

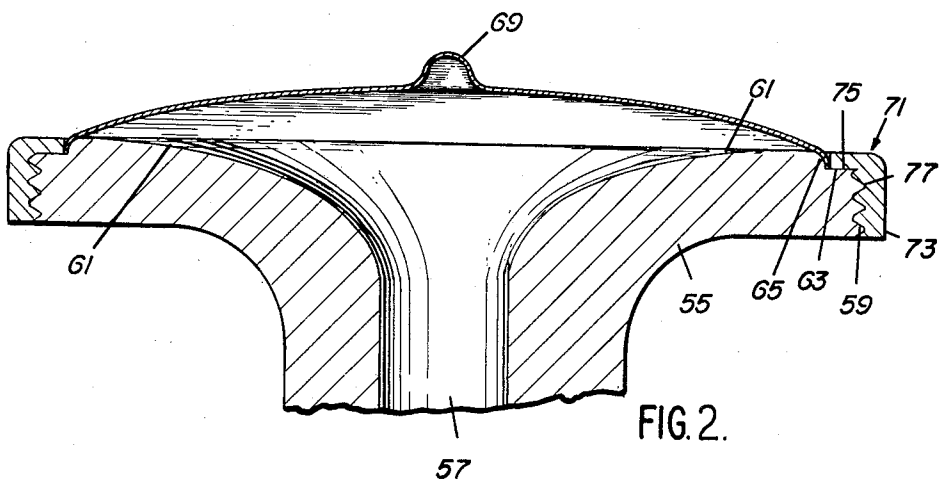
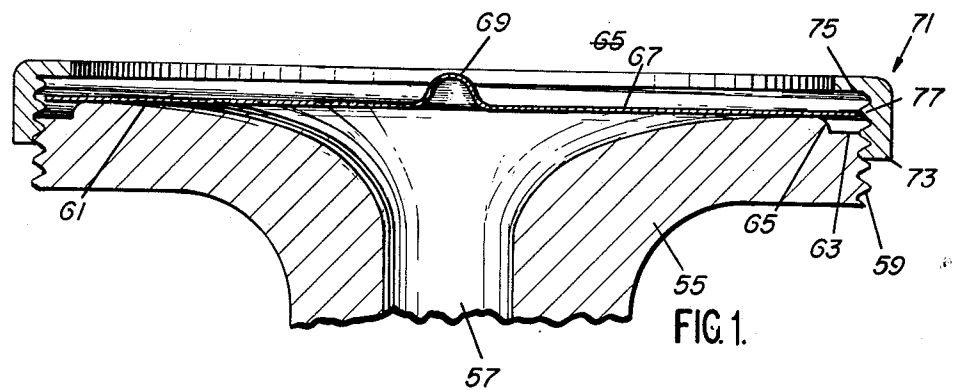
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DIAPHRAGM MOUNTING FOR STETHOSCOPE

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DIAPHRAGM MOUNTING FOR STETHOSCOPE
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7 Claims. (Cl. 181-24)

This application constitutes a continuation-in-part of my application Serial No. 185,650, filed April 6, 1942, now abandoned.

This invention relates broadly to the art of auscultation, and in its more specific aspects it relates to a stethoscope and the diaphragm mounting thereof whereby the tautness of the diaphragm may be adjusted to vary the frequency response thereof; and the nature and objects of the invention will be readily recognized and understood by those skilled in the art to which it relates in the light of the following explanation and detailed description of the accompanying drawings illustrating what I at present believe to be the preferred embodiment or mechanical expressions of my invention from among various other forms, arrangements, combinations and constructions, of which the invention is capable within the spirit and scope thereof.

My invention has been particularly designed for use with medical stethoscopes for examining the heart, lungs, etc., and, as in conventional stethoscopes provides a diaphragm, membrane or vibrating disc which is caused to vibrate by the sounds of the heart or other organ and thereby produces sound waves which are carried through tubes to the ears of the examiner.

In the medical field it has now been determined that most sounds produced by the heart are of low frequency, however, it has also been established that the sounds produced in the case of aortic insufficiency and in certain pulmonary disorders are of high frequency.

The behavior of a diaphragm depends upon its thickness, the material with which it is made, and such behavior also depends upon the tautness of the diaphragm.

Efforts have been made to provide diaphragms which will mask the low frequency signals while responding to and reproducing the high frequency signals. Such attenuation is said to be attained by the Bowles stethoscope which provides a relatively rigid diaphragm of relatively substantial thickness to make the high frequency sounds better audible to the human ear.

It is known that the masking of low frequency sounds increases proportionally to the thickness of the diaphragm.

Prior to my invention, as far as I am aware, all efforts to provide a stethoscope which will make high frequency sounds audible have been based on diaphragm thickness and materials of which the diaphragm is made, so that no stethoscope is presently available which is capable of picking up sounds of varying frequency so that the normal low frequency sounds and certain high frequency sounds are clearly audible by the use of one instrument, having a single diaphragm.

I have discovered that by using a diaphragm of uniform thickness and tensile strength which may be formed of a suitable plastic such as Mylar, or shim stock, such as steel, the low frequency and high frequency sounds may both be audible depending upon the tautness of the diaphragm. The diaphragm may be tightened or loosened to operate at the same frequency as the sounds being picked up for clear audition thereof.

In implementing my concept I have devised a stethoscope having unique means whereby the tautness of the tautness of the diaphragm may be varied in order to obtain the aforementioned highly desirable results. Such provision for varying the tautness of the diaphragm gives to the examining physician a substantially larger scope of audible sounds than has heretofore been possible with one instrument.

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In contra-distinction to the single optimum frequency of a violin string, multiple optimum frequencies are inherent in a diaphragm, and the location of such optimum frequencies on the frequency scale may be altered by a change in the tautness of the diaphragm as provided by my invention.

My invention is not only useful with conventional stethoscopes, but is also useful in demonstrations and the like to large or small audiences where mechanical diaphragms are used on electronic amplifiers to obtain optimum volume.

The means which I have developed whereby that tautness of the diaphragm or membrane may be varied do not add substantially to the cost of the instrument and are not of a complex nature and have high life expectancy under normal use conditions.

My invention provides a structural arrangement and mounting means whereby the diaphragm is caused to assume an upwardly arched condition which removes it a substantial distance from the bowl of the stethoscope head so that its tautness may be varied dependent upon the pressure with which it is applied to the body so that the range of frequency response of the stethoscope may be widened, and the diaphragm may be provided with means which pin points low frequency sounds.

With the foregoing general objects, features and results in view, as well as certain others which will be apparent from the following explanation, the invention consists in certain novel features in design, construction, mounting and combination of elements, as will be more fully and particularly referred to and specified hereinafter.

Referring to the accompanying drawings:

FIG. 1 is a vertical sectional view of my invention illustrating the microphone head of a stethoscope with the diaphragm assembled with the head and in readiness for clamping to produce the desired upward arching of the diaphragm.

FIG. 2 is a view similar to FIG. 1 with the clamping ring tightened and the diaphragm in upward arched condition.

In accompanying the drawings I disclose the stethoscope of the invention involving a head whereby I widen the range of frequencies which may be picked up by the stethoscope, and I pin point the low frequency sounds.

FIGS. 1 and 2 disclose a stethoscope head which includes a bowl 55 having a central duct 57 formed therethrough. As will be understood the duct communicates with a pair of tubes (not shown) the ends of which are adapted for placement in the ears of the examining physician. The peripheral surface of the bowl is threaded as at 59, while the major upper or supporting surface 61 thereof is flat or plane and merges into a lower outer surface 63. The surface or shoulder 65 which connects the upper and lower surfaces is preferably, though not necessarily, curved, as is most clearly illustrated in FIG. 2 of the drawings. I provide a diaphragm 67 formed of any suitable pliant material, which may be a plastic material, and at its center a dimple or upstanding circular projection 69 is molded or otherwise formed. The diaphragm is of uniform thickness and is of a diameter approximately the same as the diameter of the bowl 55.

I provide a retaining ring designated in its entirety by the numeral 71, the retaining ring comprising a top annulus 75 which extends radially inwardly from a skirt 73 which is internally threaded as at 77. The top annulus 75 is of substantially the same width as the width of the lower outer surface 63.

As is apparent from the disclosure of FIG. 1, the diaphragm rests upon the upper surface 61 of the bowl and extends over the lower outer surface 63. The retaining ring 71 is threaded on threads 59 of the bowl and the annulus 75 thereof engages the peripheral area of the

diaphragm and, as the retaining ring is screwed on the bowl the periphery of the diaphragm will be bent downwardly as shown in FIG. 2 and the diaphragm will flex or arch upwardly as disclosed in said figure of the drawings. The curvature 65 of the connecting surface between surfaces 61 and 63 ensures against damage to the diaphragm when the retaining ring is screwed on the bowl.

When the diaphragm is flexed, arched or upwardly distorted as shown and described in FIG. 2 it will be spaced a substantial distance from the bowl and the projection 69 will engage the skin of the patient, and the examining physician by varying the pressure on the head of the stethoscope may vary the degree of tautness of the diaphragm to thereby widen the range of frequency response as well as pin pointing the low frequency sounds.

While I have illustrated the diaphragm as being formed with the projection 69, it is to be distinctly understood that I may use a diaphragm which does not have this projection. In this case the diaphragm itself when arched upwardly will engage the skin of the patient and by varying the pressure thereon the frequency response thereof may be varied. Thus, it is clearly within the spirit and scope of my invention to utilize a diaphragm which is flat or smooth, when in non-flexed position, and is not formed with the projection 69.

I claim:

1. A head assembly for a stethoscope including a bowl, a diaphragm formed of a pliant material and having a major body portion and a peripheral portion and in operating condition said major body portion being arched upwardly away from said bowl a substantial distance to enable the tautness thereof to be varied dependent upon the degree of pressure at which said upwardly arched major body portion is applied against a body to thereby significantly widen the range of frequency response to the stethoscope, said bowl having a supporting surface and provided with an area in a plane below said supporting surface into which said peripheral portion of the diaphragm may be bent to maintain said major body portion of the diaphragm in its upwardly arched condition, and means adjustably connected with said bowl and in engagement with the peripheral portion of said diaphragm and operable thereon to bend and maintain the peripheral portion of the diaphragm in said area and the major body portion of the diaphragm in upwardly arched operative condition.

2. A head assembly for a stethoscope including a bowl, a diaphragm formed of a pliant material and in operating condition arched upwardly away from said bowl a substantial distance to enable the tautness thereof to be varied dependent upon the degree of pressure at which said upwardly arched diaphragm is applied against a body to thereby significantly widen the range of frequency response to the stethoscope, said bowl providing a supporting surface and a peripheral surface in a plane below said supporting surface and radially adjacent thereto, and means adjustably connected with said bowl and in engagement with the peripheral portion of said diaphragm and operable on said peripheral portion to bend said portion downwardly toward said peripheral surface to maintain said diaphragm in upwardly arched operative condition.

3. A head assembly for a stethoscope including a bowl, a diaphragm formed of a pliant material and in operating condition arched upwardly away from said bowl a substantial distance to enable the tautness thereof to be varied dependent upon the degree of pressure at which said upwardly arched diaphragm is applied against a body to thereby significantly widen the range of frequency response to the stethoscope, said bowl providing a supporting surface and a peripheral surface in a plane below said

supporting surface and radially adjacent thereto, and a retaining ring adjustably connected with said bowl and having an annulus extending radially inwardly therefrom and in engagement with the peripheral area of said diaphragm, said annulus being movable downwardly toward said peripheral surface of said bowl with the peripheral area of the diaphragm to bend the latter to maintain the diaphragm in upwardly arched condition.

4. A head assembly in accordance with claim 3, wherein said annulus is spaced radially outwardly with respect to said supporting surface.

5. A head assembly in accordance with claim 3, wherein said supporting surface and said peripheral surface are connected by a curved shoulder and the peripheral area of the diaphragm extends thereover when it is bent toward said peripheral surface.

6. A head assembly for a stethoscope including a bowl, a diaphragm formed of a pliant material and having a major body portion and a peripheral portion and in operating condition said major body portion being arched upwardly away from said bowl a substantial distance to enable the tautness thereof to be varied dependent upon the degree of pressure at which said upwardly arched major body portion is applied against a body to thereby significantly widen the range of frequency response to the stethoscope, and said major body portion having an upwardly extending projection in the center thereof, said bowl having a supporting surface and provided with an area in a plane below said supporting surface into which said peripheral portion of the diaphragm may be bent to maintain said major body portion of the diaphragm in its upwardly arched condition, and means adjustably connected with said bowl and in engagement with the peripheral portion of said diaphragm and operable thereon to bend and maintain the peripheral portion of the diaphragm in said area and the major body portion of the diaphragm in upwardly arched operative condition.

7. A head assembly for a stethoscope including a bowl, a diaphragm formed of a pliant material, and said diaphragm comprising a body portion and a peripheral portion, and the major portion of said body portion in normal condition providing a flat disc, and said pliant material being characterized by an upward arching of the body portion thereof corresponding to downward pressure applied to the peripheral portion thereof, said bowl providing a supporting base for said body portion and having a peripheral area radially adjacent to and in a plane below said supporting base and adapted to receive said peripheral portion of the diaphragm, and means adjustably connected with said bowl and in engagement with the peripheral portion of the diaphragm and operable on said peripheral portion to move it into said area by bending, to cause said body portion of the diaphragm to arch upwardly.

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