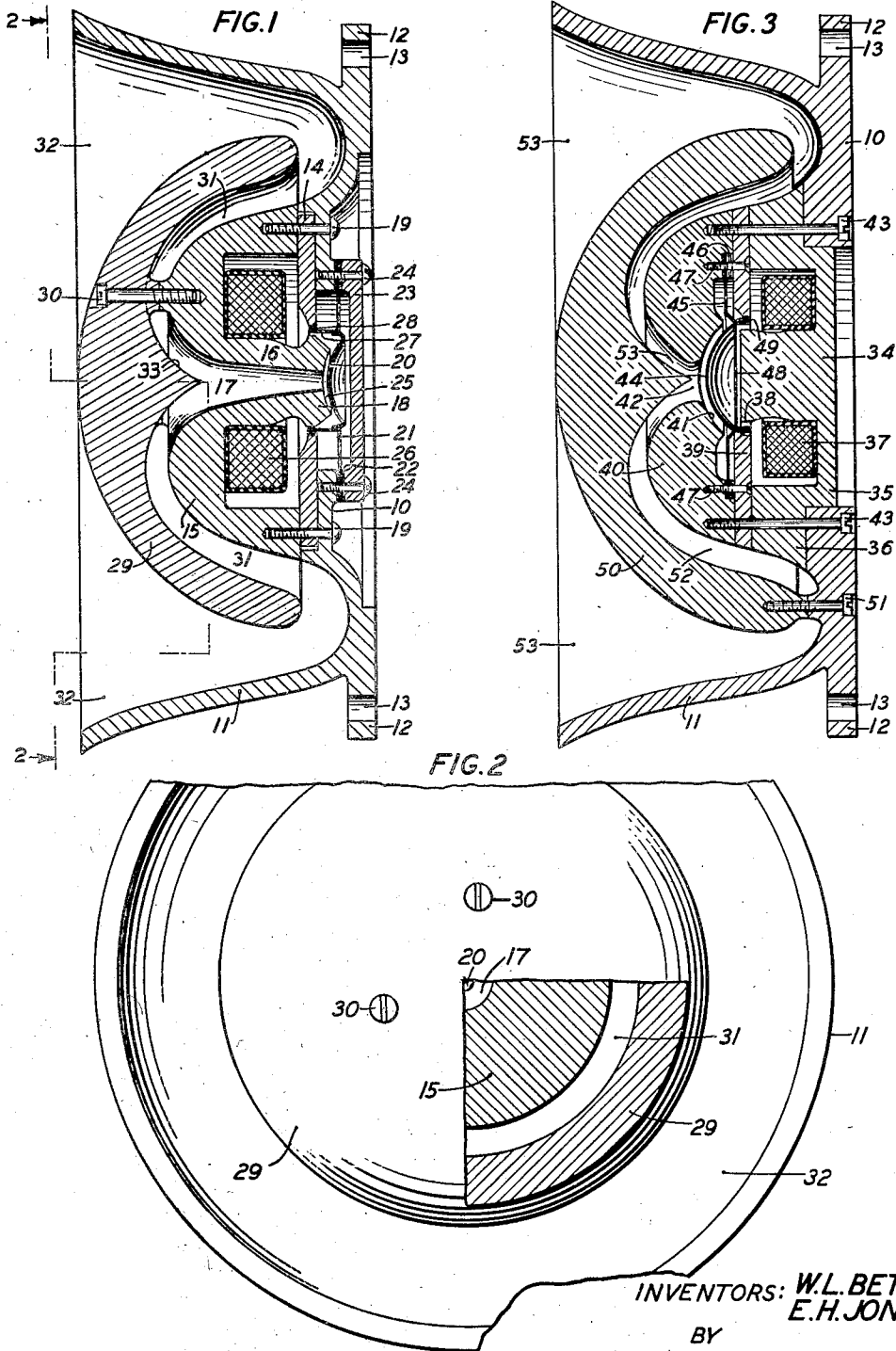
Oct. 27, 1936.

W. L. BETTS ET AL

2,058,555

ACOUSTIC DEVICE

Filed March 17, 1934



INVENTORS: W.L. BETTS
E.H. JONES
BY
Walter C. Kiesel
ATTORNEY

UNITED STATES PATENT OFFICE

2,058,555

ACOUSTIC DEVICE

Walter L. Betts, Brooklyn, N. Y., and Edward H. Jones, Summit, N. J., assignors to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application March 17, 1934, Serial No. 716,076

10 Claims. (Cl. 179—115.5)

This invention relates to acoustic devices and more particularly to electrodynamic loudspeakers of the horn type.

One object of this invention is to simplify the structure and to reduce the overall dimensions of electrodynamic loudspeakers of the horn type.

In accordance with a feature of this invention, portions of the magnet assembly of a moving coil actuated receiver are utilized as walls of an elongated sound passageway or horn acoustically coupled to the diaphragm of the receiver.

More specifically, portions of the magnet assembly of the receiver are utilized in association with sound directing members to form a tortuous sound passageway or horn of relatively large length and of gradually increasing cross-section.

In one embodiment of this invention, a loudspeaker comprises a dished or bell-shaped member on the base of which a receiver of the moving coil type is mounted. The receiver includes a magnet substantially semi-toroidal in section, extending into the dished member, the bore or aperture in the inner pole of the magnet forming an inlet or throat portion of a sound passageway. A diaphragm is disposed adjacent one end of the bore or aperture in the inner pole of the magnet and in alignment therewith. A dished sound-directing member is mounted on the magnet, within the dished or bell-shaped member, and is disposed in spaced relation to the outer surface of the magnet to form therewith an annular sound passageway in communication with the bore or aperture in the magnet. The sound-directing member is spaced laterally from the dished or bell-shaped member to form an annular passageway in communication with the first mentioned annular passageway. The magnet, therefore, in association with the bell-shaped and the sound-directing members forms a tortuous sound passageway and provides a compact, unitary structure of relatively small axial dimension which may be fabricated expeditiously.

The invention and the features thereof will be understood more clearly and fully from the following detailed description with reference to the accompanying drawing in which:

Fig. 1 is a side view in cross-section of a loudspeaker illustrative of one embodiment of this invention;

Fig. 2 is a front view of the loudspeaker shown in 1, partly in cross-section to show the disposition and contour of the sound passageways; and

Fig. 3 is a side view in cross-section of a loud-

speaker illustrative of another embodiment of this invention.

Referring now to the drawing, the loudspeaker shown in Figs. 1 and 2 comprises a dished or bell-shaped member having an annular base portion 10, an outwardly flaring wall 11, and a flange 12 provided with apertures 13 for receiving securing means, such as bolts, not shown, for mounting the loudspeaker on a wall or panel. The dished or bell-shaped member may be cast of metal, for example aluminum, in a single piece or be made of any other suitable material. An annular magnetic member 14 is seated upon the base portion 10, and has mounted thereon a semi-toroidal magnet 15. The magnet has a central pole 16 provided with a flaring bore or aperture 17 and an annular pole-piece 18 coaxially disposed with the annular member 14 and forming a narrow, annular air gap therewith. The magnet 15 and magnetic member 14 may be secured to the base portion 10 by screws 19. A field or excitation coil 26 encompasses the central pole 16.

A dished or dome-shaped diaphragm 20 is coaxially disposed with respect to the bore or aperture 17, the surface of the pole-piece 18 adjacent the diaphragm preferably being hollowed as at 25 to conform to the diaphragm, and is supported by an annular, flexible mount 21, which may be formed integrally with the diaphragm 20 or separate therefrom. The mount 21 is clamped together with washers 22 upon the base portion 10 by a shallow closure member or casing 23. The closure member or casing 23 may be secured to the face portion 10 by screws 24.

A cylindrical form or support 27 is secured to the diaphragm and carries a driving coil 28 which is disposed in the annular air gap formed by the pole-pieces 14 and 18.

A dished or dome-shaped sound-directing member 29 encircles the magnet 15 and is secured thereto by screws 30. The sound-directing member 29 is spaced from the outer walls of the magnet to form therewith an annular sound passageway 31 in communication with the bore or aperture 17 and at an angle thereto. It is also spaced from the flaring wall 11 to form an annular sound outlet 32 in communication with the sound passageway 31. Preferably, the sound-directing member 29 is provided with a conoidal portion 33 coaxial with and extending partly into the bore 17, to distribute the sound waves uniformly from the bore 17 into the annular passageway 31.

The magnet 15 in association with the dished member 29 and the dished member including the

flaring wall 11 forms a tortuous sound passageway or horn in which the direction of sound waves is reversed twice between the diaphragm 20 and the mouth. Preferably, the magnet 15, the dish member 29, and the dish member including the flaring wall 11 are disposed and dimensioned so that the cross-sectional area of the sound passageway increases at a desired rate, for example, exponentially with respect to length, between the diaphragm and the mouth of the horn.

In another embodiment of this invention shown in Fig. 3, a loudspeaker includes a pot type magnet having inner and outer poles 34 and 35, respectively, the outer pole 35 being provided with a circular flange 36 seated on the base portion 10 of the dish or bell-shaped outer member. The inner pole 34 is encompassed by a field or excitation coil 37, and terminates in a circular pole-piece 38. An annular pole-piece 39 is seated upon the outer pole 35 and is coaxially disposed about the pole-piece 38 to form a narrow, annular air gap. Seated upon the pole-piece 39 is an annular member 40, of non-magnetic material, having a dome-shaped surface 41 and a central flaring sound passageway 42. The magnet, pole-piece 39, and annular member 40 may be secured to the base portion 10 by screws 43.

A diaphragm is disposed between the magnet 30 and the annular member 40 and includes a central dome-shaped portion 44 conforming to the dome-shaped surface 41 and coaxial with the sound passageway 42, and a flexible supporting portion 45, secured between the pole-piece 39 and the annular member 40, together with washers 46, which may be of paper, by screws 47. The diaphragm may be formed of a single piece of material, for example, a lightweight metal such as duralumin, or may be made in two pieces of the same or different materials.

A cylindrical form or support 48 is secured to the edge of the dome-shaped portion 44 of the diaphragm and carries a driving coil 49 which is disposed in the air gap formed by the pole-pieces 45 38 and 39.

In the assembly of the loudspeaker, the pole-piece 39, diaphragm 44, 45, and annular member 40 may be assembled as a unit, the elements being secured together by the screws 47, and then 50 mounted as a unit upon the outer pole 36 of the magnet by the screws 43.

A dish or dome-shaped sound-directing member 50 encompasses the annular member 40, pole-piece 39, and outer pole 35, and is secured 55 to the base portion 10 by screws 51, only one of which is shown. As clearly shown in Fig. 3, the dish member 50 is spaced from the annular member 40, pole-piece 39 and outer pole 35 to form an annular sound passageway 52 in communication with the sound passageway 42 in the annular member 40. Preferably, the dish member 50 is provided with a conoidal portion 53 extending into the sound passageway 42, to insure a uniform distribution of sound into the 60 passageway 52. The dish member 50 is also spaced from the flaring wall 11 and forms therewith an annular sound opening 53 in communication with the passageway 52.

All of the surfaces of the various elements 70 bounding the sound passageways are smoothly curved and form a tortuous sound passageway or horn in which the direction of sound is reversed twice between the diaphragm and the mouth of the horn. Preferably, the various elements are 75 disposed and dimensioned so that the cross-sectional area of the sound passageway increases in a desired manner, for example, exponentially with respect to length, between the diaphragm and the mouth of the horn.

It will be appreciated that the invention provides a compact and structurally simple loudspeaker of relatively small overall dimensions, including a sound passageway of sufficient length to insure an adequate air load upon the diaphragm and uniform reproduction of a wide band of frequencies of importance in speech and music.

Although two specific embodiments of the invention have been shown and described, it will be understood, of course, that modifications may be made therein without departing from the 15 scope and spirit of the invention as defined in the appended claims.

What is claimed is:

1. An acoustic device comprising a plurality of spaced members forming a continuous sound passageway having an inlet portion and an outlet portion extending in the same direction and an intermediate portion extending in the opposite direction, a diaphragm adjacent the throat of said inlet portion, and actuating means for said diaphragm, one of said spaced members being a magnet associated with said actuating means and having surfaces constituting walls of said inlet and intermediate portions.

2. An acoustic device comprising a plurality of spaced members forming a continuous doubly reversed sound passageway having an inlet portion, an annular bell portion, and an annular intermediate portion, a diaphragm at the throat of said inlet portion, and means for actuating said diaphragm, one of said spaced members being a magnet having annular surfaces constituting walls of said inlet and intermediate portions.

3. An acoustic device comprising a diaphragm, a coil coupled to said diaphragm for actuating it, and means forming a continuous sound passageway having a tubular portion terminating at one end adjacent said diaphragm and a reversely bent annular portion connected to the other end of said tubular portion, said means including a magnet, portions of which form walls of said tubular and annular portions, said magnet having an air gap in which said coil is disposed.

4. An acoustic device comprising an outer dish member, a magnet disposed within said dish member, an inner dish member disposed about said magnet and spaced from said outer dish member to form a continuous, doubly reversed sound passageway therewith, a diaphragm adjacent one end of said passageway, and actuating means for said diaphragm associated with said magnet.

5. An acoustic device comprising an outer dish member, a magnet within said dish member and having a bore extending there-through, said magnet having pole-pieces forming an air gap, a diaphragm adjacent one end of said bore, actuating means coupled to said diaphragm and disposed in said air gap, and an inner dish member adjacent the other end of said bore and encompassing said magnet to form therewith an annular sound passageway in communication with and extending in the opposite direction to said bore, said inner dish member being disposed within said outer dish member and forming therewith an annular sound passageway in communication with said first passageway and extending in the same direction as said bore.

6. An acoustic device comprising a magnet having coaxial pole-pieces forming an air gap, said 75

magnet being substantially semi-toroidal and bounding a sound passageway, a diaphragm adjacent one end of said passageway, a coil coupled to said diaphragm and disposed in said air gap, a
 5 dished member adjacent the other end of said passageway and encompassing said magnet to form an annular sound passageway therewith in communication with said first passageway, said
 10 dished member having a conoidal portion extending into said first passageway, and another dished member encompassing said first dished member and forming therewith an annular sound passageway in communication with said first annular
 passageway.

15 7. An acoustic device comprising a magnet having pole-pieces forming an air gap, a diaphragm, actuating means for said diaphragm disposed in said air gap, an annular member overlying said
 20 diaphragm and forming a sound passageway in communication therewith, and a sound-directing member overlying and encompassing said annular member and said magnet and forming therewith an annular sound passageway in communi-
 cation with said first passageway.

25 8. An acoustic device comprising a magnet, a diaphragm adjacent one end of said magnet, actuating means for said diaphragm associated with said magnet, a dished member adjacent said end
 30 of said magnet and encompassing a portion of said magnet to form a passageway, and an annular member disposed between said diaphragm and said dished member and forming with said dished
 member an annular passageway in communication with said first passageway.

35 9. An acoustic device comprising an outer

dished member, a magnet within said member, a diaphragm adjacent the inner end of said magnet, actuating means for said diaphragm associated with said magnet, an annular member over-
 5 lying said diaphragm and forming a sound passageway in communication therewith, an inner dished member encompassing said annular member and portions of said magnet and forming
 10 therewith an annular sound passageway in communication with said first passageway, said inner dished member being disposed within said outer dished member and forming therewith a sound
 opening in communication with said second passageway.

15 10. An acoustic device comprising a pot type magnet having inner and outer pole-pieces forming an air gap, a diaphragm mounted on said outer pole-piece, actuating means for said dia-
 20 phragm disposed in said air gap, an annular member mounted on said outer pole-piece and overlying said diaphragm to form a sound passageway in communication therewith, portions of said
 magnet, outer pole-piece and annular member forming a smoothly curved continuous surface, a dished sound-directing member having a
 25 smoothly rounded surface adjacent said curved surface and forming therewith an annular passageway in communication with said first passageway and at an angle thereto, and another
 30 dished member encompassing said sound-directing member and forming therewith an annular sound opening in communication with said second passageway and at an angle thereto.

WALTER L. BETTS.
 EDWARD H. JONES. 35