United States Patent [19]

Bertagni

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[54] **FLAT DIAPHRAGM FOR SOUND TRANSDUCERS**

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June 8, 1971 Argentina.....236060

[52] **U.S. Cl.**.....**181/32 R**
[51] **Int. Cl.**.....**G10k 13/00,** H04r 7/00
[58] **Field of Search**....181/32 R, 32 A, DIG. 1, 31 R, 181/31 B

[56] **References Cited**

UNITED STATES PATENTS

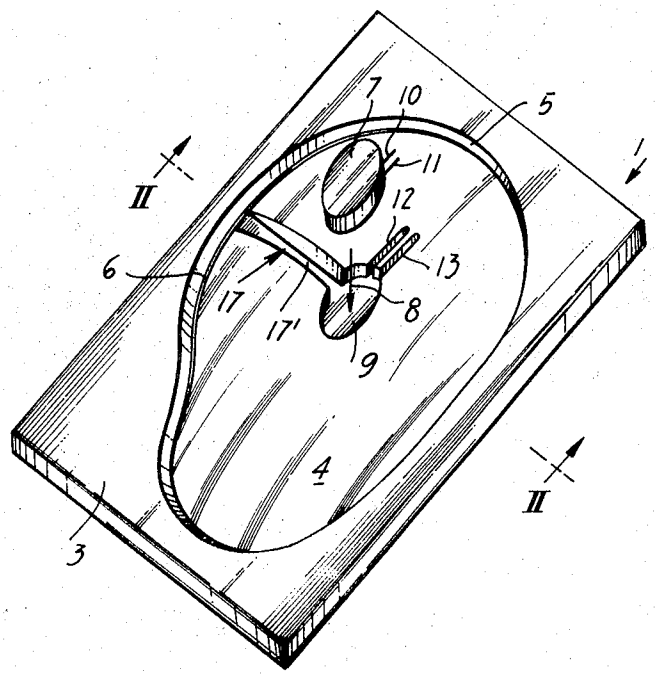
1,825,833 10/1931 Tennesse et al. .....181/32 R
3,596,733 8/1971 Bertagni .....181/32 R

Primary Examiner—Stephen J. Tomsky
Attorney—Milton Osheroff

[57] **ABSTRACT**

Flat diaphragm for sound transducers having a flat front face and rear face defining a central figure portion connected to an electromagnetic assembly and surrounded by a marginal vibration damping portion of larger thickness than the adjacent peripheral zone of said figure portion, an endless channel member in said diaphragm, surrounding said figure portion to better acoustically separate said figure portion from said marginal vibration damping portion and if certain tones are to be emphasized a substantially straight metal band resting on said figure portion arranged between said electromagnetic assembly and said endless channel member.

11 Claims, 4 Drawing Figures



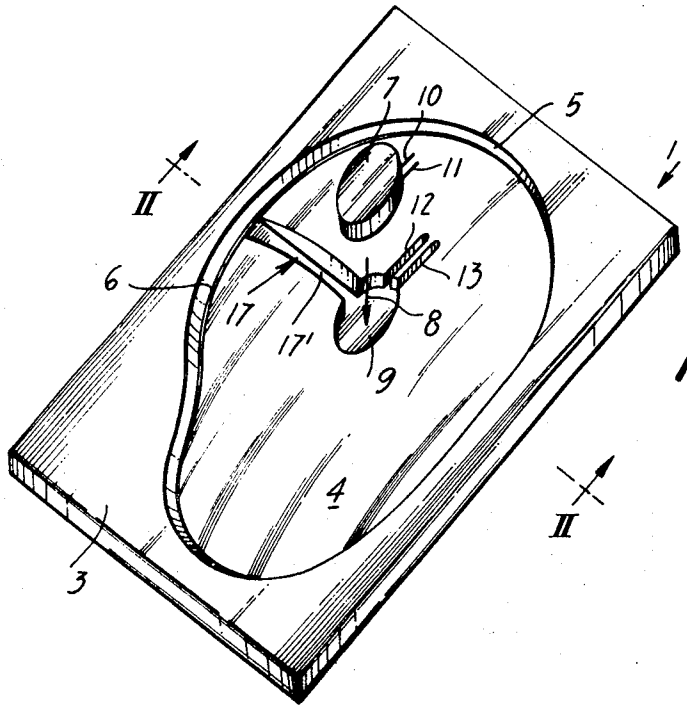


FIG. 1

FIG. 2

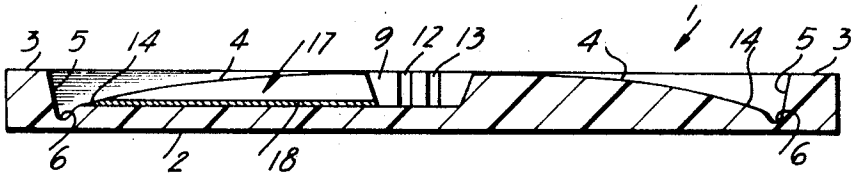


FIG. 3

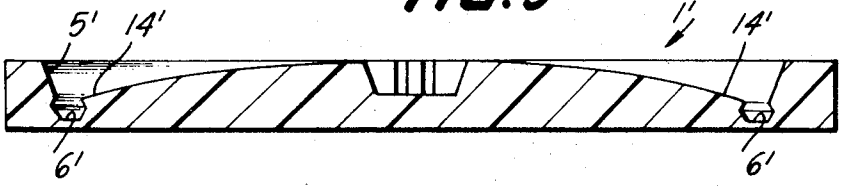
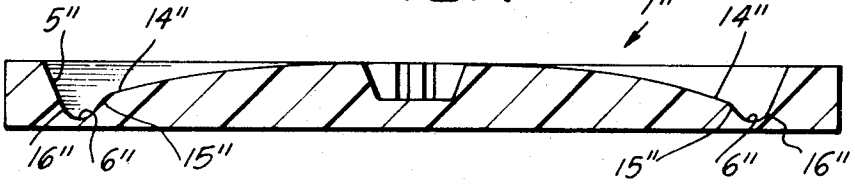


FIG. 4



FLAT DIAPHRAGM FOR SOUND TRANSDUCERS

BACKGROUND OF THE INVENTION

1. Field of the invention

The present invention relates to improvements in a substantially flat diaphragm to be used in a sound transducer and more particularly it refers to a diaphragm which is primarily used in the so-called "flat loudspeakers", although the improvements of the present invention may likewise be applied to microphones which use such diaphragms. The concept of the present invention is applicable to substantially all flat loudspeakers which have been so far proposed and where preferably granular expanded-bonded cellular, strong, stiff, imperforated plastics, plate-like members are used, such as those made of polystyrene and polyurethane.

2. Description of the Prior Art

A typical diaphragm of this type is the one described in my U.S. Pat. No. 3,596,733, although the field to which the present invention may be applied is not circumscribed thereto, but in the introductory portion of said patent, other known systems are described and therefore said descriptive portion is not necessary to be repeated herein. In the diaphragms which are used for flat loudspeakers a zone exists which transmits the vibrations to generate the sound; said zone is surrounded by vibration absorbing means, generally a marginal vibration damping portion. It has been noted that there is a tendency that the vibrations propagate into such a marginal damping portion, specially when the latter forms part of the same plastics plate member, so that thereby the acoustic fidelity is somewhat diminished.

SUMMARY OF THE INVENTION

It is an object of the present invention to decrease as far as possible the propagation of these vibrations into the marginal vibration damping portion.

After many tests it has been finally found that such an object is achieved by forming in the marginal zone an endless channel which increases the insulation or bars the propagation of vibrations into said marginal damping portion. This is due to the fact that the vibrations which move along the channels as explained in my above cited patent will be stopped upon entering the channelled marginal zone due to the change of shape of the diaphragm in said last mentioned zone.

Another object of the present invention is to provide in such an improved diaphragm means in the zone transmitting the vibrations, particularly when the diaphragm is used in the flat loudspeakers, to emphasize certain tones, such as for instance the high pitches, by adding in one or several channels of said diaphragm corresponding to the reproduction of the high pitches, at least one sound reproduction band which is directly connected to the signal source. If this concept is applied to a group of loudspeakers and in each of them to zones which will emphasize different frequencies, very peculiar sound effects may be achieved, which is specially interesting in stereophonic sound reproduction systems.

A further object of the invention is to provide in the linking zone of the electromagnetic assembly with the rear face of said plate, a pair of partial channel members enabling to house therein a portion of respective

electric conductors which are connected to the electromagnetic assembly, to avoid that the material at the point of connection with the conductors may prematurely crack.

Thus, the present invention relates to improvements in a substantially flat diaphragm to be used in a sound transducer of the type having a flat front face and a rear face linked at one zone to an electromagnetic assembly in vibration transmitting relationship with said diaphragm, wherein said rear face forms part of a marginal vibration damping portion which substantially circumscribes a figure portion for transmitting the vibrations and to which at one zone said electromagnetic assembly is connected, the thickness of said marginal vibration damping portion is larger than the thickness of said figure portion adjacent said marginal vibration damping portion so that a lateral wall member is formed in between both and an endless channel member connecting said figure portion to said lateral wall member and defining a sudden change in direction to increase the sound damping features and decrease the capability of sound generating vibration transmission into said marginal vibration damping portion.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to facilitate the comprehension of the present invention, reference will be now made to specific examples, in relationship to the accompanying drawings, in which:

FIG. 1 is a perspective view of the diaphragm of the present invention showing the pertinent improvements. FIG. 2 is a cross-section along line II—II of FIG. 1 and in addition the metal band is shown as housed in the pertinent recess.

FIGS. 3 and 4 are similar cross-sectional views as FIG. 2, but showing other alternative embodiments in relationship to the endless channel member — the recess and metal band are not shown.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As may be appreciated from FIG. 1, the flat diaphragm 1 of FIGS. 1 and 2 comprises a front face 2 which is flat and a rear face defining a marginal vibration damping portion 3 which substantially circumscribes a figure portion 4 of a particular shape, similar to the pinna of a human ear. The thickness of said figure portion 4, at least adjacent said marginal vibration damping zone 3 is smaller than the thickness of said damping zone 3 so that a side wall member 5 is formed in between both. An endless channel member 6 connects said figure portion 4 to said side wall member 5 defining a sudden change in direction, to increase the damping or insulating feature and to decrease the vibration transmission feature, as to those vibrations which tend to enter into the marginal vibration damping portion 4. These vibrations may be produced, for instance, at the electromagnetic assembly 7, which may also be a vibration collecting center if diaphragm 1 is used as a microphone instead of a loudspeaker. Since the electromagnetic assembly 7 as such does not form part of the present invention, it has merely been shown in a schematic manner in FIG. 1 and arrow 8 graphically indicates any type of means which links the electromagnetic assembly 7 and the figure portion 4, which

to this end preferably includes a recess 9. Recess 9 is generally out of the geometric center of the figure portion 4. If the diaphragm should also include means for emphasizing certain tones, such as for instance the high pitches, then in addition the figure portion 4 between the endless channel member 6 and the recess 9 has a channel 17, usually a straight channel, which links the recess 9 with the endless channel member 6. Channel 17 has a bottom wall 17'. A metal band 18, for instance an aluminum foil, connects the recess 9 with the periphery 14 of the figure portion 4, that is to say up to the endless channel member 6. Conveniently, the metal band 18 is adhesively adhered to the bottom wall 17' of the channel 17.

The electromagnetic assembly 7 is provided with a pair of conductors 10 and 11 to be connected to the pertinent electric circuit. These conductors 10 and 11 are to be housed in the channel members 12, 13 formed in the figure portion 4 and which end in the recess 9. Thus it is avoided that the conductors 10 and 11 at their welding points with the electromagnetic assembly, may easily crack.

Returning now to the endless channel member 6, the latter may have several shapes, it being important that at the periphery 14 of the figure portion 4, the side wall 5 defines a sudden change in direction, to avoid that the vibrations which may for instance be produced at the electromagnetic assembly 7, continue their movement into the vibration damping portion 3. It is convenient that the bottom of the channel member 6 is near the front face 2. In the embodiment of FIG. 2 channel member 6 is substantially V shaped. In FIG. 3 channel member 6' has a polygonal cross-sectional area so that several sudden directional changes are achieved thereby. In this embodiment the mould will have to include retractable members in order to be able to produce diaphragm 1'. In the embodiment of FIG. 4, diaphragm 1'' had a channel member 6'' which is likewise V-shaped but where the arms 15'' and 16'' of the V define an almost straight angle. Returning now to the feature of the metal foil 18, if the diaphragm is used as a loudspeaker, it will be understood that the signal generated at the electromagnetic assembly 7 — when the latter vibrates at a frequency corresponding to the length of the band 18 — is directly transferred to the band at the signal generating center. Thus this particular frequency is emphasized and increases for instance the high pitches. It is already known that the figure portion 4 vibrates for different frequencies in different zones or radial channels; one radial channel or an assembly of radial channels corresponds to the channel 17. Accordingly, if a loudspeaker assembly is specially used in order to achieve particular stereophonic effects and the channels 17 are arranged in this loudspeaker in different radial zones, any desired effect and shade may be obtained.

It will be obvious that modifications may be introduced in this invention upon carrying it out into practice as far as certain structural details are concerned, but always without departing from the fundamental principles which are clearly specified in the following claims.

I claim:

1. In a substantially flat diaphragm to be used in a sound transducer having a flat front face and a rear face linked at one zone to an electromagnetic assembly in vibration transmitting relationship with said diaphragm, wherein said rear face forms part of a marginal vibration damping portion which substantially circumscribes a figure portion for transmitting the vibrations and to which at one zone said electromagnetic assembly is connected, the thickness of said marginal vibration damping portion is larger than the thickness of said figure portion adjacent said marginal vibration damping portion so that a lateral wall member is formed in between both and an endless channel member connecting said figure portion to said lateral wall member and defining a sudden change in direction to increase the sound damping features and decrease the capability of sound generating vibration transmission into said marginal vibration damping portion.

2. The diaphragm of claim 1, wherein the bottom of the endless channel member reaches near the flat front face.

3. The diaphragm of claim 1, wherein the cross-sectional area of said channel member is V-shaped.

4. The diaphragm of claim 3, wherein the ends of said V form in the adjacent zone with said lateral wall member and the figure portion, respective substantial angles.

5. The diaphragm of claim 1, wherein the cross-sectional area of said channel member is a polygon.

6. The diaphragm of claim 1, wherein the figure portion has a recess in the portion corresponding to the connection with said electromagnetic assembly and a pair of channel members start from said recess.

7. The diaphragm of claim 6, wherein said pair of channel members is substantially parallel.

8. The diaphragm of claim 1, wherein a sound reproduction band passes from said zone which is linked to said electromagnetic assembly to said endless channel member and said band rests on said rear face.

9. The diaphragm of claim 8, wherein said sound reproduction band is a metal band.

10. The diaphragm of claim 8, wherein said band is adhesively adhered to the figure portion forming part of said rear face.

11. The diaphragm of claim 10, wherein said band is housed in a substantially straight channel provided in said rear face.

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