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M. NYSTROM

1,783,385

SOUND REPRODUCING DEVICE

Filed April 12, 1926

FIG. 1

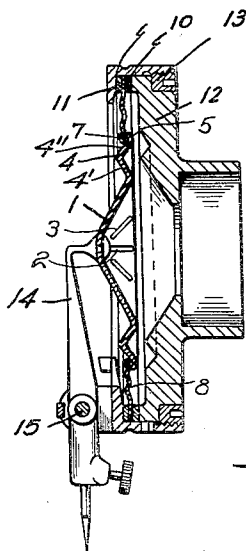


FIG. 5

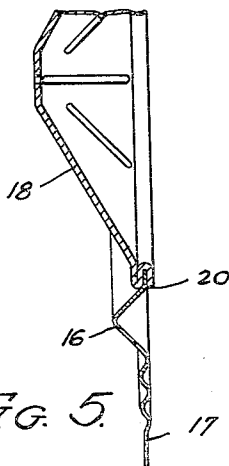
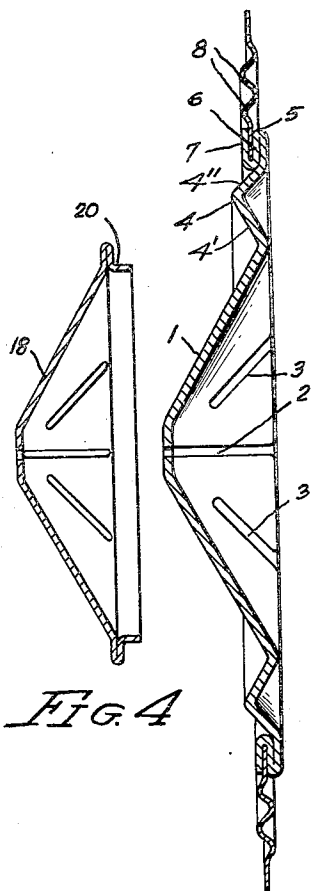


FIG. 4

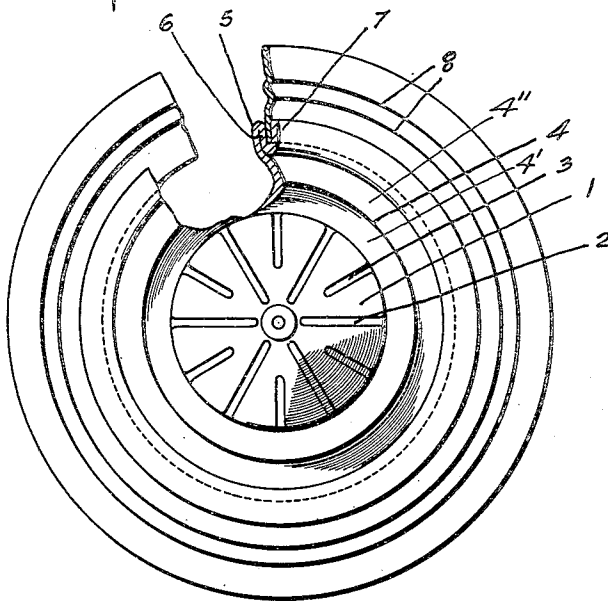


FIG. 3

FIG. 2

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MARTIN NYSTROM, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO UNITED RESEARCH CORPORATION, OF LONG ISLAND CITY, NEW YORK, A CORPORATION OF DELAWARE

SOUND-REPRODUCING DEVICE

Application filed April 12, 1926. Serial No. 101,439.

My invention relates to devices for reproducing sound and it has a special relation to sound boxes for phonographs.

One object of the invention is to provide a diaphragm comprising an inner portion and an outer portion having an opening therein with gripping devices in directly opposed relation to each other for securing one of said portions to the edge of the other.

Another object of the invention is to provide a rigid central portion of a diaphragm with a folded periphery for gripping the edge of a flexible annular portion of the diaphragm.

A further object of the invention is to provide a method of folding the periphery of a rigid center of a diaphragm to cause it to grip the edge of a flexible annular portion of the diaphragm.

Other objects and advantages of the invention will appear as the description proceeds.

Referring to the accompanying drawings, Fig. 1 is a central sectional view of a sound box embodying the invention, detached from the tone arm.

Fig. 2 is a detail central sectional view on an enlarged scale of a diaphragm embodied in the sound box shown in Fig. 1.

Fig. 3 is an elevational view partly broken away on an enlarged scale of the outer side of the diaphragm shown in Fig. 2.

Fig. 4 is a central sectional view illustrating a stage in the making of the piston of a diaphragm in a modified embodiment of the invention.

Fig. 5 is a fragmentary view partially in central section of the modified form of diaphragm corresponding to the construction shown in Fig. 4.

The diaphragm comprises a central piston and a flexible annulus on which the piston is supported in its vibratory movement.

In order that the piston may be of extremely light mass, it is made extremely thin and is composed of a light substance such as aluminum or an aluminum alloy.

To prevent flexure of the piston and the setting up of undesirable vibrations therein, it may be deformed. The central portion may be given the shape of a cone 1 and a plurality

of radial strengthening ribs 2 extending from the apex to the face of the cone may be provided to increase its rigidity. Similarly shorter ribs 3 extending for a short distance from the face of the cone toward the apex may be provided. The piston may also have a strengthening deformation 4 therein; this deformation is provided by walls 4', 4'', which have joining trunco-conical faces.

The piston may be deformed at its periphery to provide for securement to the annulus and the parts may be held together by a joint.

In shaping the piston for securement to the annulus, it may be bent along its periphery at a line 5 into an inwardly extending portion or fold 6 which may be pressed against the flat face of the outer portion of the piston. At this stage of the process the edge of the diaphragm is interior of the line 5.

The position of the edge of the piston permits the annulus to be placed in engagement with the fold 6. The annulus may be flattened adjacent its inner edge so that it may lie snugly against the fold 6.

After the assembly of the two parts, the edge of the piston may be bent outwardly so that the portion or fold 7 may be brought into engagement with the annulus. The folding of the piston at line 5 to form the portion or fold 6 may be performed by suitable dies as will be understood by those skilled in the art. Similarly the bending of the portion or fold 7 may be accomplished by suitable dies.

The folds 6 and 7 securely grip the annulus therebetween and unite the two parts rigidly together, eliminating the possibility of bodily movement of one part relative to the other, and preventing the parts from tearing loose in operation, or setting up objectionable vibrations.

The annulus is extremely thin to facilitate flexure thereof, and is preferably made of a light material such as aluminum or an aluminum alloy. To facilitate flexure of the annulus a plurality of deformations may be provided therein which may be in the shape of annular corrugations 8. The corrugations may be made of different shapes and sizes and may be varied in number to suit dif-

ferent conditions. The outer portion of the annulus may be flat and may be retained between a pair of washers 10, which may be compressed between a cap 11 and a plate 12. A clamping ring 13 in threaded engagement with the cap 11 may be provided for holding the latter securely in position.

An aluminum diaphragm of which the piston was approximately .004" in thickness and the annulus .002" in thickness has been found to give excellent results.

Such a diaphragm embodying the invention is extremely sensitive because of its exceedingly low mass, and the readily flexible character of the exterior portion. It therefore effects a faithful reproduction of sound over a wide range of frequencies without tendency to distortion or the setting up of undesirable vibrations, yet notwithstanding its extreme sensitiveness, it is very durable and shows no tendency to deteriorate even after long usage.

The piston may be actuated in diverse manners depending on whether or not it is used in a loud speaker, a phonograph sound box, or other machines.

A stylus bar 14 may be secured to the apex of the cone 1 in a suitable manner. A suitable securing device is shown and described in my application Serial No. 101,186 filed April 10, 1926. The stylus bar is pivoted at 15.

In the modified form of my invention illustrated in Figs. 4 and 5, a deformation 16 similar to the described deformation 4 may be provided in the thin annulus 17. The piston may be in the form of a cone 18.

Before assembling the annulus the piston may be shaped as shown in Fig. 4, the edge 20 being inward of the outermost portion of the piston.

After assembly the edge is folded outwardly to the position illustrated in Fig. 5 wherein it is in secure gripping relation with the annulus.

Although the fold illustrated in Fig. 2 is on the side of the diaphragm opposite to that shown in Fig. 5, it will be understood that the invention is not limited to this specific arrangement as it is not essential to the invention that the fold be on a particular side of the diaphragm.

The invention is not limited to the specific details of the embodiments illustrated and described but is capable of diversified embodiment. A substantial range of equivalents is contemplated within the spirit of the invention and the scope of the following claims.

I claim:

1. A diaphragm comprising an annular portion having an inner edge and approximately .002" in thickness, said annular portion being deformed to facilitate flexure thereof, and a central portion approximately .004" in thickness, deformed to prevent

flexure thereof, said central portion having jaws gripping the inner edge of the other portion therebetween, said jaws being in facing relation so that a plane perpendicular to the face of the diaphragm and within the periphery thereof will run through both jaws and the portion gripped therebetween, said portions being composed of a light metallic substance substantially as light in weight as aluminum.

2. A diaphragm comprising a thin, flexible annulus having an inner edge, and a rigid central portion having a shallow recess therein along its periphery receiving the inner edge of said annulus, said central portion having substantially rigid walls forming said recess and providing rigid jaws tightly gripping the inner edge of said annulus.

3. A diaphragm comprising an outer flexible portion having a substantially central opening therein and a central portion over said opening folded on itself at its periphery and enclosing and gripping the edge of said outer portion around said opening.

4. The combination of a diaphragm comprising an outer flexible portion having a substantially central opening therein, a central portion over said opening folded on itself at its periphery and enclosing and gripping the edge of said outer portion around said opening, and a stylus bar secured to said central portion for actuating the same.

5. A diaphragm comprising an annular portion having an inner edge and deformed to facilitate flexure thereof, and a central portion deformed to prevent flexure thereof, said central portion being folded on itself to enclose and grip the inner edge of said annular portion.

6. A diaphragm comprising a metallic annular portion having an inner edge and deformed to facilitate flexure thereof and a central metallic portion deformed to have a surface of truncated conical shape and folded on itself along its entire periphery to enclose and grip the inner edge of said annular portion.

7. A diaphragm comprising an outer annular portion approximately .002" in thickness, deformed to facilitate flexure thereof and a central portion approximately .004" in thickness, deformed to prevent flexure thereof, both of said portions being composed of a light metal substantially as light in weight as aluminum, said central portion being folded upon itself along its entire periphery to enclose and grip an edge of said annular portion.

8. A diaphragm comprising a flexible annulus having an inner edge and a central member; said central member having an inwardly folded portion along its periphery, which is again folded outwardly into an opposed portion, said portions gripping the inner edge of said annulus therebetween.

9. A diaphragm comprising a metallic an-

nulus having an inner edge and deformed to facilitate flexure thereof, and a metallic central member deformed to prevent flexure thereof, said central member having a portion folded inwardly along its periphery and bent into an outwardly extending portion, said portions being in opposed relation and gripping the inner edge of said annulus therebetween.

10 10. A diaphragm comprising a metallic outer portion deformed to facilitate flexure thereof and a metallic central portion having a conical deformation in the center thereof and an annular deformation surrounding
15 said conical deformation, said annular deformation having joining trunco conical faces, said central portion being folded inwardly along its periphery and again folded outwardly to grip said annular portion between
20 the outward and inward folds.

11. The method of making a diaphragm which comprises folding the edge of a central member inwardly, assembling an annular member on said central portion exteriorly
25 of said edge and bending said edge outwardly again into gripping relation with said outer portion.

12. A diaphragm comprising a flexible metallic annulus having a substantially central opening, a relatively rigid metallic portion
30 in said opening, and jaws on one portion tightly gripping the adjacent edge of the other portion.

13. A diaphragm comprising a relatively
35 thin flexible metallic portion, a relatively rigid metallic portion, one of said portions having a substantially central opening therein and the other portion being disposed in said opening, and jaws on one portion tightly
40 gripping the adjacent edge of the other portion.

Signed at Chicago, State of Illinois, United States of America, this 10th day of April A. D., 1926.

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