Feb. 9, 1960 S. J. ZUERKER 2,924,290

DOUBLE CONE LOUDSPEAKER

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FIG.1.

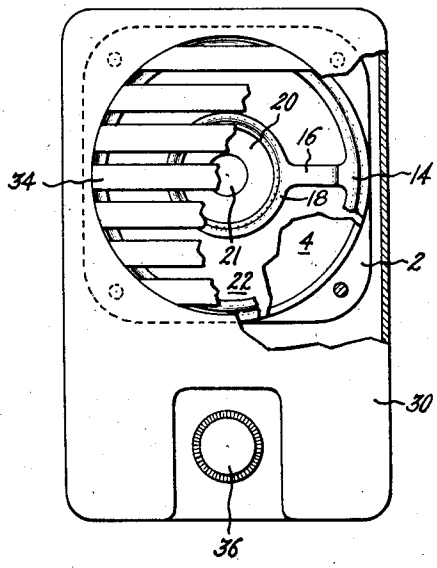
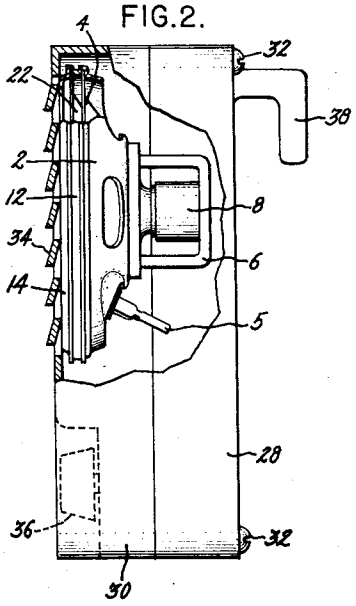


FIG.2.



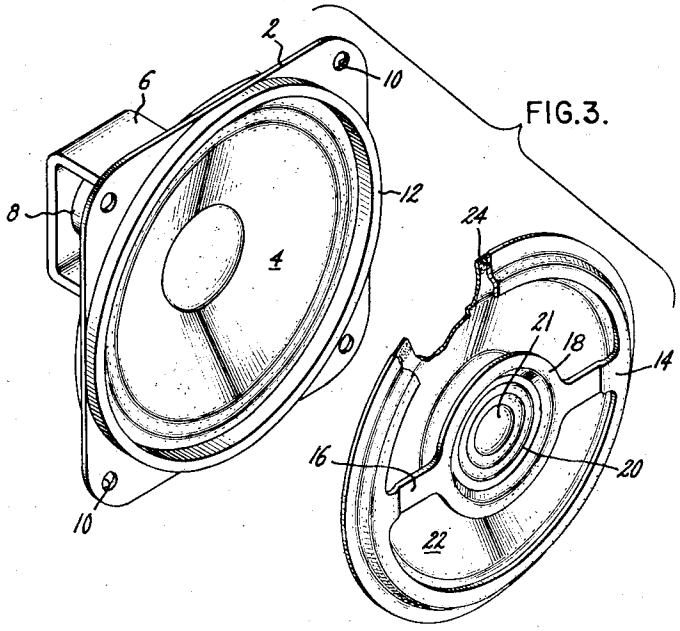
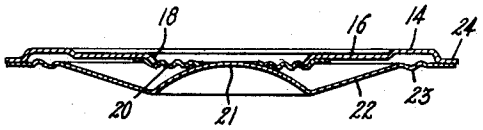


FIG.4.



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DOUBLE CONE LOUDSPEAKER

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2 Claims. (Cl. 181—32)

This invention relates to the improvements in loudspeakers which may be exposed to the effects of extreme weather conditions or other hazards against which a protection is desired for the loudspeaker diaphragm.

In the use of loudspeakers in outdoor areas, such as open-air theaters and outside of private homes, commercial and industrial installations or in other areas where there is a possibility of an object or an environment damaging the diaphragm of the loudspeaker, a protective diaphragm may be advantageously superimposed over the diaphragm found in the ordinary loudspeaker. A suitable spacing means may be provided between the two diaphragms and the air in the substantially enclosed space, therebetween will serve to couple the energy from one diaphragm to the other. Such diaphragms have been permanently attached to the loudspeaker and its supporting structure thereby complicating the problem of and increasing the cost of the repair or replacement of the outer or secondary diaphragm if it should become damaged. Another disadvantage in the prior protective diaphragm is that after repeated exposures to moisture and subsequent drying, the axis of the protective diaphragm becomes misaligned from its original position as the result of uneven shrinkage of the fibers in the diaphragm. When so misaligned, the original spacing of the loudspeaker diaphragm and the protective diaphragm is altered even to the point where the protective diaphragm may contact the loudspeaker at one or more points. In both of these instances the response characteristics of the loudspeaker will become considerably impaired. Other protective diaphragms have involved the use of a stretched membrane across the base of the loudspeaker but such constructions may cause distortion in the sound produced, a loss of fidelity, and a general lowering of efficiency.

Therefore, it is an object of this invention to provide a novel loudspeaker structure which includes a protective diaphragm mounted on a separate frame whereby it may be easily assembled on and disassembled from the loudspeaker structure.

It is another object of this invention to provide a loudspeaker construction which provides a protective cone which serves to prevent either weather or other influences from damaging the speaker diaphragm.

It is still another object of this invention to provide a novel loudspeaker which may be quickly mounted in a housing and which includes a protective diaphragm mounted on a removable frame and wherein no special means is required to mount the protective diaphragm.

It is a further object of this invention to provide a novel loudspeaker construction which includes a protective diaphragm spaced from the loudspeaker standard diaphragm and mounted in such a manner that there is no distortion or loss of fidelity and efficiency as a consequence of the presence of the protective diaphragm.

It is a still further object of this invention to provide a novel protective diaphragm for a loudspeaker which is supported at its outer periphery and at its center

whereby the possibility of axial misalignment after use is considerably lessened.

Briefly, the objects of this invention are achieved in one form by the provision of a protective diaphragm which is secured in its outer periphery to an annular frame. A pair of inwardly extending radial arms on the frame support, a center ring on which a flexible spider is mounted. The center of the diaphragm is supported on the flexible spider so that by virtue of the center support, and the support at the periphery, sufficient freedom of the protective diaphragm to move in the axial direction is obtained. The annular frame with the protective diaphragm thereon is positioned adjacent the standard diaphragm of the loudspeaker and is spaced a suitable distance therefrom by the use of a spacing ring. The assembly described permits rapid assembly and disassembly of the protective diaphragm from the loudspeaker and the entire assembly may be easily mounted in a protective housing.

The features of my invention which I believe to be novel are set forth with particularity in the appended claims. My invention itself, however, both as to its structure and mode of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings in which:

Figure 1 is a front view having a portion cut away to show the loudspeaker in its assembled position;

Figure 2 is a side view of Figure 1 with a portion of the housing cut away to show the assembled relation of the speaker and the protective diaphragm;

Figure 3 is an exploded isometric view of a loudspeaker and protective diaphragm incorporating my invention; and

Figure 4 is a cross-section view of a protective diaphragm incorporating my invention.

Referring to Figure 3 of the drawing there will be seen a loudspeaker which is constituted by a supporting frame or basket **2** which diverges from its central portion to have a generally frusto-conical configuration in which is mounted a flexible diaphragm **4** which may have a configuration as illustrated. A pair of connectors **5** may be provided on the diaphragm **4** to couple current to a voice coil (not shown). A yoke **6** is secured by any suitable means to the frame **2** and carries the magnetic flux eminating from a magnet **8** which magnet may be of the permanent type. The diaphragm is secured to the voice coil (not shown) which is positioned in the magnetic field (not shown) created by the magnet **8** and yoke **6** in the manner well known in the art. The periphery of the frame has provided therein a plurality of apertures **10** which may be used to mount the loudspeaker in suitable supporting structures. Secured to the periphery of frame **2**, to which the diaphragm **4** is mounted, a spacing ring **12** is provided which may be formed of any suitable material such as a plastic rubber or paper fiber composition.

In accordance with my invention, I provide an annular ring **14** which has provided thereon a pair of radial arms **16** which extend inwardly along a diameter of the ring. A concentric integral center ring **18** is provided on the confronting ends of the radial arms **16** and is supported thereby. The annular frame **14**, arms **16** and ring **18** may be formed from any suitable material such as metal or plastic. Secured to the inner ring is a corrugated spider **20** which is formed from a flexible material such as paper, fiber composition or treated fabric. The flexible spider is provided with an aperture at its center to provide a supporting portion for the center **21** of a flexible diaphragm **22** secured thereto. This diaphragm may be formed of the same material as diaphragm **4**. The outer edge of the diaphragm **22** is secured at **24** to the periphery of the annular ring **14**.

As may be best seen in Figure 4, the diaphragm 22 is provided with a plurality of corrugations 23 which may conform to similar corrugations provided the loudspeaker diaphragm 4 whereby vibrations sympathetic to those in the latter diaphragm are induced in the diaphragm 22 by the movement of the air in the space between which couples the two diaphragms together. The material and configuration of the spider 20 must likewise be selected with a view to matching the characteristics of the supporting structure of diaphragm 4. The area of contact of the diaphragm 22 with the spider 20 is to the rear of the center ring 18 and the central concave portion 21 has portions extending further to the rear from which point the diaphragm extends forwardly to the periphery of the annular ring 14 where it is secured. The construction thus formed is substantially frusto-conical in configuration and matches that of the diaphragm 4. This construction permits the transfer of the sound intelligence from the diaphragm 4 to the diaphragm 22 with a high efficiency and substantially no distortion. Further, it may be seen that the support afforded the center of the diaphragm 22 by the spider 20 mounted on the center ring 18, acts to hold the diaphragm in its original position on the same axis even though the fibers thereof have not shrunk equally after exposure to moisture. Thus, there is no possibility of altered spacing between or the contact of diaphragm 4 and the diaphragm 22 whereby the coupling between the two diaphragms is changed with its consequent deleterious effects on response and output. A further advantage gained by the center support is that the similar characteristics of the two diaphragms are maintained in the rise of the device. It is obvious that the diaphragms need not be round but can be oval or any other desired shape.

To assemble the protective diaphragm to the loudspeaker, it need only be placed so that the annular frame 14 engages the spacing ring 12. When so assembled, the members may be held in assembled position by mounting them in a housing or by any other suitable means.

A housing suitable for mounting the speaker and the protective diaphragm is illustrated in Figures 1 and 2. It comprises a pair of hollow box-like members 28 and 30. A plurality of threaded members 32 pass through openings in the members 28 and 30 and also through the openings 10 in the speaker frame 2. The member 30 is provided with a louvered opening 34 and the speaker when mounted in the housing is positioned behind the louvers. The threaded member 32 passes through the opening 10 in the speaker frame 2 and are received in internally threaded portions (not shown) of the housing member 30 to hold the speaker and protective diaphragm in assembled position. The speaker housing may be provided with a knob 36 for a volume control potentiometer (not shown) mounted in the speaker housing. A bracket such as shown at 38 may be provided on the speaker housing in order to hang it on any suitable support.

In the use of my device when the protective diaphragm becomes damaged because of weather action or because of other harmful effects to point where it is no longer able to develop the sound intelligence with fidelity, or the loudspeaker diaphragm itself becomes subject to harm, the housing or other structure mounting the assembly may be removed and the protective diaphragm easily replaced with a new one.

While the invention has been described by reference to a particular embodiment thereof, it will be understood that numerous modifications may be made by those skilled in the art without departing from the invention itself. Therefore, I aim in the appended claims to cover all such equivalent variations as come within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A weather shielding diaphragm for a loudspeaker comprising an annular frame formed from a thin sheet of metal, a pair of integral radial arms extending along a diameter of said frame toward the center thereof, an integral inner ring supported by said radial arms and concentric with said annular frame, a flexible annular spider secured to said inner ring and having a supporting portion extending toward the center and, a diaphragm having its central portion secured to said supporting portion of said annular spider, a portion of said diaphragm including a frusto-conical portion extending from the portion secured to said annular spider to the annular frame, and the outer edge of said diaphragm being secured to said annular frame.

2. In a loudspeaker for use outdoors, the combination with a generally frusto-conically shaped frame terminating at its larger end in a stiff annular portion and carrying at its small end a magnetic field producing means and an axially movable voice coil associated therewith, and a flexible generally frusto-conical shaped sound diaphragm connected at its small end to the voice coil and secured at its larger end to the annular portion of the frame, of an outstanding spacing ring on said annular portion, a weather protection diaphragm frame having an annular ring removably engaging said spacing ring, a center ring positioned concentrically with respect to said annular ring and supported from said annular ring by radial arms extending from said center ring to said annular ring, a flexible weather protection diaphragm having a frusto-conical marginal portion supported at its outer edge by said annular ring and having a central portion situated opposite said center ring, and a concentric corrugated flexible spider connecting the central portion of the weather protection diaphragm to the center ring.

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