

Feb. 11, 1936.

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2,030,501

LOUDSPEAKER CONE DIAPHRAGM AND METHOD OF PRODUCING SAME

Filed Jan. 31, 1934

Fig. 1.

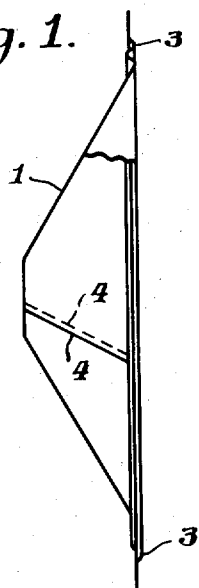


Fig. 4.

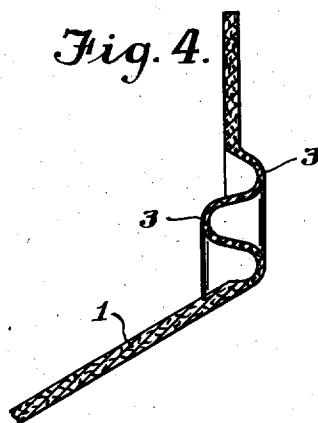


Fig. 2.

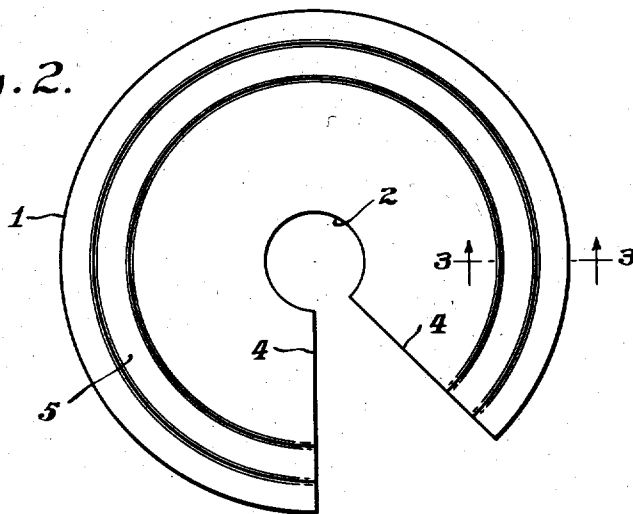


Fig. 3.



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2,030,501

LOUDSPEAKER CONE DIAPHRAGM AND
METHOD OF PRODUCING SAMEDavid H. Cunningham, Haddonfield, N. J., as-
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Application January 31, 1934, Serial No. 709,111

12 Claims. (Cl. 181—32)

This invention relates to loudspeaker dia-
phragms and the method of producing same, and
in particular it is directed to the object of pro-
ducing such a diaphragm as will have certain
advantages of flexibility around its peripheral
portion while having the desired stiffness at other
portions.

Heretofore, in the manufacture of loudspeakers,
it has been customary to secure the conical por-
tion of the diaphragm to a supporting ring by
means of a flexible element which is not integral
with the cone itself. The process of assembly is
not only costly but the structure does not always
lend itself to good performance of the cone.

I have found that when the thickness of the
material of which the diaphragm member is
blanked out is reduced adjacent the peripheral
portion to give it the desired flexibility, it is pos-
sible to select a cone material of suitable thick-
ness and stiffness to exhibit the optimum of vi-
bratory characteristics of the cone itself.

I am aware of attempts that have been made in
the past to produce a conical diaphragm for a
loudspeaker by the adoption of various more or
less elaborate processes in the making of the
paper itself from which the cone is ultimately
formed. Thus it has been proposed to build up
the structure beginning with the paper making
operation which consists in depositing the paper
pulp upon a screen having a conical contour.
The flow of pulp would in that case be controlled
so as to deposit upon the screen a greater thick-
ness of fibers near the center of the cone than
at the periphery. Hence, when the cone was
finished, it would have the desired stiffness in
the center portion and would perhaps have the
desired flexibility around the rim. This process
appears to be disadvantageous in that it is quite
expensive and the product itself cannot easily be
held uniform and within reasonable tolerances.

Accordingly, I have adopted a method which
has decided advantages in that it makes possible
the selection of a suitable cone material from a
wide range of available kinds of paper or other
sheets. Furthermore, the grinding operation to
which the blanks may be subjected can be per-
formed at low cost compared with the cost of
cementing an auxiliary flexible rim strip around
the cone blank.

Cone diaphragms made according to my pre-
ferred method are of improved appearance be-
cause there is no use of cement and no showing of
cement about the rim. Furthermore, there is
complete freedom from defective operation of the
cone in such instances as are caused by failure of

the cement to bond together the cone and the
rim piece along any part of the seams.

It will be seen from the above that my inven-
tion has for its object to provide, as an article
of manufacture, a sheet of fibrous material from
which loudspeaker diaphragms may be suitably
formed.

A further object of my invention is to develop a
process by which flat material can be utilized to
form a cone diaphragm of sufficient stiffness to
give it satisfactory vibratory characteristics,
while having a rim portion, integral therewith,
which has suitable flexibility.

My invention is defined according to the scope
of the appended claims. The carrying out of
the process and the nature of the article produced
may best be understood, however, by reference to
the specification following, when read in con-
nection with the accompanying drawing, in
which:

Fig. 1 is a side view, partly in section, of a
typical cone diaphragm;

Fig. 2 is a plan view showing a blank made from
flat sheet material and having a portion near the
circumference reduced in thickness;

Fig. 3 is an enlarged cross-sectional view along
the line 3—3 of Fig. 2; and

Fig. 4 is an enlargement of that portion of the
diaphragm which is also shown sectionally in
Fig. 1.

Referring now to the drawing in detail, I show
a truncated cone diaphragm 1 having an orifice
2 at its center and having corrugations 3 formed
about the rim. This cone is preferably made from
a blank as shown in Fig. 2. In order to give it
conical shape, a sector is cut out so that the two
edges 4 may be brought together and lapped one
over the other.

Before cementing the edges 4 together, I resort
to a process of reducing the thickness of the
blank near its periphery. This operation is per-
formed preferably by placing the blank and hold-
ing it in a flat position on a turn-table and ro-
tating it beneath a grinding wheel. If desired,
a weight can be placed on top the paper to keep
it flat. The turn-table is so spaced from the
grinding wheel that, when it is rotated, some of
the fibrous material from the blank is removed
from the rim area shown at 5 in Figs. 2 and 3.
It is preferable that the axes of rotation of the
grinding wheel and of the turn-table should in-
tersect. It will be understood that the apparatus
required for performing this operation can be
very simple in design and yet provided with suit-

able adjustments for gauging the depth of the grinding operation as applied to the zone 5.

As compared with other processes the grinding operation as just described may be performed on successive blanks at low cost. The process lends itself to uniformity of product. The sound reproducing qualities of the diaphragm are enhanced.

Fig. 3 shows how, in the grinding operation, the thickness of the material throughout the zone 5 may be reduced, if desired, to substantially half the original thickness of the paper. This relation between the original thickness and the reduced thickness need not be adhered to, however, if the requirements for a satisfactory finished article appear to dictate grinding off more or less than half the thickness.

The operations of moistening and molding the cone to form circular corrugations adjacent the periphery are well known in the art. By including these operations, however, as steps of my process, novelty is imputed to the results obtained by virtue of the increased flexibility of the rim portion when it is both thinned and corrugated.

Although I have described a specific embodiment of my invention as an article of manufacture and have illustrated its manufacture by specific steps of a process, it will be understood that the foregoing specification is merely an example of how my invention may be carried out. To those familiar with the art, various modifications of the article itself and of the process of producing it will readily suggest themselves. For example, it may be found that a portion of the disc can be sand-blasted, scraped, milled or otherwise treated as by softening, stretching, and molding to give it suitable flexibility, and preferably to reduce the thickness adjacent the rim. Such modifications would not, however, be a departure from the spirit and scope of the invention as defined in the appended claims.

I claim as my invention:

1. As an article of manufacture, a circular sheet of fibrous material from which a sector has been cut away and from an annular surface near the periphery of which a substantial portion of the thickness has been removed.

2. In a membranous device for use in a loudspeaker, a sheet of fibrous material conically formed and having near its periphery a zone the thickness of which has been substantially reduced by abrasion.

3. A conical loudspeaker diaphragm made from a fibrous flat blank and having a zone thereof

finished to a fractional part of its original thickness.

4. A loudspeaker diaphragm formed from a flat sheet of fibrous material a portion of which adjacent the periphery has been reduced in thickness and then corrugated so as to effectively increase its flexibility per unit of area.

5. A loudspeaker diaphragm formed from a sheet of fibrous material from a portion of which some of the original fibers have been removed.

6. The method of producing a loudspeaker diaphragm which consists in cutting a blank from a fibrous sheet, turning the blank on its center, grinding off some of the fibers near the periphery of said blank and forming said blank conically and with circumferential corrugations.

7. The method as defined in claim 6 further characterized in that the fibrous structure is moistened and molded under heat and pressure to give it the desired configuration.

8. The method of producing a diaphragm for a sound propagating device which consists in blanking out said diaphragm from sheet material having a fibrous structure, swiveling said blank on its center, grinding said blank near the periphery thereof to reduce its thickness at that portion, and moistening and molding said blank into conical shape with circumferential corrugations disposed along the portion of reduced thickness.

9. The method of producing a diaphragm for a sound propagating device which consists in blanking out said diaphragm from sheet material, rotating said blank about its center while subjecting a portion of its surface to abrasive action whereby said portion is reduced in thickness, and forming said blank into a finished article having the desired configuration.

10. The method as defined in claim 9 further characterized in that the operation of reducing the thickness is applied to a zone which is at least coextensive with the formation of circumferential corrugations in the diaphragm.

11. The method of preparing a diaphragm for use in a sound propagating device which includes the steps of cutting a flat blank from a fibrous sheet, reducing the thickness of the blank near its periphery, and molding said blank with circumferential corrugations.

12. As an article of manufacture, a circular sheet of fibrous material from which a sector has been cut away and from an annular surface near the periphery of which a substantial portion of the thickness has been removed, said sheet having then been formed into a conical diaphragm having corrugations in said annular surface.

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