July 18, 1933. M. NYSTROM 1,918,422

SOUND REPRODUCING DEVICE

Filed June 22, 1926

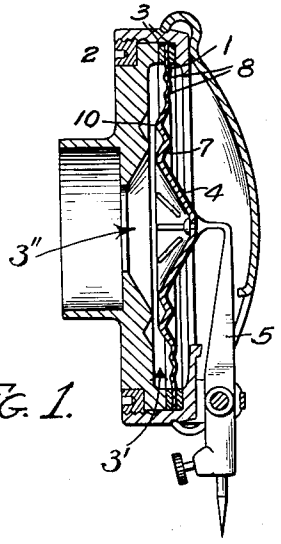


FIG. 1.

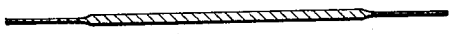


FIG. 2



FIG. 3

FIG. 6.

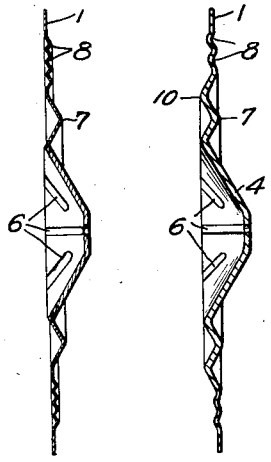


FIG. 4

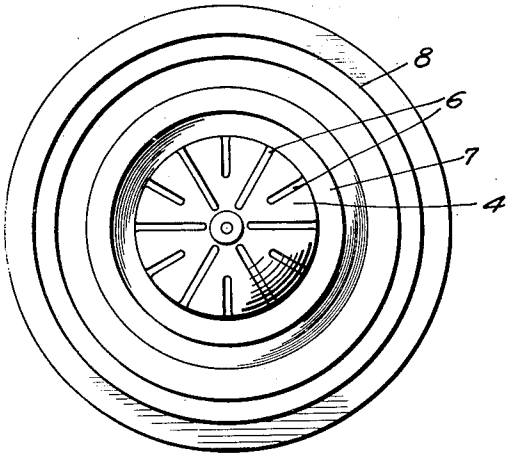


FIG. 5

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1,918,422

UNITED STATES PATENT OFFICE

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 June 22, 1926. Serial No. 117,723.

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

One object of my invention is to produce a diaphragm for reproducing sound which will be extremely sensitive so as to faithfully reproduce sounds over a wide range of frequencies and at the same time will be of such construction that it will endure constant and prolonged usage without in any manner getting out of order or impairing the excellence of the reproduction.

Another object of the invention is to provide a low mass one-piece diaphragm having a portion of extreme thinness to reduce the weight and facilitate flexure thereof.

A further object of the invention is to provide a method of making diaphragms of the type described.

Other objects and advantages will appear as the description proceeds.

Referring to the accompanying drawing, Figure 1 is a central sectional view of a sound-box embodying the invention; Figures 2 and 3 are central sectional views illustrating a diaphragm embodied in the sound-box illustrated in Figure 1, the views being taken at different steps in the formation of the diaphragm; Figure 4 is a central sectional view of a completed diaphragm; Figure 5 is an elevational view of the outer side of the completed diaphragm and Figure 6 is a central sectional view illustrating a modified form of diaphragm.

The diaphragm is extremely thin and comprises a central rigid portion or piston and an outer flexible portion or hinge 1 of reduced thickness. The hinge may be secured in a sound box 2 by means of washers 3.

In order that the piston may exercise a true piston action and not be flexed in operation, it may be deformed. The deformation may be in the shape of a cone 4, which may be slightly flattened at the apex for securement to a stylus bar 5.

Radial deformations 6 may also be provided in the cone 4 to further insure rigidity. An annular deformation 7 having meeting truncoconical faces and surrounding the cone 4 may also be provided for increasing the rigid area of the central portion or piston.

To facilitate flexure of the hinge 1 it may have deformations therein. These may be in the shape of annular corrugations 8.

The diaphragm may be made of a desired material, a light metal such as aluminum or aluminum alloy being especially advantageous, and latitude in the thickness and dimensions of the diaphragm is contemplated. An embodiment of the invention in which the diaphragm was made of aluminum and was approximately .004″ in thickness throughout the piston area and approximately .002″ in the hinge was found to be very satisfactory.

In the embodiment of the invention illustrated in Figures 1 to 5 inclusive, the reduction in thickness of the diaphragm occurs along a line 10 at the outer border of deformation 7.

In the modified embodiment of the invention illustrated in Figure 6, the reduction in thickness of the diaphragm occurs at the base of the cone 4. This increases the flexible area.

The low mass of diaphragms embodying the invention and the readily flexible character of the exterior portion or hinge makes possible a faithful reproduction of sound over a wide range of frequencies. The character of the diaphragm as being in one piece and lacking in joints, renders it very durable. Diaphragms made in accordance with the invention have no tendency to deteriorate even after long usage. There is no tendency of the piston to tear loose from the hinge or of the stylus bar to tear loose from the piston.

In making the diaphragm a central blank of a desired material, such, for instance, as aluminum or an aluminum alloy may be used, the blank being of a desired thickness as, for instance, .004″. An outer marginal portion of the blank may be reduced to a desired thickness, as for instance, .002″.

The reduction in thickness may be produced by grinding either or both faces of the outer portion of the blank or by subject-

ing the outer portion of the blank to compression between dies in such a manner as described in my copending application Serial No. 120,161 filed July 2, 1926, now Patent No. 1,783,386, Dec. 2, 1930. Figure 2, illustrates the condition of the blank at this stage of its manufacture.

The central portion may then be shaped into a cone 4, and a deformation 7 by the action of suitable dies as illustrated in Figure 3.

The radial deformations 6 and the corrugations 8 may then be impressed by suitable dies, the diaphragm taking the shape illustrated in Figure 4, but the invention is not limited to a precise sequence of steps in the formation of deformations and corrugations, as these may be formed simultaneously or in any desired order.

The invention is not limited to the specific details of construction of the embodiments illustrated and described, but is capable of diversified embodiment and the diaphragm may be used not only in sound-boxes, but in loud-speakers, telephones and other devices in which it is desired to transmit or reproduce sound. A substantial range of equivalents is contemplated within scope of the appended claims.

I claim:

1. A diaphragm composed of aluminum and having a central portion, deformed to prevent flexure thereof, in one piece with a relatively thin outer portion, deformed to facilitate flexure thereof.

2. A metal diaphragm having a central portion, deformed into the shape of a cone to prevent flexure thereof, and a relatively thinner outer portion formed in one piece with the central portion and having therein annular corrugations to facilitate flexure thereof.

3. A diaphragm composed of a light metal and having an outer portion relatively thinner than and in one piece with a central portion, said central portion being deformed into the shape of a cone, and said cone being surrounded by an annular deformation having meeting truncoconical faces.

4. A diaphragm composed of an extremely light metal having a central portion reinforced by radial deformations and in one piece with an outer relatively thinner flexible portion.

5. A diaphragm comprising a thin central portion, deformed substantially into the shape of a cone, in one piece with a thinner outer portion, the reduction in thickness occurring substantially at the base of said cone.

6. A diaphragm composed of an extremely light metal and comprising a rigid central portion having the shape of a cone, and being approximately .004″ in thickness uniformly throughout, and a flexible outer portion in one piece with said central portion and having deformations therein to facilitate flexure thereof, said flexible outer portion being approximately .002″ in thickness throughout.

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