

Aug. 11, 1964

J. BODENGER
STETHOSCOPE

3,144,091

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Fig. 1

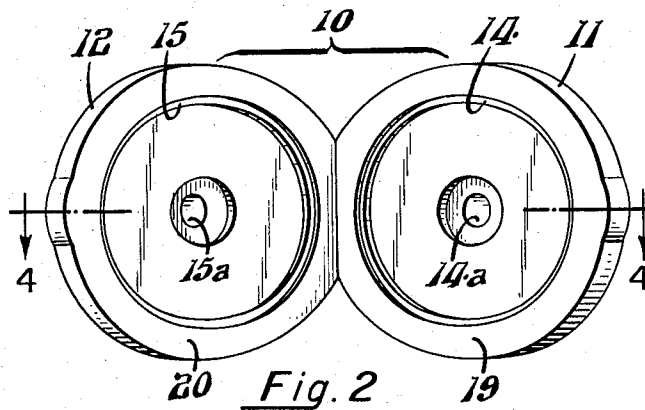
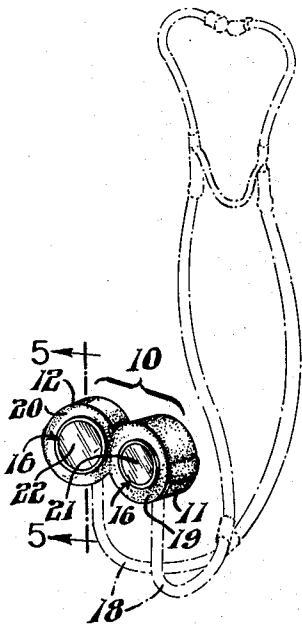


Fig. 2

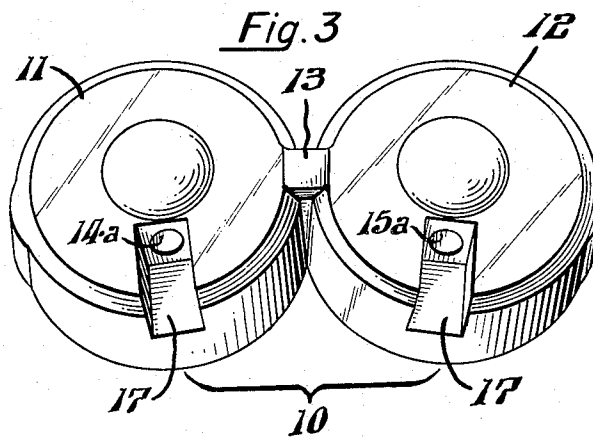


Fig. 3

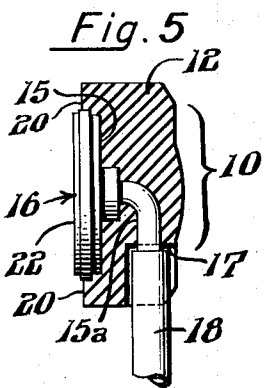


Fig. 4

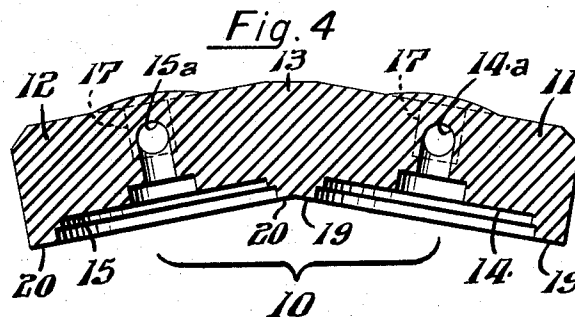


Fig. 5

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FIG. 6 -

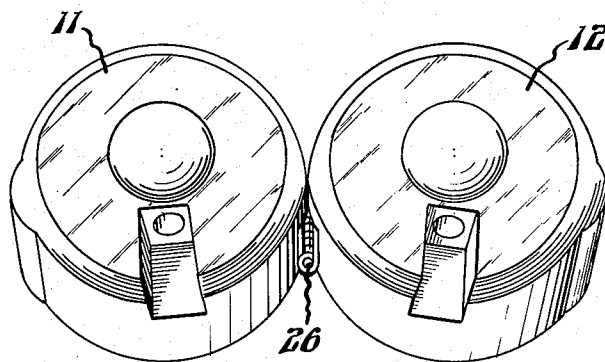


FIG. 7 -

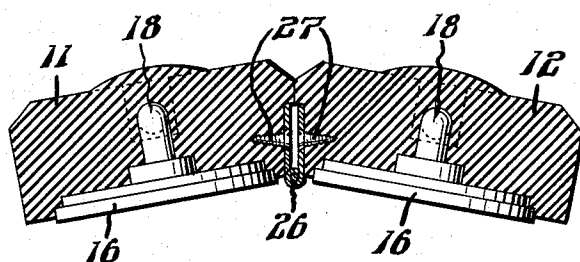
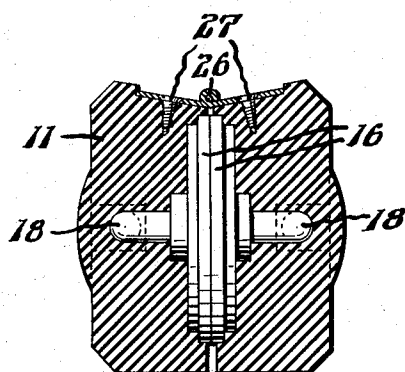


FIG. 8 -



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STETHOSCOPE

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9 Claims. (Cl. 181-24)

This invention relates to the mechanical amplification of audible sound, and more particularly it relates to a mechanical sound amplification device for use in combination with stethoscopes utilized in medical diagnosis. This is a continuation-in-part of my application Serial No. 77,176, filed December 20, 1960, now abandoned, which application is a continuation-in-part of my application Serial No. 771,859, filed November 4, 1958, and now abandoned.

For the investigation of a variety of normal and abnormal sounds produced within the human body, the physician relies in large measure upon listening to these sounds with an ordinary stethoscope of either the bell or diaphragm type. It is known that the conventional bell-type of chest piece can best transmit those sounds within the frequency range of from about 30 c.p.s. to about 300 c.p.s. The conventional diaphragm-type chest piece can best transmit higher-pitched sounds, i.e. within the range of from about 90 c.p.s. to about 1200 c.p.s. Therefore, it is necessary for the physician desiring an optimum diagnosis to determine the higher-pitched heart murmurs and lung sounds with a diaphragm-type chest piece, and to determine normal heart sounds and low-pitched murmurs, such as presystolic murmurs and the like, with a bell-type chest piece. Of particular importance are the characteristics of the normal heart sounds, heart murmurs, normal breathe sounds, and rales. The presence of any one of several types of lesions in or near the valves of the heart gives rise to eddies in the blood current which result in abnormal sounds known as murmurs. Such murmurs are important in the diagnosis of several conditions, such as, for example, mitral stenosis, which causes a narrowing of the left atrioventricular orifice. Rales are those sounds produced by the passage of air through portions of the bronchial tree which have been narrowed or which contain fluid and debris.

Additionally, it is known that in many cases, clinical diagnosis is aided by the auscultation of arteries apart from those close to the heart or those involved by arteriovenous fistulae, arterial aneurysms, and coarctation of the aorta. The findings on auscultation of the peripheral arterial system, when taken in conjunction with all other clinical information, may enable the physician to make accurate diagnosis without the use of arteriography.

All of the aforementioned sounds heard by auscultation are really complex mixtures of sounds. Each component sound consists of a fundamental tone, which is the note of lowest pitch, and a number of higher-pitched tones called the overtones. The tonal quality of a sound is determined by the number of overtones present, their frequencies, and their relative intensities. Generally, the more overtones present the richer the tone color or tone quality. To reproduce the aforementioned sounds faithfully, a diagnostic instrument must be capable of transmitting all frequencies involved and at adequate intensity. It is known that no one stethoscope has heretofore been capable of transmitting an adequate range of sound frequencies.

It is therefore an object of this invention to provide means for overcoming the aforementioned disadvantages of conventional stethoscopes.

It is another object of this invention to provide means for use with conventional stethoscopes in order to intensify the sound emanating therefrom.

It is another object of this invention to provide means

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for use with conventional stethoscopes which will permit the transmission of sounds over an extremely broad range of frequencies.

It is another object of this invention to provide such means which will increase the distinctiveness of a plurality of different sounds.

It is another object of this invention to provide such means which will provide increased resolution of transmitted sounds.

It is another object of this invention to provide such means which will provide stereophonic perception, including sense of depth, direction and spatial dimension.

It is another object of this invention to provide means for conventional stethoscopes having the aforementioned characteristics which is compact in structure and serves to protect the stethoscope chest pieces utilized therewith.

Other objects and advantages of this invention will readily become apparent from the following description and drawings wherein:

FIG. 1 is a general view showing the device of this invention in combination with conventional stethoscope components;

FIG. 2 is a front elevational view of the device of my invention;

FIG. 3 is a rear isometric view of the device of my invention;

FIG. 4 is a longitudinal section of the device as shown in FIG. 2 taken along the lines and in the direction of the arrows 4-4 of FIG. 2;

FIG. 5 is a sectional view on an enlarged scale of the device of my invention, taken along the lines and in the direction of the arrows 5-5 of FIG. 1;

FIG. 6 is a rear isometric view of a modification of the device of my invention;

FIG. 7 is a longitudinal sectional view of the device shown in FIG. 6 and showing the manner of mounting stethoscope chest pieces therein;

FIG. 8 is a side view in section of the device shown in FIGS. 6 and 7, showing the device in the storage position.

Referring now to FIGS. 2 and 3 there is shown generally the device 10 of my invention, which comprises a solid dense body portion having a right and left stethoscope chest-piece receiving portions 11, 12. Portions 11 and 12 are integrally joined by a rib portion 13. Portions 11 and 12 have formed therein substantially identical cavity portions 14, 15, which are each so configured as to receive therein in close-fitting relationship a conventional stethoscope chest-piece 16, as shown in FIG. 5. It is seen that cavity portions 14, 15, include tubular shaped bore portions 14a, 15a, which likewise receive the stem portion of the chest pieces, also as shown in FIG. 5. Portions 14a, 15a, communicate through the body portion of the device to identical slots 17, which slots are adapted to receive the conventional tubing 18 of a stethoscope, also as shown in FIGURE 5.

It will be apparent from FIG. 4 that the chest-piece receiving portions 11, 12, are angulated so that the planes of their face surfaces define an obtuse angle therebetween. This angulation is an important feature of my invention, and amount of angulation is limited only by the principle that the device must be capable of supporting the stethoscope chest pieces in a position whereby the diaphragm of each chest piece may contact the body wall of the patient. It will also be apparent from FIGS. 1 and 4, that lip portions 19, 20 of the chest-piece receiving portions 11, 12 extend substantially coplanar with the chest-piece diaphragms 21, 22, and therefore likewise are adapted to contact the body wall when in use.

Although the actual mechanical effect of the device of this invention is not exactly known, it is believed to result from the action of the device as a barrier preventing

dissipation of sound energy, and from the ability of the device to concentrate sound towards the imbedded chest pieces by deflection of sound energy, which deflection is made possible by the angulation of the chest-piece receiving portions 11, 12. Additionally, the construction of the amplification device 10 from a solid dense material which surrounds the conventional stethoscope chest-pieces 16 in a close fitting relationship provides for intensification of sounds as above described. Any suitable dense solid material which will act as a barrier preventing dissipation of sound energy may be utilized to construct the device 10, however, it is preferred that a material having a hardness of at least about 10 durometers be used. Durometer hardness is a standard of measurement utilized in the rubber and plastic industry, wherein the durometer hardness scale runs from zero at full extension to 100 at zero extension of the indenter foot of the hardness measuring instrument. A more complete discussion of this standard of measurement is contained in the Vanderbilt Rubber Handbook, published by R. T. Vanderbilt Company, Inc., 230 Park Avenue, New York, N.Y., page 212. This material additionally preferably has sufficient resiliency such that individual chest-pieces 16 may be inserted into the cavity portions 14, 15 by the user of the device. Among the materials which may therefore suitably be used in constructing the device of this invention are for example synthetic rubber, pure gum rubber, nylon and synthetic plastics.

The angulation of the device of this invention and the concomitant angulation of the imbedded chest pieces also causes the transmission of two dissimilar sound images to the ears and brain of the listener. This results in substantial stereophonic perception which supplies a sense of depth and direction and enables the observer to locate the source-points of sounds.

From FIGS. 1 and 5, it is seen that the device of this invention is assembled as a component part of a clinical stethoscope, as shown by the dotted lines, and the relationship of the chest-pieces 16, to the cavities 14, 15 of the portions 11, 12 is apparent. The conventional stethoscope tubing 18, shown in dotted lines in FIG. 1 may be connected right-to-right, or right-to-left, depending on individual preference, and such connection is not critical.

Referring now to FIGS. 6, 7 and 8, there is shown a modification of the mechanical amplification device of this invention. As there shown, chest piece receiving portions 11, 12 are articulated to each other by a hinge means 26. The operative elements of hinge means 26 are affixed to portions 11, 12 by a plurality of screws 27. From FIG. 7, it is apparent that the presence of hinge means 26 does not prevent portions 11, 12 from maintaining a chest piece angulation therebetween as hereinbefore described. FIG. 8 illustrates the degree to which the portions 11, 12 may be relatively oriented. The position shown in FIG. 8 constitutes a storage position for the portions 11, 12 and it is apparent therefrom that considerable protection against shock and abrasion is afforded to the contained chest pieces 16. The embodiment of the mechanical amplification means shown in FIGS. 6, 7 and 8, provides such amplification means which automatically adjusts for the degree of body curvature at the area of auscultation, thereby avoiding any possible area of non-contact with the stethoscope diaphragms 21, 22. This feature is especially advantageous in that the physician is relieved from concern as to the existence of good contact between the stethoscopic device and the body wall of the patient as different body areas are auscultated. While a specific form of the hinge means 26 has been shown for purposes of illustration, any suitable hinge functioning to achieve the same effect achieved by the illustrated device is equivalent therewith.

In clinical use, the herein disclosed device has proven to permit the transmission of sounds by stethoscope over a greatly increased frequency range; has provided significant intensification of sounds; has adequately trans-

mitted overtones; has improved transmission of low pitch, high pitch and second heart sounds; has permitted easy hearing of emphysematous chest and thick-walled chest sounds; has shown greater sensitivity than is possible with conventional stethoscope auscultation, with heart sounds, including gallops being well appreciated. Furthermore, low-pitch murmurs of mitral stenosis are heard well. Moreover, diagnosis of breathe sounds is significantly aided when use is made of the amplification device of this invention. Additionally, by the use of the amplification device of this invention auscultation of the arterial and venous systems has been made possible. Finally, the amplification device of this invention provides stereophonic perception and impressions of spatial dimension, whereby the observer may more readily detect the regional origin of those sounds which emanate from the body.

While the preferred embodiment of this invention has been described in some detail, it will be obvious to one skilled in the art that various modifications may be made without departing from the invention as hereinafter claimed. For example, the device 10, might be suitably constructed so as to permit the support of more than two chest-pieces in accordance with the principles of this invention.

Having thus described my invention, I claim:

1. A stethoscopic instrument including, in combination, a pair of stethoscopic chest pieces, each chest piece having an operative diaphragm means associated therewith and a stem portion extending therefrom; barrier means for preventing dissipation of sound energy comprising a pair of body portions composed of solid dense material, each of said body portions having an integral chest piece receiving cavity portion formed therein, which cavity portion is complementary to the outer configuration of one of said chest pieces, each chest piece being disposed within a complementary cavity portion whereby said chest pieces are substantially encased in close fitting relationship by said solid dense material, except for the exposure of said diaphragm means and said stem portions; connecting means formed medially of said body portions, said connecting portion being adapted to juxtaposed the planes of the diaphragm means of said chest pieces at an obtuse angle to each other.

2. A stethoscopic instrument in accordance with claim 1 wherein the material forming the body portion thereof has a hardness of at least 10 durometers hardness.

3. A stethoscopic instrument in accordance with claim 2 wherein the material forming the body portions thereof is resilient whereby said chest pieces are removable from said body portions.

4. A stethoscopic instrument in accordance with claim 1 wherein each of said body portions have formed thereon body wall engaging surfaces extending substantially concentrically of and coplanar with the diaphragm means of each chest piece.

5. A stethoscopic instrument in accordance with claim 1 wherein each of said chest piece receiving cavity includes a tubular bore portion formed therein communicating into said cavity portion and extending therethrough to an external opening therein, said bore portion having a diameter throughout substantially equal to the outer diameter of the stem portions of the corresponding chest piece.

6. A stethoscopic instrument in accordance with claim 5 wherein said body portion includes body wall engaging surfaces circumferentially adjacent each of said diaphragm means.

7. A stethoscopic instrument in accordance with claim 1 wherein said connecting means comprises articulating means connected to each of said body portions, and wherein each body portion has formed thereon a projecting portion adapted to abut a corresponding projecting portion of the other body portion so as to establish said obtuse angle.

8. A stethoscopic instrument in accordance with claim

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7 wherein said articulating means is adapted to permit the juxtaposition of said separate diaphragm means throughout a plurality of obtuse angles.

9. The device in accordance with claim 7 wherein the articulating means is a hinge.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,144,091

August 11, 1964

Jacob Bodenger

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 42, for "juxtaposed" read -- juxtapose --;
line 57, after "cavity" insert -- portions --.

Signed and sealed this 24th day of November 1964.

(SEAL)

Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents

**UNITED STATES PATENT OFFICE
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