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3,095,941

LOUD SPEAKER CONSTRUCTION

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2 Sheets-Sheet 1

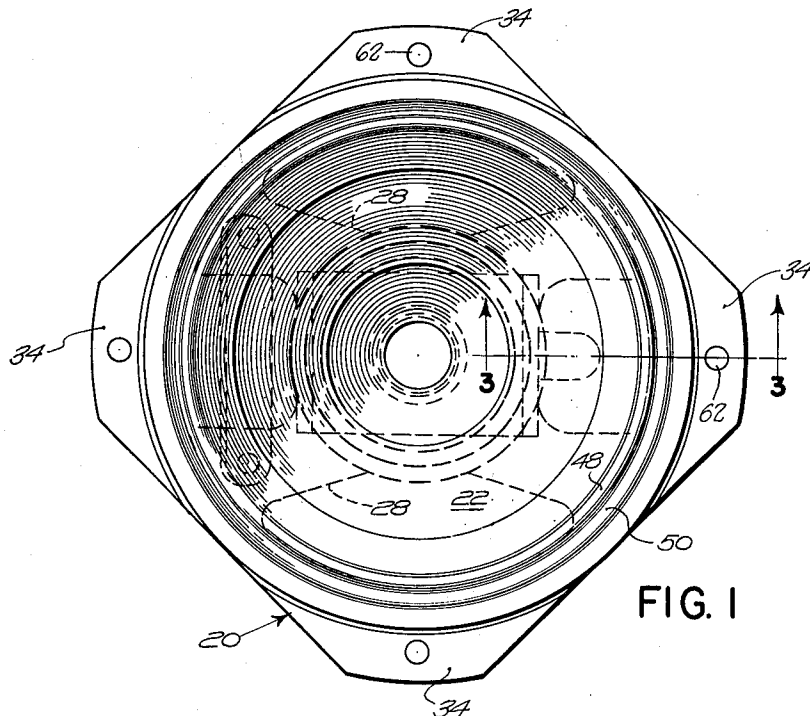


FIG. 1

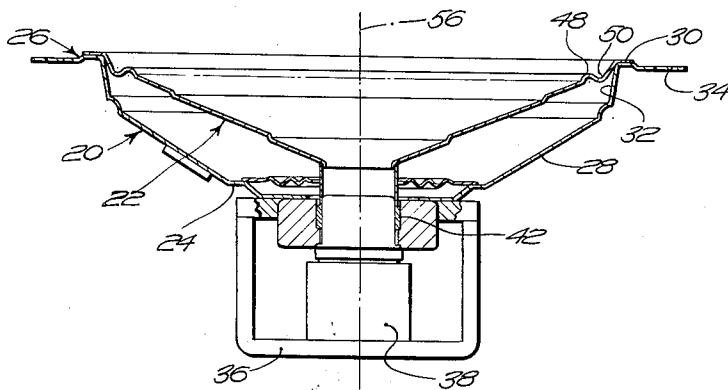


FIG. 2

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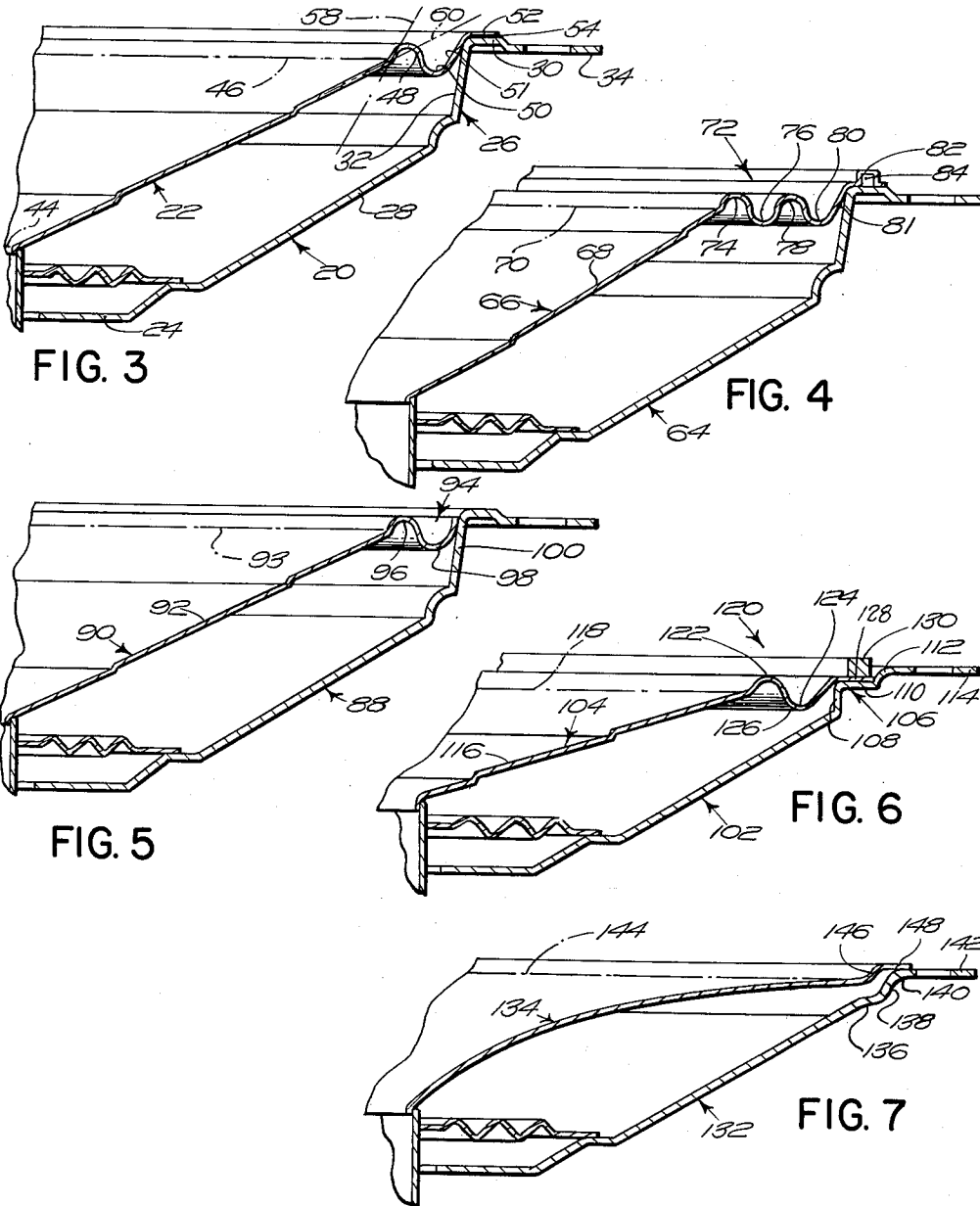
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LOUD SPEAKER CONSTRUCTION

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2 Claims. (Cl. 181-32)

The present invention relates to acoustic devices and, more particularly, to loudspeakers of the type comprising a frame carrying a voice coil, and a diaphragm integrally including a conical piston portion, the apex of which is associated with the coil, and an annular convoluted portion the periphery of which is connected to the frame. Generally, if the piston portion is to generate frequencies within a desirable sound range, particularly bass frequencies, its diameter should not be too small. Generally, the convoluted portion, if it is not to restrict unduly the diameter of the piston portion or otherwise to effect adversely its operation, must be carefully designed to occupy minimum space and to vibrate freely.

The primary object of the present invention is to provide a loud speaker of the foregoing type in which: a frame of conventional size omits the gasket usually required as an acoustic seal between a frame and its support in order to provide a much space as possible for a diaphragm and in which the diaphragm has a piston portion of unusually large area by virtue of a convoluted portion, of minimum extent and exceptional efficiency, having a ridge immediately adjacent to the piston portion that is forwardly convex i.e. the cross-sectional slope with respect to the axis of the diaphragm of the roll immediately continuing from the external periphery of the piston portion, initially decreases with respect to the axis as its distance outwardly from the axis increases.

Other objects of the present invention are: to provide a loudspeaker of the foregoing type wherein the frame includes a forward annular portion and the convoluted portion of the diaphragm includes, immediately adjacent to the forward annular portion, a trough that is forwardly concave; to provide a loudspeaker of the foregoing type wherein the cross-sectional length from the periphery of the piston portion to the apex of its adjoining ridge is considerably less than the cross-sectional length from the annular portion of the frame to the apex of its adjoining trough, whereby the adhesive by which the convoluted portion is affixed to the annular portion does not interfere with the flexibility of the convoluted portion; to provide a loudspeaker of the foregoing type wherein the outer periphery of the trough is cemented to a face of the annular portion of the frame that lies in a plane perpendicular to the axis of the diaphragm, whereby the outer periphery of the trough is capable of serving as a gasket; and to provide a loudspeaker of the foregoing type wherein the outer periphery of the trough is cemented to the inner cylindrical periphery of the annular portion of the frame.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the device possessing the features, properties and relation of elements, which will be exemplified in the device hereinafter described and the scope of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention reference should be had to the following detailed description taken in connection with the accompanying drawings wherein:

FIGURE 1 is a top plan view of a loudspeaker embodying the present invention;

FIG. 2 is a side elevation of the loudspeaker of FIG. 1;

FIG. 3 is an enlarged, fragmentary, cross-sectional view

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of the loudspeaker of FIG. 1, the section being taken substantially along the line 3-3 of FIG. 1;

FIG. 4 is an enlarged fragmentary, cross-sectional view of an alternative loudspeaker embodying the present invention, the section being analogous to that of FIG. 3;

FIG. 5 is an enlarged, fragmentary, cross-sectional view of a further alternative loudspeaker embodying the present invention, the section being analogous to that of FIG. 3;

FIG. 6 is an enlarged, fragmentary cross-sectional view of still another alternative loudspeaker embodying the present invention, the section being analogous to that of FIG. 3; and

FIG. 7 is an enlarged, fragmentary cross-sectional view of still another alternative loudspeaker embodying the present invention, the section being analogous to that of FIG. 3.

The loudspeaker of FIGS. 1, 2, and 3 in accordance with the present invention, comprises a reticulated metal frame 20 and a generally conical diaphragm 22, composed of a light but stiff fibrous material, such as paper or cardboard.

As shown, frame 20, in the form of a dish shaped basket, includes a rear inward base 24 of relatively small extent and a front outward annulus 26 of relatively great extent. Annulus 26 is integrally joined to base 24 by rearwardly converging webbing 28. Annulus 26 presents a forward face 30 lying in a plane that is perpendicular to the axis of the annulus. Annulus 26 presents an inner substantially cylindrical face 32 disposed about the axis of the annulus and extending longitudinally thereof a substantial distance, for a reason to become apparent below. Extending outwardly from annulus 26, at spaced 90° intervals in a plane rearwardly of the plane of face 30, are four mounting extensions 34, the free edges of which lie generally along the four sides of a square. Extending rearwardly from base 24 is a flux loop 36 in the form of a magnetic metal strap, the legs of which are affixed to the base. A magnetic core 38 extends forwardly from the bight of flux loop 36, its forward portion being received by a reciprocable voice coil 42.

Diaphragm 22, the apex portion of which is connected to the forward end of voice coil 42, diverges forwardly with respect to the diaphragm axis at an angle of 20 to 45°. The conical portion of diaphragm 22, extending from the circle partially shown in phantom lines at 46, i.e. the portion of the diaphragm that is cross-sectionally substantially linear in a plane through the diaphragm axis, is termed the piston. The forward periphery of the piston is integrally joined to a peripheral convoluted portion extending from circle 46 to the inner edge of face 30. This convoluted portion includes, in integral sequence, a forwardly convex peripheral ridge 48, a forwardly concave peripheral trough 50, a spacing continuation 51 and a flange 52, which is affixed to face 30 by cement 54. It will be noted that the slope of ridge 48 with respect to the axis 56 of diaphragm 22 immediately adjacent to the piston is less than the slope of the piston with respect to axis 56, i.e. the angle between phantom line 58 and axis 56 is less than the angle between phantom line 60 and axis 56. It will also be noted that the cross-sectional length of ridge 48 from the outer periphery 46 of the piston to the apex of the ridge is less than the combined cross-sectional length of trough 50 and spacer 51 from the apex of the trough to the inner edge of face 30 of frame 20. Flange 52, which is cemented to face 30, serves as the gasket between the frame and the panel to which it is affixed, for example, by bolts extending through apertures 62 in extensions 34.

An alternative embodiment of the present invention is illustrated in FIG. 4 as comprising a frame 64 similar

in all respects to frame 20 of FIGS. 1, 2, and 3 and a diaphragm 66 including a piston 68 terminating outwardly at 70 and a convolution portion 72. Convolution portion 72, in integral sequence, includes a first ridge 74, a first trough 76, a second ridge 78, a second trough 80 and a spacing continuation 81. The outer periphery of trough 80 provides a channeled flange 82 having a fabric core 84. The channel and the core incorporate cement by which they are affixed to the forward face of frame 64. It will be noted that the length from the outer extremity 70 of piston 68 to the apex of ridge 74 is considerably less than the combined length from the apex of trough 80 and extension 81 to the point at which extension 81 contacts frame 64.

Another embodiment of the present invention is illustrated in FIG. 5 as comprising a frame 88, similar in all respects to frame 20 of FIGS. 1, 2, and 3, and a diaphragm 90 including a piston portion 92 extending generally downwardly from phantom line 93 and a convolution portion 94 extending generally upwardly from phantom line 93. The convolution portion includes a forwardly convex ridge 96 integrally extending from piston 92 and a forwardly concave trough 98 integrally extending from ridge 96. The free extremity of trough 96 is cemented to the inner tubular periphery 100 of the forward annular portion of frame 88.

Another embodiment of the present invention is illustrated in FIG. 6 as comprising a frame 102 and a diaphragm 104. The forward annular portion 106 of frame 102 is peripherally stepped to provide a first generally tubular portion 108, a flange portion 110, a second generally tubular portion 112 and extension portions 114. Diaphragm 104 includes a piston 116 terminating outwardly at 118 and a convolution portion 120, which, in integral sequence, includes a ridge 122, a trough 124, a continuation extension 126 and a flange 128. Flange 128 is cemented to flange portion 110. In turn, a gasket 130 is cemented to flange 128. This embodiment provides various advantages of the present invention and, in addition, the advantage of a conventional gasket where desirable.

An alternative embodiment of the present invention is illustrated in FIG. 7 as comprising a frame 132 and a diaphragm 134. As shown, frame 132 comprises an annular portion including a first flange portion 136, a first tubular portion 138, a second flange portion 140 and extension portions 142. Diaphragm 134 includes a bowed conical piston portion that is inwardly convex in cross section extending below phantom line 144. Diaphragm 134 includes a convolution portion including a fragmentary ridge portion forwardly convex that has a forwardly projecting portion 146 and an extension 148, which is cemented to flange portion 140 of frame 132. This modification of the present invention is a so called "tweeter" that employs the present invention in the advantageous production of sounds of high frequency.

Since certain changes may be made in the foregoing devices without departing from the scope of the invention

herein involved, it is to be understood that all matter mentioned in the foregoing description or shown in the accompanying drawings is to be interpreted in an illustrative and not a limiting sense.

What is claimed is:

1. A loudspeaker comprising a frame having a forward peripheral and a rearward medial portion, a conical diaphragm and a loudspeaker coil, the apex of said diaphragm being connected to said loudspeaker coil, said diaphragm including a piston portion and a convolution portion integral therewith, said convolution portion integrally including an outwardly convex ridge extending from said piston portion and an outwardly concave trough, the outer extremity of which is connected to said forward peripheral portion, the length from the extremity of said piston portion to the apex of said ridge being less than the length from the apex of said trough to said forward peripheral portion, an integral extension from said forward peripheral portion, the forward face of said extension lying substantially in a plane rearward of the plane in which lies the forward face of said peripheral portion.

2. A loudspeaker comprising a frame having a forward peripheral and a rearward medial portion, said forward peripheral portion presenting a forward face, a conical diaphragm and a loudspeaker coil said diaphragm having an axis, the apex of said diaphragm being connected to said loudspeaker coil, said diaphragm including a piston portion and a convolution portion integral therewith, said convolution portion integrally including an outwardly convex ridge and an outwardly concave trough, the outer extremity of which is connected to said forward peripheral portion, the length from the extremity of said piston portion to the apex of said ridge being less than the length from the apex of said trough to said forward peripheral portion, an integral extension from said forward peripheral portion, the forward face of said extension lying substantially in a plane rearward of the plane in which lies the forward face of said peripheral portion, the slope of said ridge with respect to the axis of said piston portion being less than the slope of said piston portion with respect to said axis.

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