United States Patent [19]

Itagaki

[11] **3,855,428**

[45] **Dec. 17, 1974**

[54] **SPEAKER DIAPHRAGM**

[75] Inventor: **Tadasi Itagaki,** Tokorozawa, Japan

[73] Assignees: **Pioneer Electric Corporation,** Tokyo; **Tokorozawa Electronics Corporation,** Tokorozawa-shi, Saitana, Japan

[22] Filed: **Oct. 30, 1972**

[21] Appl. No.: **301,930**

[30] **Foreign Application Priority Data**

Oct. 29, 1971 Japan 46-100611

[52] **U.S. Cl. ... 179/115.5 ES,** 179/181 R, 181/31 R

[51] **Int. Cl. H04r 7/14,** H04r 7/16, H04r 9/06

[58] **Field of Search** ..... 179/115.5 R, 115.5 ES, 179/181 R, 181 F; 181/31 R, 32 R

[56] **References Cited**

UNITED STATES PATENTS

1,843,367	2/1932	Langley	181/31 R
2,034,882	3/1936	Scribner	181/32 R
2,814,353	11/1957	Olson et al.	181/31 R
3,095,941	7/1963	Hassan	181/32 R
3,179,204	4/1965	Cefaly	181/32 R
3,679,844	7/1972	Derkacz	179/115.5 R

FOREIGN PATENTS OR APPLICATIONS

244,415	1/1966	Austria	179/115.5 ES

Primary Examiner—Kathleen H. Claffy
Assistant Examiner—George G. Stellar
Attorney, Agent, or Firm—Sughrue, Rothwell, Mion, Zinn & Macpeak

[57] **ABSTRACT**

A U-shaped, annular indentation within the edge of a cone-shaped diaphragm forms a reinforcing rib within the periphery of the diaphragm and provides dual, right angle contact surfaces with the annular frame which edge supports the diaphragm at its outer periphery.

2 Claims, 3 Drawing Figures

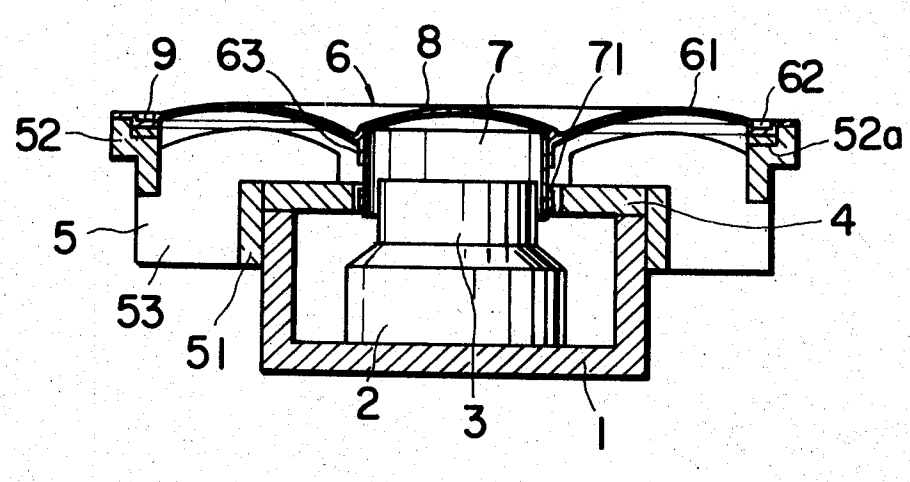


FIG. 1 PRIOR ART

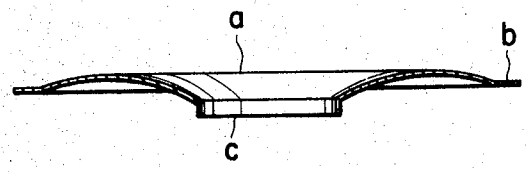


FIG. 2

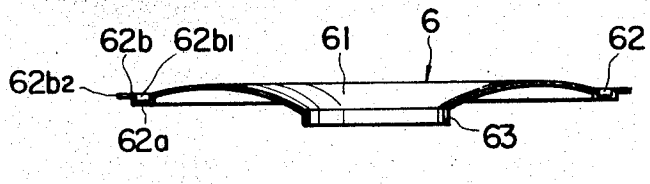
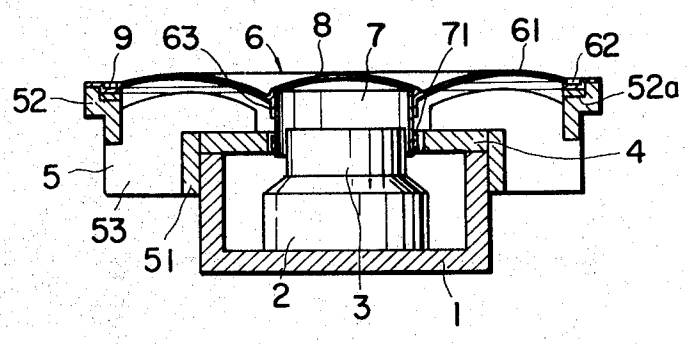


FIG. 3



SPEAKER DIAPHRAGM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a loudspeaker and more particularly, to a diaphragm construction for a speaker employed as a tweeter.

2. Description of the Prior Art

Heretofore, diaphragms may be constructed of extremely thin film material, as readily evidenced by the construction illustrated in FIG. 1 in which the illustrated diaphragm is suitable for use in a tweeter speaker. The illustrated, conventional diaphragm is annular in form and consists of a large cone-shaped portion *a*, carrying a simpler circular opening defined by a flange portion *c* which acts as a coil bobbin-mount, the cone-shaped portion a terminating in an outer peripheral edge *b* which is unitary therewith. In this case, portions *a*, *b* and *c* are unitary. However, diaphragms constructed in this manner are unable to maintain their desired shape by reason of the weight of the diaphragm itself, the warp of the material forming the same after molding, etc. It has been, therefore, difficult to accurately form the center opening and to maintain it at the center position or to form the edge portion b concentrically therewith. The errors resulting in the position of the center opening and the peripheral deviation of the edge portion b in terms of concentricity, causes an eccentric error within the coil gap. Such errors have not only caused great difficulty in the manufacture of speakers, but the diaphragm so constructed is quite unsuitable, particularly for speakers requiring more accuracy in the reproduction of sound.

SUMMARY OF THE INVENTION

The present invention is formulated with the intention of overcoming the above-mentioned disadvantages, in terms of thin film speaker diaphragms, and thus it is an object of the present invention to to provide a diaphragm for a speaker which is capable of maintaining its desired shape and may be manufactured with high accuracy and with relative ease of evenly extremely thin film materials. Another object of the present invention is to provide within the diaphragm, means enabling the control of the position of the diaphragm as well as the mounting of the diaphragm to the speaker frame in a manner which eliminates the occurrence of trouble such as eccentricity of the coil gap and thereby enable the easy manufacture of speakers of the present design.

These objects are met preferably by forming an integral, reinforcing rib within the edge of the diaphragm which is characterized by right angle portions which may be fixed respectively to corresponding right angle surfaces of the annular frame which supports the diaphragm at its outer periphery. The rib may be formed by providing a U-shaped annular indentation within the edge of the diaphragm and by providing an annular recess within the forward end of the frame such that one sidewall of the U-shaped indentation such that one sidewall of the U-shaped indentation abuts the sidewall of the recess within the annular frame, while a right angle plane extending radially outward from the sidewall of the U-shaped indentation overlies and abuts the outer end of the frame adjacent the peripheral recess within the same.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal sectional view of a prior art thin film diaphragm for a conventional speaker.

FIG. 2 is a longitudinal sectional view of a speaker diaphragm forming one embodiment of the present invention.

FIG. 3 is a longitudinal sectional view of a loudspeaker in which the diaphragm of FIG. 2 is employed.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the accompanying drawings, there will be described an explanatory embodiment of the present invention. The speaker of FIG. 3 is formed of a yoke **1** within which is coaxially positioned a magnet having a pole **3** at its forward base and disposed within an annular plate **4** which forms with the pole **3** an annular air gap for a magnetic circuit including yoke **1**, magnet **2**, pole piece **3**, and annular plate **4**, in conventional fashion. A frame **5** includes an inner rim portion **51** which is fitted to the periphery of the magnetic circuit, and an outer rim portion **52** to which the peripheral edge of diaphragm **6** is fixedly attached, and a plurality of radial supporting plates **53** interconnect the inner rim portion **51** to the outer rim portion **52**. The diaphragm indicated generally at **6** is composed of a large, cone-shaped portion **61** carrying a central opening as defined by a depending annular coil bobbin mount portion **63**, while integrally connected therewith in like fashion to the coil bobbin mount portion **63** is a peripheral edge portion indicated generally at **62**. A coil bobbin **7** carries a voice coil **71**, the coil bobbin **7** constituting an annular member which is in peripheral abutment with the annular coil bobbin mount portion **63** of the diaphragm **6**. In this respect, the coil bobbin is inserted into the opening defined by the coil bobbin mount portion **63** and is bonded by adhesive or the like to the coil bobbin mount portion at its upper end thereof. A cap **8** covers and is bonded to the top of the coil bobbin **7**.

In accordance with the present invention, and in particular by reference to FIG. **2** as well as FIG. **3**, the peripheral edge portion **62** of the diaphragm **6** is so configured and constructed such as to provide a specially formed edge portion **62***a* which is unitary with the cone-shaped portion **61** and joins the same at the outer periphery of the cone-shaped portion and is provided with a reinforcing rib indicated generally at **62***b* and which is also unitary therewith. In cross section, it is apparent that the thin film diaphragm is provided with a U-shaped annular indentation which forms the reinforcing rib **62***b*, the rib being composed of right angle edge portions constituted by an axial edge portion $62b_1$ which is, in fact, the outer wall of the U-shaped indentation and a horizontal plane portion $62b_2$ which extends radially outward thereof and, of course, unitary therewith. The horizontal plane portion and the outer wall of the U-shaped annular indentation therefore forms an inverted L-shaped annular rim which cooperates with the step portion **52***a* of the outer rim portion **52** of the annular frame **5**. In this respect, the forward end of the frame is recessed at its inner periphery to provide the step, the annular recess or step carrying packing material **9** against which the bottom of the U-shaped annular indentation rests with the outer side-

wall abutting and being fixed to the annular frame member and, in particular, the outer rim portion **52** of the frame **5**. By suitable adhesive or other means, the sidewall or axial edge portion **62***b*$_1$ and the horizontal plane portion **62***b*$_2$ radially outward of the same and defining the reinforcing rib **62***b*, are fixed to right angle contact surfaces of the outer rim portion **52**.

Although the peripheral edge portion **62** of the diaphragm **6** is adhered to the frame **5** through the use of packing material **9**, in the illustrated embodiment, it is to be noted that the peripheral edge and, in particular, the right angle rib portion, may adhere directly to the frame **5** and the packing material **9** may then, in turn, be adhered to the peripheral edge portion of diaphragm **6**.

In accordance with the present invention, since the peripheral edge portion **62** of diaphragm **6** is composed of an L-shaped reinforcing rib which is unitary with and forms a portion of the peripheral edge of the diaphragm and, in particular, is adjacent to the bottom of the U-shaped annular indentation, the desired shape of the diaphragm will be successfully maintained without deformation due to its own weight or any warp of the material in comparison to the diaphragm illustrated in FIG. **1**. Therefore, the opening of the center of the diaphragm and the stamping of the outer diameter of the diaphragm may be accomplished with high accuracy, and any processing work after providing the configuration to the diaphragm as illustrated in FIG. **2** including the U-shaped annular indentation, will be achieved with relative ease. Furthermore, since the U-shaped indentation which incorporates reinforcing rib **62***b* are fixed within the outer rim portion **52** of the frame **5**, the position of the diaphragm **6** relative to frame **5** is accurately determined, so that the operational efficiency in the assembling of the speaker components will be greatly improved.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. In a loudspeaker having an annular thin film diaphragm, an annular frame concentrically surrounding an axially movable voice coil, said diaphragm including an annular portion with its inner peripheral edge supporting a rearwardly directed cylindrical bobbin holding said voice coil and its outer peripheral edge fixed to said frame, the improvement wherein:

said frame includes an annular, right angle recess within the forward end face of the same at its inner periphery,

said diaphragm includes a right angle, U-shaped annular indentation inwardly of its outer peripheral edge at a radial position corresponding to said frame recess, said indentation forming a reinforcing rib,

and a right angle flange portion radially outward thereof,

the radially outer sidewall of said indentation is fixed to the radially inner sidewall of said frame recess, and

the right angle flange portion of said outer peripheral edge of said diaphragm, radially outwards of said radially outer sidewall, is fixed to the forward end face of said frame with the forward surface of said diaphragm free of said frame.

2. The loudspeaker as claimed in claim **1**, further comprising: an annular strip of packing material fixed at its top to the bottom wall of said U-shaped indentation and fixed at its bottom to the bottom of said annular recess within said frame to dampen the vibrations of said diaphragm.

* * * * *