

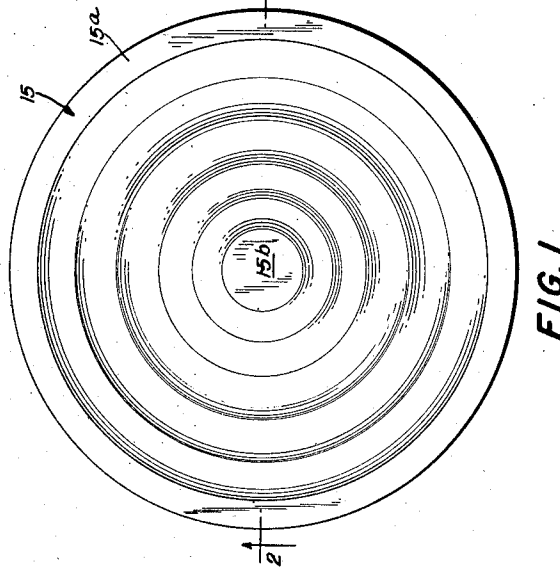
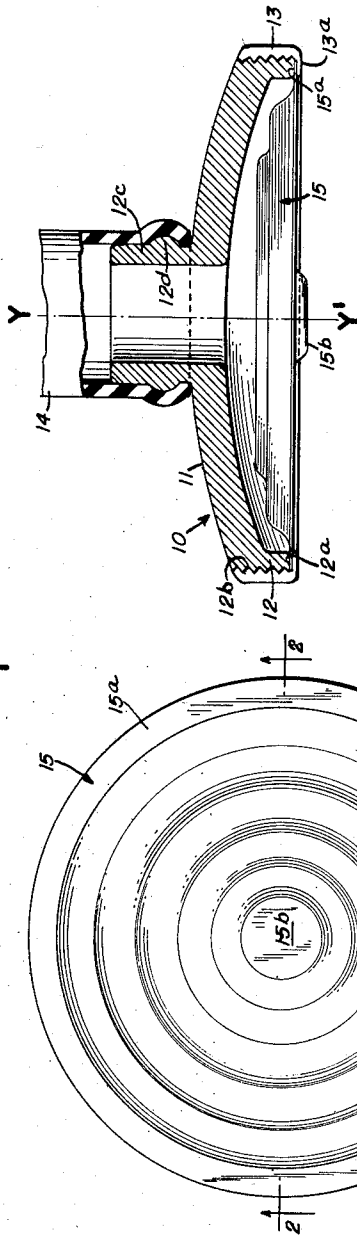
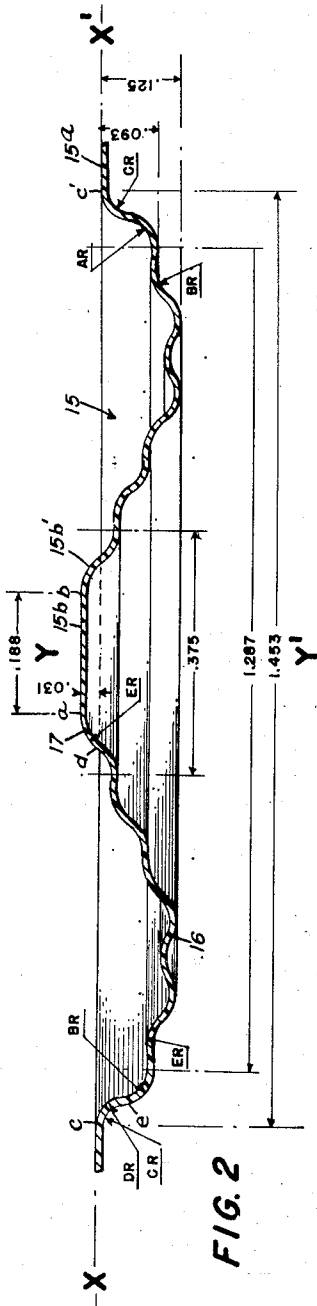
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R. CEFALY

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ACOUSTIC STETHOSCOPE

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INVENTOR
RALPH CEFALY

BY *Beale & Jones*

ATTORNEYS

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ACOUSTIC STETHOSCOPE

Ralph Cefaly, Brentwood, Md., assignor, by mesne assignments, to Taylor Instrument Companies, Rochester, N.Y., a corporation of New York
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My invention is related to acoustic stethoscopes and particularly to the diaphragm used therein.

An object of my invention is to provide a stethoscope of the acoustic type that will reproduce accurately and efficiently the sounds picked up.

Another object of my invention is to provide in a stethoscope a highly efficient diaphragm that will pick up and transmit sound vibrations.

A still further object of the invention is to provide a stethoscope diaphragm that is circular, has an annular peripheral flat portion for mounting the same, a central circular flat portion that protrudes beyond a plane containing the annular peripheral flat mounting portion and an intervening generally concave in cross-section annular portion between the central portion of the peripheral mounting portion with said intervening portion made up of a plurality of small alternate and contiguous concave and convex in cross section portions all of which portions within the annular peripheral mounting portion forms a vibratory pick up and vibration transmission medium.

Still further objects and the entire scope of applicability of the present invention will become apparent from the detailed description given hereinafter. It should be understood, however, that the detailed description and specific examples are given by way of illustration only and, while indicating preferred embodiments of the invention, are not given by way of limitation, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

For a more complete understanding of the nature and scope of my invention reference may be had to the drawings in which:

FIG. 1 is a plan view of a stethoscope diaphragm as it would appear viewing the exposed face;

FIG. 2 is a sectional view on line 2—2 of FIG. 1 showing the cross sectional contour of the diaphragm on an enlarged scale; and

FIG. 3 is a typical stethoscope in section showing the pick up portion having mounted therein one of my diaphragms.

A typical acoustic stethoscope is generally indicated at 10 in FIG. 3 having a pick up device or portion 11 of hard material which may be shaped and threaded such as a suitable metal that is saucer shaped with an annular protruding flange 12 thereon having a flat front diaphragm receiving face 12a and external threads 12b to receive a diaphragm retaining collar 13. Collar 13 is internally threaded and has a transversely and inwardly extending flange portion 13a which overlies the face 12b of the pick up device body 12 so as to clamp and hold in position a diaphragm to be described.

The body pick up portion 11 of the stethoscope may be typically formed with a rearwardly projecting apertured stem portion 12c arranged about the central axis Y—Y'. Stem portion 12c may have formed thereon a protruding annular boss portion 12d to retain on the stem an end of a flexible tubing such as 14 that extends so that the other end is connected to a typical Y-connection (not shown) to which is attached further flexible tubing leading to the conventional ear pieces (not shown). Other types and forms of stethoscope pick up structures may be used to accommodate the diaphragm.

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The diaphragm according to the invention is generally indicated at 15 and a particular size here illustrated has a diameter of 1.600 inches. It is securely held within the concave body 11 by having its annular peripheral portion 15a lying on axis X—X' extending transverse to the axis Y—Y' normal to the diaphragm at the center thereof. Diaphragm 15 is specially formed from flexible sheet material which may be of paper-like stock, of fibrous or non-fibrous material. A cellulose acetate sheet material having a thickness of about .010 inch may be used. Such material as is used must be capable of retaining its shape as formed and its resiliency to return to its normal shape after having been vibrated by picked up vibrations impressed therein by having its center face portion 15b placed against a body to be sensed for certain internal vibrations. Such vibrations may be from a patient's chest as observed by a physician. It will be observed that the center sensing portion 15b is circular in plan as viewed in FIG. 1 and as viewed in FIG. 2 has a diameter of about .188 inch in its flat portion a—b which is parallel to axis X—X' and offset therefrom about .031 inch as illustrated. The diaphragm is symmetrical about axis Y—Y'. About the flat central pick up portion 15b there is an annular generally concave in cross section portion 16 which extends in cross section in a zone from a to c on the flat annular peripheral portion 15a. The diameter measurement from c to c' is about 1.453 inches along the axis X—X'.

Surrounding the flat central circular pick up portion 15b is an annular curved depending skirt portion 17 extending in width from a to d where it terminates at d lying on axis X—X'. The outside radius of portion a—d is indicated at ER as .0669 inch while the inside radius BR is indicated as .0569 inch. A flat bottom saucer-like section is formed by the flat portion 15b and the adjacent annular intermediate portions at 15b' and 16.

Lying between points d to e are a plurality of alternating in cross section concave and convex joining portions of short radius making up the generally overall concave portion 16 as referred to above. There are, for example, five convex small portions designated by the radius ER for each such portion and five concave small portions designated by the radius BR for each such portion alternately melding contiguously with each other between point a to point e.

Between points e and c there is a curved portion having an inside radius CR of .0312 inch and an outside radius as shown at DR of .0412 inch to complete the diaphragm cross sectional contour. This last mentioned portion e to c forms a transition area between the vibrator portions making up the diaphragm and the immobilized annular peripheral portion 15a which is held clamped in a generally immobilized condition on face 12b of member 12 by ring 13.

As an example given, the diaphragm has a diameter of 1.600 inches and the respective radii are summarized as follows:

AR=.0469"
BR=.0569"
CR=.0312"
DR=.0412"
ER=.0669"

In making up the diaphragm suitable male and female dies are prepared to impart into the sheet stock used the various convolutions as disclosed. The sheet material if of a cellulose acetate base, for example, is heated to make it pliable and then it is worked between the dies to give it the shape. The diaphragm on cooling to room temperature of about 70° F. sets and retains its designed shape.

While I have shown a typical stethoscope mounting the diaphragm other stethoscope mountings may be used.

In use the stethoscope arranged according to my invention and the diaphragm structure has been found to be highly efficient. It gives a faithful indication of observed vibrations and is faithful and reliable in uniformity of operation.

I claim as my invention:

1. In an acoustic stethoscope having a pick up device having means for receiving and retaining a diaphragm and an acoustic coupling conduit connected at one end to said pick up device and adapted to be connected at its other end to a detector, a readily flexible diaphragm received in said pick up device and having an annular peripheral portion for securing to said pick up device, a central vibration sensing flat portion lying adjacent and parallel to a plane extending to include at least a part of said peripheral portion of the diaphragm in its annular extent, said central vibration sensing flat portion protruding axially and outwardly from the pick up device for abutting contact with a body portion to be sensed, a generally concave in cross section portion surrounding and joining with said central sensing portion and extending to and joining with said annular peripheral portion and lying generally symmetrically about an axis extending through the center of said central portion and normal to said plane, said generally concave in cross-section portion receding from said annular peripheral portion, the central portion and said plane so that its maximum distance from said plane is approximately midway the distance along said plane between the annular peripheral portion and said central portion.

2. In an acoustic stethoscope having a pick up device having means for receiving and retaining a diaphragm and an acoustic coupling conduit connected at one end to said pick up device and adapted to be connected at its other end to a detector, a diaphragm received in said pick up device and having an annular peripheral portion for securing to said pick up device, a central vibration sensing portion lying adjacent a plane extending to include at least a part of said peripheral portion of the diaphragm in its annular extent, a generally concave in cross section portion surrounding and joining with said central sensing portion and extending to and joining with said annular peripheral portion and lying generally symmetrically about an axis extending through the center of said central portion and normal to said plane, said generally concave in cross section portion having a plurality of small alternate and contiguous concave and convex in cross section portions, said generally concave in cross-section portion receding from said annular peripheral portion, the central portion and said plane so that its maximum distance from said plane is approximately midway the distance along said plane between the annular peripheral portion and said central portion.

3. In an acoustic stethoscopic according to claim 2 wherein said central vibration sensing portion is flat and extends parallel with said plane.

4. In an acoustic stethoscope according to claim 2 wherein said central vibration sensing portion is flat, extends parallel to and offset from said plane and lies on the opposite side of said plane from said generally concave in cross section portion.

5. In an acoustic stethoscope according to claim 2 wherein said central vibration sensing portion is flat, extends parallel to and offset from said plane and lies on the opposite side of said plane from said generally concave in cross section portion so as to protrude out beyond the diaphragm and its peripheral annular portion at its securement to said pick up device.

6. A vibratory body for use in acoustical apparatus consisting of a circular sheet of readily flexible material of the order of about .010 inch in thickness having an annular peripheral portion for securement to a pick up device, a central vibration sensing flat portion lying ad-

jacent and parallel to a plane extending to include at least a part of said peripheral portion of the vibratory body in its annular extent, said central vibration sensing flat portion protruding axially and outwardly beyond the peripheral portion for abutting contact with a body portion to be sensed, a generally concave in cross section portion surrounding and joining with said central sensing portion and extending to and joining with said annular peripheral portion and lying generally symmetrically about an axis extending through the center of said central portion and normal to said plane, said generally concave in cross-section portion receding from said annular peripheral portion, the central portion and said plane so that its maximum distance from said plane is approximately midway the distance along said plane between the annular peripheral portion and said central portion.

7. A vibratory body for use in acoustical apparatus consisting of a circular sheet of flexible material having an annular peripheral portion for securement to a pick up device, a central vibration sensing portion lying adjacent a plane extending to include at least a part of said peripheral portion of the vibratory body in its annular extent, a generally concave in cross section portion surrounding and joining with said central sensing portion and extending to and joining with said annular peripheral portion and lying generally symmetrically about an axis extending through the center of said central portion and normal to said plane, said generally concave in cross section portion having a plurality of small alternate and contiguous concave and convex in cross section portions, said generally concave in cross-section portion receding from said annular peripheral portion, the central portion and said plane so that its maximum distance from said plane is approximately midway the distance along said plane between the annular peripheral portion and said central portion.

8. A vibratory body according to claim 7 wherein said central vibration sensing portion is flat and extends parallel with said plane.

9. A vibratory body according to claim 7 wherein said central vibration sensing portion is flat, extends parallel to and offset from said plane and lies on the opposite side of said plane from said generally concave in cross section portion.

10. A vibratory body according to claim 7 wherein said central vibration sensing portion is flat, extends parallel to and offset from said plane and lies on the opposite side of said plane from said generally concave in cross section portion so as to protrude out beyond the diaphragm and its peripheral annular portion at its securement to said pick up device.

11. A vibratory body for use in acoustical pick-up apparatus consisting of a circular sheet of readily flexible material of the order of about .010 inch in thickness having an annular peripheral portion for securement to a pick-up device, a centrally protruding vibration sensing flat portion for application to the body to be sensed, said central portion lying adjacent and spaced outward from a plane extending to include at least a part of said peripheral portion of the vibratory body in its annular extent, and an intermediate annular portion joining said central vibration sensing portion and said annular peripheral portion, said intermediate annular portion being made up of a plurality of sequentially and integrally connected alternating concave and convex in cross section relatively small portions, said centrally protruding vibration sensing flat portion protruding axially outward and beyond said intermediate annular portion thereadjacent and said peripheral portion of said vibratory body, the central portion with its adjacent portion of the intermediate annular portion forming a flat bottom saucer-like section with its open portion facing toward said plane with which it defines a circular wafer-like sound chamber portion, whereby the central vibration sensing

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portion when applied to the body to be sensed may have varying pressure applied thereto through pressure applied to the pick-up device to vary the characteristic of the co-action of the vibratory body with the pick-up device.

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