April 25, 1950 E. W. LEPESCHKIN 2,505,124

VALVED STETHOSCOPE WITH LOGARITHMICALLY VARIABLE PASSAGE

Filed Dec. 19, 1947

Fig. 1.

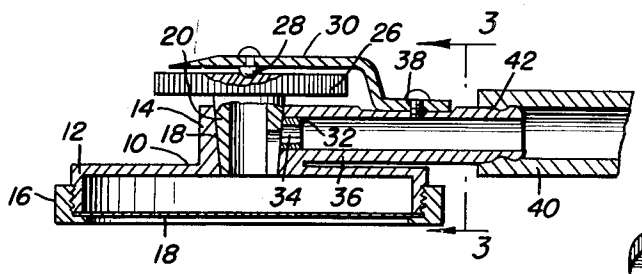
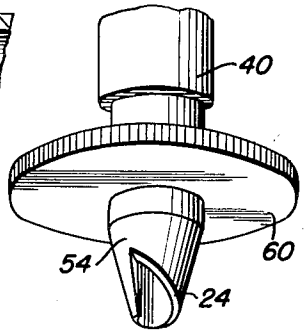


Fig. 7.



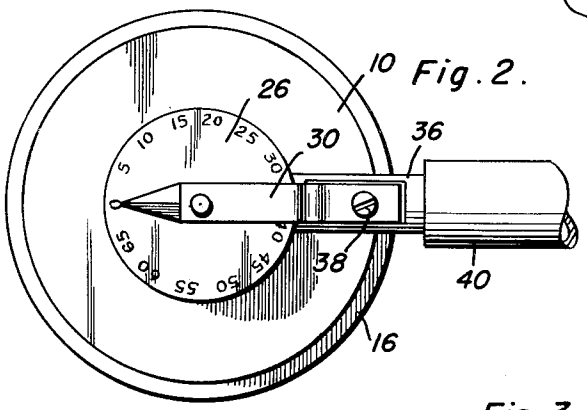


Fig. 2.

Fig. 4.

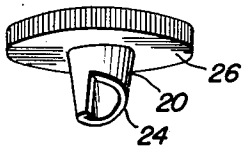


Fig. 9.

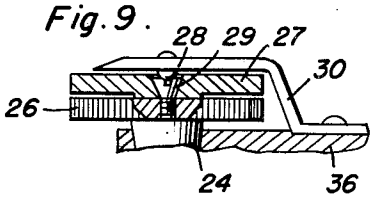


Fig. 3.

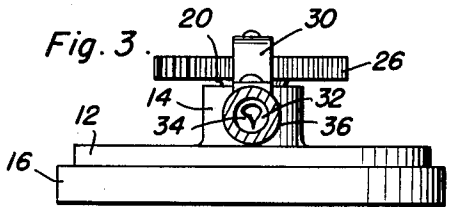


Fig. 5.

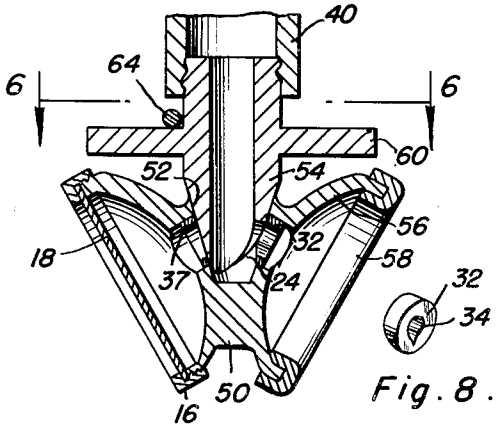


Fig. 6.

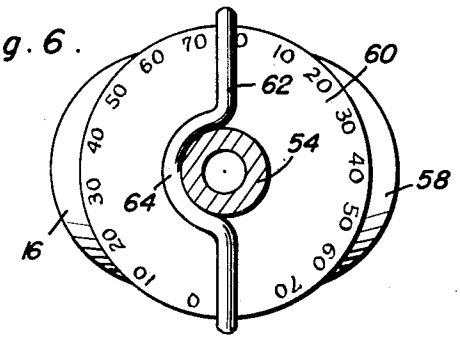


Fig. 8.

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VALVED STETHOSCOPE WITH LOGARITHMICALLY VARIABLE PASSAGE

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2 Claims. (Cl. 181—24)

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This invention appertains to novel and useful improvements in medical devices or instruments.

An object of this invention is to regulate the sound which is amplified, as it is conducted from the anatomy of an individual to a practitioner's ear.

Another object of this invention is to measure the intensity of sound and murmurs produced by the heart and lungs by means of gradually increasing the diameter of the communication between the stethoscope bell and the ear, from the limits of zero sound to maximum.

Another object of this invention is to controllably regulate and indicate the relative positions of a valve core and base member, receiving the said core.

Ancillary objects and features of novelty, such as simplicity in construction, will become apparent to those skilled in the art, in the following description of a preferred form of the invention, illustrated in the accompanying drawings, wherein:

Figure 1 is a sectional view of one form of the invention;

Figure 2 is a plan view of the invention shown in Figure 1;

Figure 3 is a sectional view taken substantially on the line 3—3 of Figure 1 and in the direction of the arrows;

Figure 4 is a perspective view of the valve core and turning plate utilized therewith;

Figure 5 is a sectional view of a second form of the invention;

Figure 6 is a plan view of the invention shown in Figure 5;

Figure 7 is an enlarged perspective view of the valve core utilized in association with the second form of the invention;

Figure 8 is a perspective view of a collar having a rounded wedge-like aperture therein; and,

Figure 9 is a side elevational view, portions being shown in section, illustrative of a slightly modified form of an indicia bearing plate which is adjustable in nature to compensate for variance in individual hearing.

By listening to the sounds and murmurs produced by various organs of the body various disorders may be discovered. One of the prime purposes of the present invention is to readily ascertain the intensity of the sound produced by these organs.

As is well known, the propagation of sound waves involves the transfer of energy, and it is this idea which is expressed in the concept of acoustic intensity, which is the average rate of

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flow of energy per unit area normal to the direction of propagation. Care must be taken to distinguish between intensity and loudness. The former is a purely physical quantity, whereas the latter is a physico-psychological one.

The general law connecting the two concepts in a special case is the so-called Weber-Fechner psychophysical law that equal increments of sensation correspond to equal increments in the logarithm of the stimulus. Thus the difference in the loudness level of two sounds of physical intensity I, and I_2 respectively is:

$$\text{Loudness}=10 \log I_2/I$$

Therefore, it follows that logarithmically regulating an orifice or opening for conducting sound waves renders it possible to indicate the loudness and intensity in a straight line relation; or in the instant case by using equally spaced indicia for indicating an inherently logarithmically changing phenomenon.

The following structure is used for realizing two reductions to practice of the invention:

A base member 10 is provided of several elements to form a sound pick-up device, including a bell 12 and a sleeve 14. The said sleeve 14 communicates with the said bell 12 which bell has external threads therearound. A collar 16 is positioned on the threaded portion of the said bell and retains a membrane or diaphragm 18 therein. This diaphragm is relatively stiff or rigid. However, it is capable of vibrations for amplifying the sound produced in the selected portions of an anatomy.

The bore 18 of the said sleeve 14 is slightly tapered in order to receive a hollow valve core 20 therein.

For the specific structure of the valve core, reference is made primarily to Figure 4 wherein there is disclosed a tapered core 20 having a smoothly curved aperture or cut-out 24 at the end thereof. A plate 26 is secured to the said core 20 and may have serrations about the marginal edge or periphery thereof. Also, a recess (unnumbered) may be provided in the upper surface or top of the said plate 26 in order to receive a bearing 28 therein.

The said bearing 28 is rigidly secured to a pointer or bracket 30, utilized for the purpose of indicating certain markings or indicia on the upper surface of the said plate 26. These markings will be calibrated to indicate decibels, above the normal threshold as tested by a conventional audiometer.

These markings or indicia will be calibrated

to indicate decibels above the normal hearing threshold, as tested on normal persons by means of a conventional audiometer. The upper portion of the plate 26 bearing the markings may be separated from the entire plate, as by means of a supplemental plate 24, to which it may be adjustably attached. Of course, when this construction is utilized the markings will actually be on the supplemental plate 27 in lieu of the main plate 26. The plates' relative position may be fixed by means of a conventional screw 29.

If the person using the stethoscope has a hearing threshold above or below the normal level, the upper plate bearing the markings may be rotated with respect to the lower plate for a distance corresponding to the number of decibels the hearing acuity of the person using the stethoscope deviates from the normal. Since equal differences in decibels are indicated by equal distances on the scale of indicia, the values of sound loudness above the normal hearing threshold given by the stethoscope will be thus valid even if the person using it has a hearing acuity above or below the normal.

Referring now to Figure 8 it will be noted that a collar or member 32 is supplied with a rounded wedge-like aperture 34 therein. This collar 32 is placed in a conduit 36, which conduit communicates with the bore 18. The said collar 32 is at the terminal of the said conduit and communicates directly with this bore.

As is readily apparent from an inspection of Figure 1, when the valve core 20 is turned, a larger amount of the cut-out or aperture 24 communicates with the aperture 34, thereby permitting freer and freer communication between the conduit 36 and the membrane 18. Also, as the valve core 20 is turned, the area of overlap of the opening 34 and the aperture or cut out 24 defines an aperture, the area of which varies logarithmically for equal displacements or equal linear increments of movement of the core 20 relative to the collar 32.

It is upon this conduit 36 that the said pointer or bracket 30 is supported by any suitable means, such as the screw 38, illustrated in Figure 1. It is readily apparent of course, that a suitable flexible hose or the like may be associated with the terminal portion of the said conduit and a peripheral recess 42 may be supplied in the said conduit 36 to assist in the retention of the said flexible hose 40.

Reference is now made to Figures 5 and 6 primarily wherein a second embodiment of the invention is disclosed. This second embodiment is identical in operation with the illustrated first embodiment. However, it is subjectable to different uses. The sound pick-up device including the base 50 is provided with a similar tapered bore 52 and receives a valve core 54 therein. An identical cut-out or aperture 24 is supplied in the said valve core and communicates with the collar 32. The conduit wherein this collar 32 is supplied is much shorter than the conduit 36 as is readily apparent from an inspection of this Figure 5.

Immediately communicating with the last-mentioned conduit is a second bell 56 having a resilient cover 58 about the marginal edges thereof. Of course, this second bell 56 is adapted

to be positioned on a selected portion of the anatomy. The said core 54 is extended longer than the core 20 and on this extension there is positioned a flexible hose 40.

A plate 60 is secured to the said core 54 and has suitable indicia thereon. Also, this plate may be provided with serrations about the edges thereof for facility in turning.

A wire clip or bracket 62 is secured to a suitable portion of the base 50 and has a loop 64 therein adapted to extend around the upper portion or extension of the said valve core 54. This, of course, retains the core within the bore 52 and may also be used for the purpose of indicating the relative position of the core and collars 32.

It will be noted at this point that either the membrane type of bell or the second bell 56 may be used in connection with the second embodiment of the invention, mere positioning of the valve core 54 being used for selectively rendering operative these elements. Of course, a collar 32 is also supplied in conjunction with the membrane receiving bell in the second embodiment of the invention, as illustrated.

It is apparent that variations may be made without departing from the spirit of the invention. Accordingly, limitation is sought only in accordance with the scope of the following claims.

Having described the invention, what is claimed as new is:

1. For use in a stethoscope, a collar having a substantially pear-shaped opening, a valve core, means for maintaining said collar and core in juxtaposition and mutually movable, said core having a cut-out having at least one wall thereof curved, the area of overlap of said opening and said cut-out defining an aperture, the area of which aperture varies logarithmically for equal linear increments of movement of the core relative to the collar.

2. In a stethoscope having a sound conducting tube, a sound pick-up device secured to said sound conducting tube, and means interposed between the sound pick-up device and said tube for modifying the sound while passing from the pick-up device to said tube including a member having a substantially pear-shaped opening, a valve core, and means carried by said sound pick-up device maintaining said core and said member juxtaposed and mutually movable, said core having a cut-out with at least one wall thereof curved, the area of overlap of said opening and said cut-out defining an aperture, the area of which aperture varies logarithmically for equal linear increments of movement of the core relative to the collar.

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