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DIAPHRAGM FOR LOUD SPEAKERS

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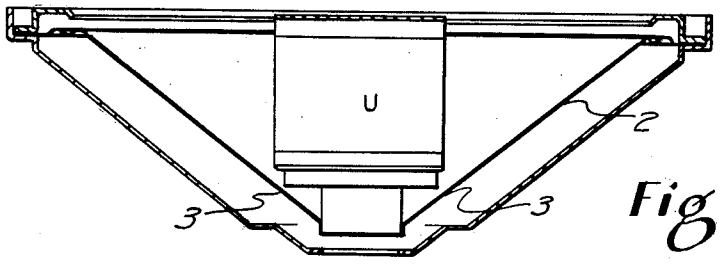


Fig. 1

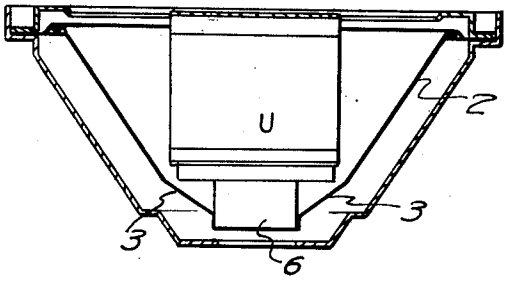


Fig. 2

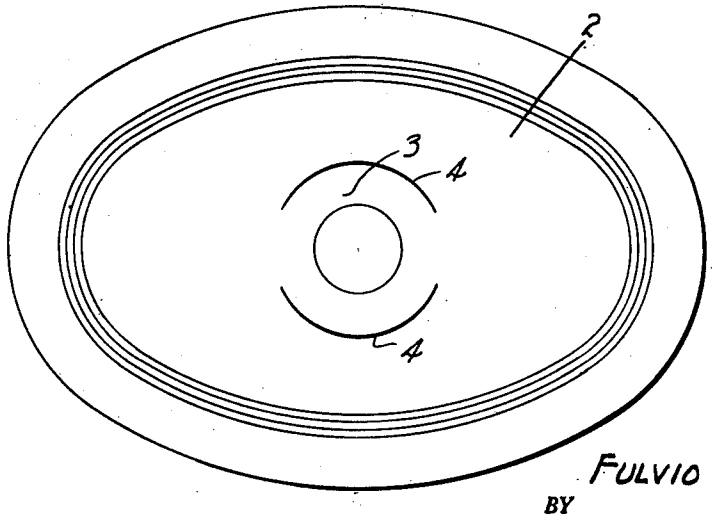


Fig. 3

INVENTOR.
FULVIO LEVI

BY
Bates, Teare, & McLean
Attorneys

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DIAPHRAGM FOR LOUD SPEAKERS

Fulvio Levi, Elsternwick, Victoria, Australia, assignor to The Rola Company Inc., Cleveland, Ohio, a corporation of Ohio

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6 Claims. (Cl. 179—115.5)

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This invention relates to loud speakers for the reproduction and amplification of sound, more particularly to loud speakers of the well known kind which includes a paper or like diaphragm, or "cone" as it is frequently termed, having at its apex a voice coil and former for disposition within an air gap provided by a magnetic unit of the loud speaker.

Originally such diaphragms were almost invariably of conical shape but more recently it has been found desirable in many cases for the diaphragms to be of oval shape, that is to say that the outer peripheral or marginal edge is of oval contour although the apex to which the voice coil former is attached is circular. These oval diaphragms have found particular favour for radio receivers of certain designs since, for a given diaphragm area, one of the dimensions of the speaker baffle can be made much smaller than with a conical diaphragm. In addition oval diaphragms possess certain acoustical advantages over and above conical diaphragms.

Research and experiments with oval diaphragms has indicated that certain improvements are desirable in order to obtain maximum efficiency in sound reproduction and/or emission and also greater compactness and simplicity in actual manufacture and assembly of the complete speaker.

Thus I have found that the zones of an oval diaphragm which are adjacent the minor axis of the oval are relatively flat in a direction or plane parallel to that of the major axis and that when the speaker is in operation those relatively flat zones tend to develop their own inherent mechanical or physical vibrations and thus generate unwanted sounds or harmonics which interfere with the emission of the actual sounds being reproduced by the speaker. The said relatively flat zones of the diaphragm are relatively weak, in the physical sense, compared with the other portions of the cone and in time are likely to give rise to harmonic distortions which detrimentally effect the sounds being emitted by the speaker.

One of the objects of the invention is to eliminate or, at least, minimize the before mentioned disadvantages.

In connection with conical diaphragms, it is often desired that the magnetic unit should be disposed within the diaphragm instead of externally thereof. This is particularly so where the utmost compactness is required, for example in the case of miniature and portable receivers. No difficulties are experienced in obtaining such internal disposition of the magnetic unit with

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conical diaphragms, as the units are usually and necessarily circular in shape and can be neatly and readily fitted into the interior of the conical apex portion. Hitherto, such internal fitting has not been practicable in the case of oval diaphragms due primarily to the fact that the limiting dimension for the magnetic unit as well as that for the spider, is determined by the minor axis of the oval and is considerably smaller than that determined by the major axis of the oval.

Another object of this invention is to provide a simple and practical solution to this problem as will be apparent hereinafter.

The invention is illustrated in the accompanying drawings in which:

Figure 1 is a sectional elevation of a loud speaker assembly incorporating an oval diaphragm according to the invention, the section being taken along the major axis of the oval.

Figure 2 is a sectional view similar to Figure 1 but taken along the minor axis of the oval.

Figure 3 is a face view of the diaphragm.

In order to fulfil the above mentioned objects, an oval diaphragm 2 may, in general, be of conventional construction and formation but according to the invention the central or apex portion 3 is fashioned so that it is substantially or approximately conical. While this formation could be imparted by a pressing or like operation after the diaphragm has been made in the usual or any suitable way, it is preferably effected during the process of manufacture by the employment of an appropriately shaped former, die or like member.

This conical portion 3 merges into the surrounding oval portions of the diaphragm by way of an integral rib, shoulder or like element, denoted at 4 in Figure 3, which will be substantially circular viewed from the front or the rear. The diameter of this circular element will be suitably proportioned to the size or area of the diaphragm proper as to yield the desired results as to imparting strength to the diaphragm, improving its acoustical properties and also permitting the electromagnet unit U indicated in general outline in Figures 1 and 2 to be snugly accommodated within the conical central portion 3 and the voice coil former 6 to be operatively connected to the apex thereof.

It will be appreciated that the circular shoulder or like element defining what may be termed the base of the conical apex portion will, in effect, be bisected by the minor axis of the oval and will be most prominent at the two diametrically opposite points at which it is so bisected and will progressively be reduced in extent and diminish

altogether as it approaches, in opposite directions, the major axis of the oval.

By such a formation objectionable harmonic distortions will be eliminated or greatly reduced so that a balanced and more faithful emission of sound becomes obtainable. In addition, the increased strength and uniform stability of the diaphragm arising out of the formation described permits of greater power-handling capacity or, in other words, considerably reduces harmonic distortions for a given power output.

A further advantage of the invention is that it now becomes possible for the magnetic unit U to be disposed within the central part of the diaphragm instead of externally thereof as has hitherto been necessary with oval diaphragms.

The benefits arising from such internal disposition will be so readily appreciated by those versed in the art that elaboration thereof in this specification is unnecessary. It may however be mentioned that adequate protection of the air gap from dust can be easily ensured in any normal or suitable way.

The magnetic unit may be of the ring type i. e. where the permanent magnet constitutes the outer portion of the unit or, alternatively, of the centre block type in which the permanent magnet is at the centre of the assembly and in line with the central pole tip.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A diaphragm comprising, a major frusto-conical surface and a minor frusto-conical surface axially disposed about a common axis of generation to form a compound frusto-conical surface having a base and a truncated apex, said major surface having an oval section in a plane normal to the axis and said minor surface having a circular section in a plane normal to the axis, said major and minor surfaces merging along a common circumference intermediate the base and apex of the compound surface to form curved ridges on opposite sides of the axis of generation and on the compound surface, said ridges diminishing and merging at their ends with the compound surface in spaced relation from each other.

2. The diaphragm of claim 1 including an electro-magnetic unit disposed therein and having a voice coil form within said minor frusto-conical surface adjacent the truncated apex, and means connecting the voice coil form to the truncated apex.

3. A diaphragm for a loud speaker comprising, a pair of truncated frusto-conical surfaces axially disposed along a common axis of generation and integrally merging along a common circumference, one of said surfaces having an oval section in a plane normal to the axis of generation and the other surface having a circular section in a plane normal to the axis of generation.

4. A diaphragm comprising in combination, a major frusto-conical surface and a minor frusto-conical surface axially disposed about a common axis of generation to form a compound frusto-conical surface having a base and a truncated apex, said major surface having an oval section in a plane normal to the axis and said minor surface having a circular section in a plane normal to the axis, means integrally connecting said major and minor surfaces along a common circumference intermediate the base and apex of the compound surface to form curved ribs on opposite sides of the axis of generation and on the compound surfaces, said ribs forming substantially semi-circular shoulders extending outwardly from the compound surface in opposite directions from opposite sides of the axis, each semi-circular rib-like shoulder having a maximum prominence intermediate its ends and diminishing and merging with the compound surface at its ends in spaced relation from each other on the compound surface.

5. A diaphragm for a loud speaker comprising, a pair of truncated frusto-conical surfaces axially disposed along a common axis of generation and integrally merging along a common circumference to form a compound frusto-conical surface having a base and a truncated apex, one of said surfaces adjacent the base having an oval section in a plane normal to the axis and the other surface adjacent the apex having a circular section in a plane normal to the axis, an electro-magnetic unit having a voice coil form disposed within said other surface adjacent the apex, and means connecting the voice coil form of said unit to the truncated apex of the compound surface.

6. A loud speaker vibratory member comprising a single diaphragm having a major and minor surface forming a compound frusto-conical surface having a base and a truncated apex, the major portion of said compound surface extending from the base having a section in the plane of the base with a transverse major axis and a lesser minor axis normal to each other, the minor portion of said compound frusto-conical surface extending from the truncated apex towards integral engagement along a common circumference with said major portion, said minor frusto-conical surface having a circular cross section in a plane parallel with the base, each of said major and minor portions forming at their common meeting edges a pair of integral ribs on opposite sides of the compound surface, said integral ribs each having a maximum prominence coincident with the extremities of the minor axis of the major portion of the surface and each diminishing within the compound frusto-conical surface of the diaphragm on corresponding opposite sides of the major axis of said major portion.

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