

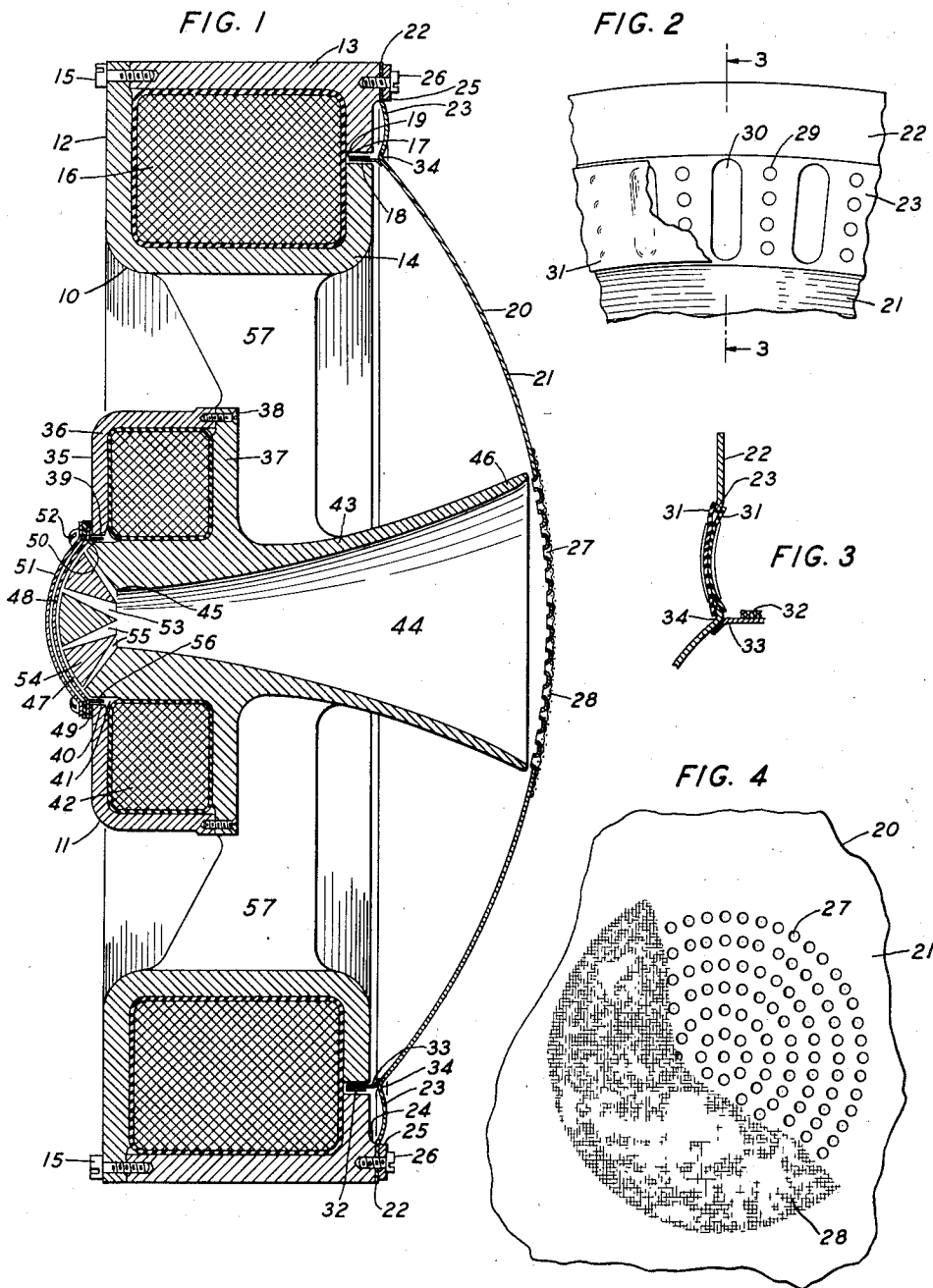
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ACOUSTIC DEVICE

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ACOUSTIC DEVICE

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This invention relates to acoustic devices and, more particularly, to sound wave reproducing devices.

An object of this invention is to translate sound waves over a broad frequency range efficiently and with fidelity to the original.

A feature of the invention comprises a sound wave reproducing arrangement including a pair of diaphragms and a horn therebetween, one diaphragm radiating into the horn and the other having an apertured portion through which the horn output passes.

Another feature comprises an acoustic device having a diaphragm and a magnet structure associated therewith, and a second diaphragm and magnet structure associated therewith positioned centrally of and within the first magnet structure with a horn extending toward the first diaphragm.

A further feature comprises a sound wave reproducing arrangement having a substantially annular magnet structure associated with a direct acting diaphragm, and a horn type loud-speaker located within the magnet structure and behind the diaphragm.

Still another feature comprises a diaphragm having an apertured central portion over which a suitable guard or screen is disposed.

A further feature comprises a combination including a diaphragm having an apertured central portion and a horn type reproducer positioned behind the diaphragm with the horn mouth adjacent the apertured portion.

Still other and further features will be apparent from the description which follows and the appended claims.

A more complete understanding of this invention will be obtained from the detailed description which follows taken in conjunction with the appended drawing, wherein:

Fig. 1 is a cross-sectional view of a sound wave reproducing device embodying the invention;

Fig. 2 is a plan view, to an enlarged scale, of a fragment of the peripheral portion of the large diaphragm of the device of Fig. 1;

Fig. 3 is a cross-sectional view of the peripheral portion of the large diaphragm of the device of Fig. 1 taken along the line 3—3 of Fig. 2; and

Fig. 4 is a plan view of a fragment of the large diaphragm of the device of Fig. 1, showing the apertures in the central portion thereof and the screen disposed over the apertures.

The device of Figs. 1 to 4 comprises a compact, space saving combination or unitary assembly of a sound wave reproducing unit or loud-speaker 10,

adapted to reproduce or translate most efficiently the lower portion of the frequency range of speech and music, that is, below about 1000 cycles per second, and a sound wave reproducing unit or loud-speaker 11, adapted to reproduce or translate most efficiently the higher portion of the frequency range of speech and music, that is, above about 1000 cycles per second.

The unit 10 comprises an annular shell 12 of magnetic material comprising frame members 13, 14 secured together by suitable means, such as screws 15, enclosing a magnetizing or field coil 16, and having spaced annular planar portions 17, 18 defining an air-gap 19. A direct acting diaphragm 20, for instance, of duralumin, having an outwardly bowed or concave central rigid portion 21, an outer annular, planar, peripheral portion 22, and an intermediate narrow, outwardly bowed or concave flexible annulus 23, is secured at its peripheral portion or rim 24 of the shell 12 by clamping member or ring 25 and screws 26. At its central portion, the diaphragm is provided with a plurality of radially and circularly arranged apertures or passages 27 formed therein by a suitable counter-sinking tool. The total area of the apertures may be such as to provide low frequency equalization. A screen 28 is placed over these apertures, being secured to the diaphragm by a suitable adhesive or cement, and may comprise acoustic resistance or damping material, such as silk or a metallic gauze member. The annulus 23 contains series of apertures 29 and slots 30, alternating and radially arranged. Thin strips 31 of flexible material, such as rubber, are vulcanized on opposite sides of the annulus 23, completely covering the slots and apertures therein. This rubber is preferably of the very dead variety used for damping purposes. A coil 32, for instance, of the edge wound ribbon conductor type, is mounted on a coil form 33 attached to the diaphragm 20 at the junction 34 of the central and annular portions thereof.

The unit 11 comprises a shell 35 joined to the shell 12 by arms 57, having cooperating magnetic frame members 36, 37 secured together by suitable means, such as screws 38, having spaced annular portions 39, 40 defining an air-gap 41, and enclosing a magnetizing or field winding 42. The member 37 comprises a horn 43 having a sound wave passage 44 flaring outwardly from a constricted or throat portion 45 to a mouth portion 46 adjacent the apertures in the diaphragm. A diaphragm 47 adapted to radiate into the horn, and having a central dome-shaped stiffened portion 48, a peripheral portion 49 and a junction

portion 50, is secured to the member 36 by cover plate 51 and screws 52. The sound chamber 53 between the diaphragm and the horn throat contains a plug member 54 providing sound wave paths 55 leading from the diaphragm. A coil 56 is attached to the diaphragm 47 at its junction portion and is disposed in the air-gap 41.

While this invention has been disclosed with reference to a specific embodiment thereof, it will be understood that it is not limited thereto but by the scope of the appended claims only.

What is claimed is:

1. An acoustic device comprising a pair of diaphragms, means for vibrating said diaphragms, and a horn having its throat adjacent one diaphragm and its mouth adjacent the other diaphragm, said second diaphragm having openings through which pass sound waves from said first diaphragm and having its peripheral portion in a plane behind that of the horn mouth.

2. An acoustic device comprising a pair of diaphragms, a coil for each for vibrating it, and a horn having its throat adjacent one diaphragm and its mouth adjacent the other diaphragm, said second diaphragm having openings in front of said horn mouth through which pass sound waves from said first diaphragm, the remaining portion of said diaphragm extending rearwardly from the horn mouth.

3. A sound wave reproducing arrangement comprising a pair of spaced diaphragms of different size to reproduce sound waves over different frequency ranges, the larger diaphragm being outwardly bowed and having openings in its central portion, and a horn behind said larger diaphragm and having its mouth portion within the concave portion of said diaphragm and adjacent said openings and having its throat portion adjacent the other diaphragm.

4. A loud-speaker combination comprising a direct acting diaphragm having a dome-shaped central portion and a flexible supporting annulus, the central portion having openings therein for the passage of sound waves, a coil for actuating said diaphragm attached thereto at the junction of said central portion and said annulus, a second diaphragm positioned behind said first-mentioned diaphragm, and a horn into which said second diaphragm radiates, the mouth of said horn projecting into the space defined by the central portion of the direct acting diaphragm.

5. A sound wave reproducing arrangement comprising a pair of spaced diaphragms of different size to reproduce sound waves over different frequency ranges, the larger diaphragm having an outwardly bowed central portion containing a sound wave passage, an outer peripheral

portion and an intermediate outwardly bowed annular portion, and a horn behind said larger diaphragm and having its mouth portion adjacent the sound passage therein, the small diaphragm radiating into said horn.

6. A loud-speaker combination comprising a direct acting diaphragm having a central stiffened portion having an apertured area, an outer clamping portion and an intermediate flexible portion, means attached to the diaphragm at the junction of its central and intermediate portions for actuating it, a second diaphragm, and a horn, said second diaphragm radiating into said horn, and said horn having a mouth portion adjacent the apertured area of the first-mentioned diaphragm.

7. An acoustic device comprising a diaphragm having a stiffened portion provided with an apertured central area, an outer clamping portion and an intermediate flexible portion, said intermediate portion containing a plurality of apertures, and strips of a flexible material secured to said flexible portion on each side thereof and disposed over said apertures.

8. An acoustic device as claimed in the preceding claim in which said strips are of rubber.

9. An acoustic device as claimed in claim 7 in which said strips are of rubber and are vulcanized to said intermediate portion.

10. An acoustic device comprising a diaphragm having a dome-shaped central portion, an outer clamping portion and an intermediate annular outwardly bowed flexible portion, a second diaphragm having a central dome-shaped portion, an outer clamping portion and an intermediate portion, said diaphragms being spaced apart with their dome-shaped portions projecting in opposite directions, and a horn positioned intermediate said diaphragms, said second diaphragm radiating into said horn, the mouth portion of which is disposed adjacent an apertured region in said first-mentioned diaphragm.

11. An acoustic device comprising an outer substantially annular magnetic structure defining an air-gap, a direct acting dome-shaped diaphragm supported on said magnet structure with its concave side adjacent thereto and extending across one end of said structure, a coil disposed in said air-gap and attached to said diaphragm for actuating it, a second magnet structure supported centrally of and within said first-mentioned magnet structure, a diaphragm supported on said second magnet structure, and a horn into which said second diaphragm radiates, so positioned that it projects into the space defined by the concave side of said dome-shaped diaphragm.

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