Oct. 10, 1933. C. M. TICHENOR ET AL 1,930,328

SOUND REPRODUCING DIAPHRAGM

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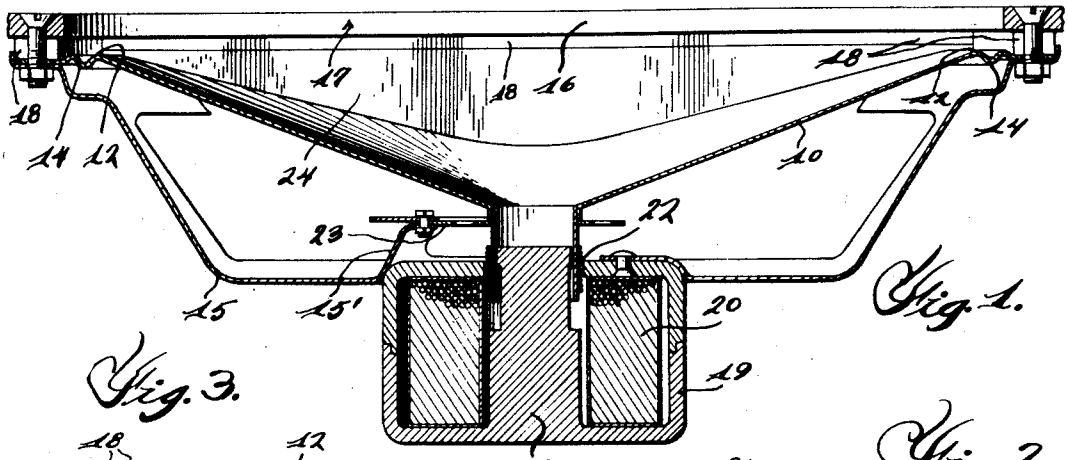


Fig. 1.

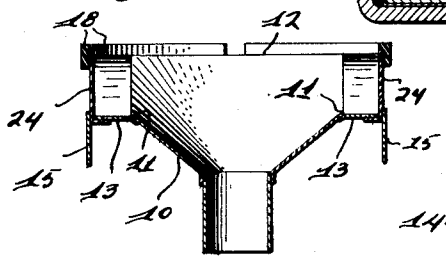


Fig. 3.

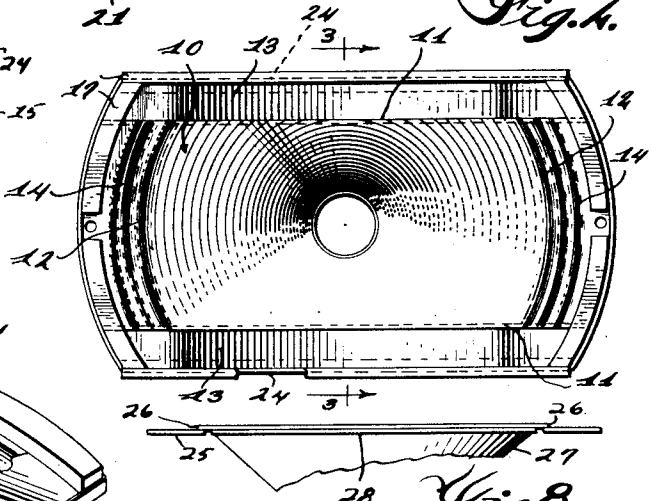


Fig. 2.

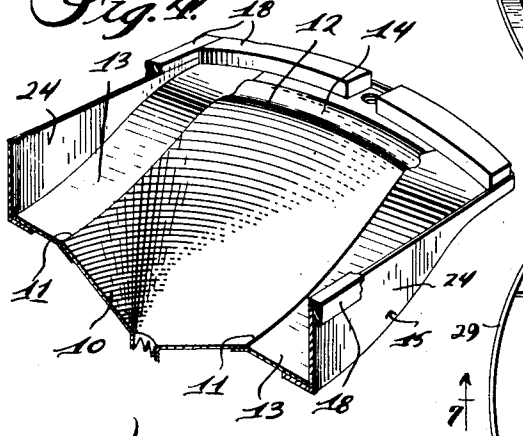


Fig. 4.

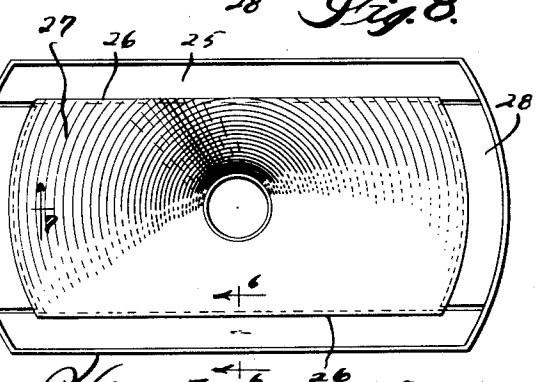


Fig. 8.

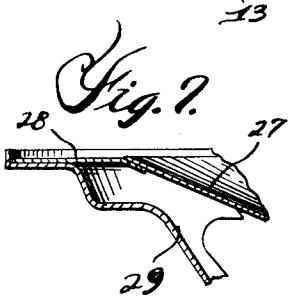


Fig. 7.

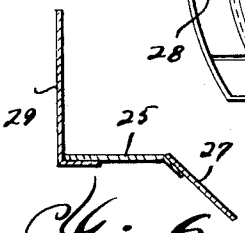


Fig. 6.

Fig. 5.

Inventors
Carl M. Tichenor
Byron C. Booth

By Hubbell & Cottrell & Belknap
Attorneys

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Fig. 9.

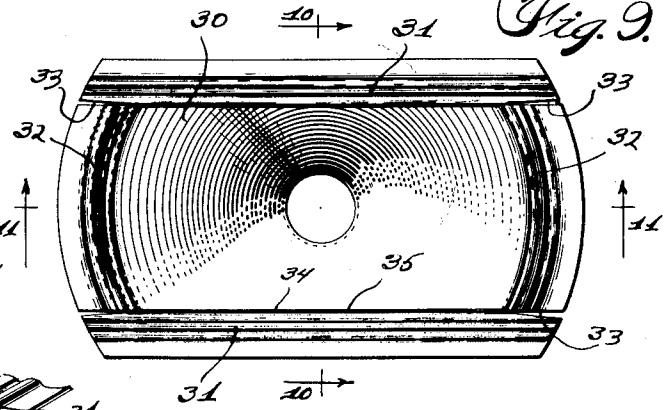
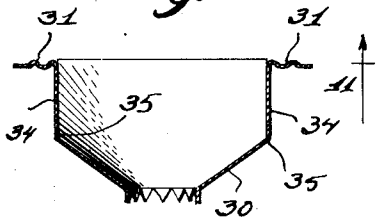


Fig. 10.



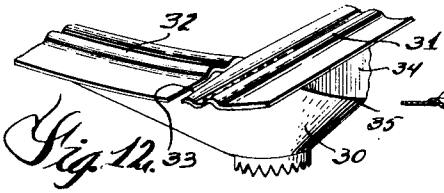


Fig. 12.

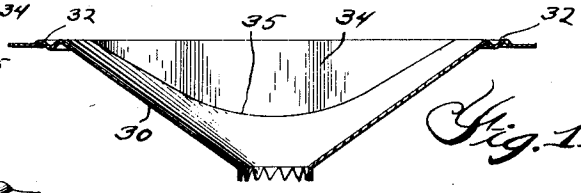


Fig. 11.

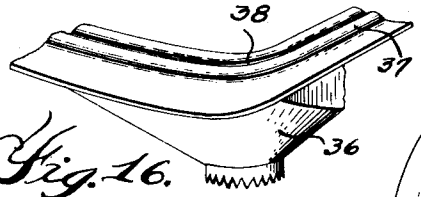
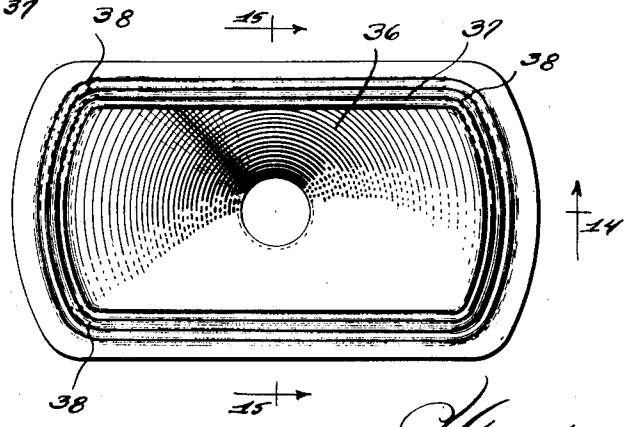


Fig. 16.



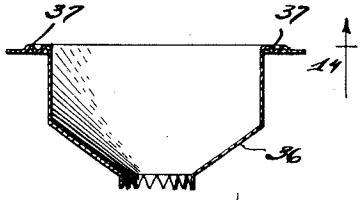


Fig. 15.

Fig. 13.

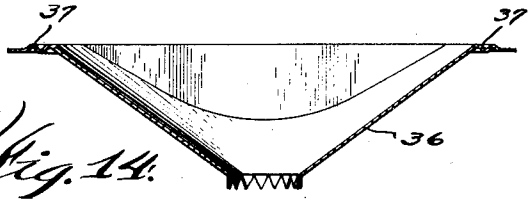


Fig. 14.

Inventors
Carl M. Tichenor
Byron C. Booth

By Hulbert & Hulbert & Battenore & Belknap
Attorneys

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UNITED STATES PATENT OFFICE

1,930,328

SOUND REPRODUCING DIAPHRAGM

Carl M. Tichenor, Muskegon, and Byron C. Booth, Muskegon Heights, Mich.; said Booth assignor to said Tichenor

Application January 25, 1933. Serial No. 653,540

11 Claims. (Cl. 181—31)

This invention relates to acoustical devices and more particularly to improvements in sound reproducing diaphragms of the cone diaphragm or tympanum type.

One of the objects of this invention is to provide a diaphragm capable of reproducing both high and low frequency notes corresponding in intensity and quantity, as well as timbre mellowness and other qualities, with the originally produced sound waves.

Another important object of the invention is to provide a sound reproducing diaphragm of this character in which the greatest frontal area possible is obtained with a minimum dimension in one direction.

While the resent invention may obviously be used to advantage in numerous and various acoustical or sound reproducing devices, it finds particular utility when used in connection with radios designed for installation either on the instrument panel or above the windshield of motor vehicles and the like. In the present day commercial type of motor vehicle, the available space at the aforementioned points for installation of a loud speaker or sound reproducing device is limited in one direction, that is in the vertical direction, the greatest available space being usually between 4½ to 5 inches. However, a sound reproducing diaphragm of these dimensions has insufficient working surface to properly produce the base or low frequency notes. In order to obtain a desirable base response it is necessary that at least one dimension of the sound reproducing cone be between 7 to 10 inches. A sound reproducing diaphragm of approximately these dimensions presents a working surface ranging from approximately 18 square inches to 30 square inches. A loud speaker with a frontal area within these dimensions will produce results that at present are considered commercially satisfactory.

In accordance with our invention, we provide a sound reproducing diaphragm substantially conical or dish-shaped having a substantially oblong effective outside periphery providing two spaced, relatively long sides. With a sound reproducing diaphragm of this character, installation is possible within the restricted areas available at the instrument panel or above the windshield of a motor vehicle, and at the same time the required frontal area of the speaker cone is obtained.

The various objects, advantages and novel details of construction of the invention, as well as several structural embodiments thereof, will be made more apparent as this description proceeds, especially when considered in connection with the accompanying drawings wherein,

Figure 1 is a longitudinal sectional view through a sound reproducing device embodying a diaphragm constructed in accordance with this invention;

Figure 2 is a plan view of the diaphragm illustrated in Figure 1;

Figure 3 is a sectional view taken substantially on the plane indicated by line 3—3 in Figure 2;

Figure 4 is a fragmentary perspective view of the diaphragm illustrated in Figure 1;

Figure 5 is a plan view of a slightly modified form of diaphragm;

Figure 6 is a detail sectional view taken substantially on the plane indicated by line 6—6 in Figure 5;

Figure 7 is a detail sectional view taken substantially on the plane indicated by line 7—7 in Figure 5;

Figure 8 is a fragmentary end elevational view of the structure illustrated in Figure 5;

Figure 9 is a plan view of still another modified form of diaphragm;

Figure 10 is a sectional view taken substantially on the plane indicated by line 10—10 in Figure 9;

Figure 11 is a sectional view taken substantially on the plane indicated by line 11—11 in Figure 9;

Figure 12 is a fragmentary detail perspective view of a portion of the diaphragm illustrated in Figure 9;

Figure 13 is a plan view of still another modified form of diaphragm;

Figure 14 is a sectional view taken substantially on the plane indicated by the line 14—14 in Figure 13;

Figure 15 is a sectional view taken substantially on the plane indicated by line 15—15 in Figure 13, and

Figure 16 is a fragmentary detail perspective view of the form of construction shown in Figure 13.

Referring now particularly to the drawings and more especially to Figures 1 to 4 thereof, it will be noted that there is illustrated a diaphragm 10 substantially conical or dish-shaped. This diaphragm is formed of light vibratile material and may be formed in any preferred or desired manner. The diaphragm is substantially oblong in plan view to thus provide a pair of spaced parallel sides 11 defining the shortest dimension of the diaphragm. The reference character 12

indicates the effective outside periphery of the diaphragm at the ends. Flat flexible strips 13 are secured to the long side edges 11 of the diaphragm either adhesively or in any other preferred manner, and the ends 12 are provided with flexible strips 14, preferably, although not necessarily, integrally formed therewith.

A supporting spider 15 provides a peripheral mounting for the diaphragm 10 and is secured respectively to the flexible strips 13 and 14. If the speaker is to be mounted in registration with an opening 16 of a baffle board 17 cushion members or gaskets 18 are interposed (see particularly Figure 1).

The reference character 19 indicates the shell of the magnet which contains a field coil 20 which surrounds the core 21. The reference character 22 indicates the voice coil, and 23 a flexible spider which is secured to the diaphragm adjacent the voice coil and to projections or the like 15' formed on the supporting spider 15.

In the form of construction shown in Figures 1 to 4 the diaphragm is dished at its longitudinal peripheral edges 11 and the supporting spider 15 has side flanges 24, the free edges of which are arranged in substantially the same plane as the peripheral end edges of the diaphragm.

Thus far one method of mounting and supporting the diaphragm has been described somewhat in detail. However, it should be understood that the form of the diaphragm just described, as well as the modified forms hereinafter to be referred to, may be mounted and supported in any preferred or desired manner, the description in this connection herein being for illustrative purposes only.

With the type of diaphragm thus far described, it will be noted that a substantially oblong contour is provided in which the two relatively long spaced edges 11 define the effective outside periphery of the diaphragm in one direction. This dimension of the diaphragm is selected so as to keep this cross-sectional area of the diaphragm within such limits as to enable the same to be properly installed in the restricted areas heretofore referred to, or in such other restricted areas as the diaphragm may be employed. The working surface or frontal area necessary to a faithful reproduction of the base tones is obtained by the longer dimension of the cone, the effective outside periphery of which is defined by the end edges 12.

In Figures 5 to 8 inclusive a slightly modified form of construction is illustrated in which flat flexible strips of leather, fabric, or the like 25 are provided at the long edges 26 of the diaphragm 27, and similar flat flexible strips 28 are provided at the ends thereof in place of the integral flexible strips 14 shown in the form of construction illustrated in Figures 1 to 4 inclusive. These flexible mounting strips for the diaphragm may be secured thereto either by adhesive or in any other preferred manner. These flexible strips are in turn secured to a supporting spider 29. The connection with the voice coil and the other details of the magnet may be similar to the form of construction shown in Figures 1 to 4.

In Figures 9 to 12 still another modified form of construction is illustrated in which the cone 30 is provided at its long sides with flexible strips 31 formed preferably integrally therewith and at its end edges with flexible strips 32 preferably formed integrally therewith. The flexible strips 31 and 32 are separated, as at 33, at the juncture thereof to provide for the maximum flexibility. In this form of construction the flexible diaphragm supporting strips are all arranged in the same general plane and for this purpose the strips 31 are provided with right angular flange portions 34 which are joined to or form continuations of the peripheral edges 35 of the diaphragm.

In Figures 13 to 16 inclusive still another modified form of construction is shown in which the diaphragm 36 is provided with a continuous flexible supporting strip 37 preferably formed integrally with the periphery of the diaphragm, the supporting strip at the corners of the diaphragm being curved on a radius, as indicated at 38, to provide sufficient flexibility so as not to retard the vibratory movement of the diaphragm. In this form of construction, the flexible diaphragm supporting strip is in the same plane throughout its length.

In each of the forms of construction herein described, the diaphragm is conical in shape to obtain the required rigidity. However, in each form of construction the effective outside diameter or periphery of the diaphragm is of substantially oblong configuration to produce a diaphragm having one relatively small transverse dimension. As heretofore mentioned, an adequate frontal area is obtained for all practical purposes by the extension of the diaphragm in the direction at right angles to this minimum transverse dimension. Thus the diaphragm adapts itself to installation on the instrument panels and header bars of motor vehicles and the like wherein the available space in one direction is limited.

Inasmuch as the invention herein defined pertains more especially to the diaphragm per se, it will be immediately obvious to those skilled in this art that the peripheral mounting for the diaphragm, the connection with the voice coil, and all other details of this character may be modified as found to be desirable or expedient. Moreover, other modifications of this invention may suggest themselves to those skilled in this art, and to this end reservation is made to make such changes as may come within the purview of the accompanying claims.

What we claim as our invention is:

1. In an acoustical device, a substantially conical tympanum having a substantially oblong periphery including two substantially parallel sides.

2. In an acoustical device, a substantially conical diaphragm having an oblong periphery including two relatively long parallel sides to provide a relatively small frontal area dimension in one direction to permit installation on the instrument panels and header bars of motor vehicles and the like where the available area in one direction is limited.

3. In an acoustical device, a substantially conical diaphragm having a substantially oblong effective outside periphery including a pair of parallel sides.

4. In an acoustical device, a substantially dish-shaped diaphragm having a substantially oblong periphery including two relatively long parallel sides.

5. In an acoustical device, a substantially dish-shaped diaphragm shaped to provide a substantially oblong effective outside periphery including two spaced relatively long parallel sides.

6. In an acoustical device, a substantially conical tympanum having a substantially oblong periphery including at least two parallel sides,

the longer dimension of the oblong being approximately twice the shorter dimension thereof.

7. In an acoustical device of the class described, a substantially conical diaphragm provided with a substantially oblong periphery, the long sides of the periphery being dished in the direction of the apex of the cone.

8. In an acoustical device of the class described, a substantially conical diaphragm having a substantially oblong periphery providing two spaced relatively long parallel sides, and flexible mounting strips secured to the periphery of the diaphragm.

9. In an acoustical device of the class described, a substantially conical diaphragm shaped to provide a substantially oblong periphery, flexible mounting strips secured to the long peripheral sides of the diaphragm, and other flexible mounting strips secured to the short peripheral sides of the diaphragm.

10. In an acoustical device of the class described, a substantially conical tympanum shaped to provide a substantially oblong periphery, and separate flexible mounting strips formed integrally with the peripheral edge of the diaphragm.

11. In an acoustical device of the class described, a substantially conical tympanum shaped to provide a substantially oblong periphery, and a continuous flexible mounting strip formed integrally with the periphery of said diaphragm.

CARL M. TICHENOR.
BYRON C. BOOTH.