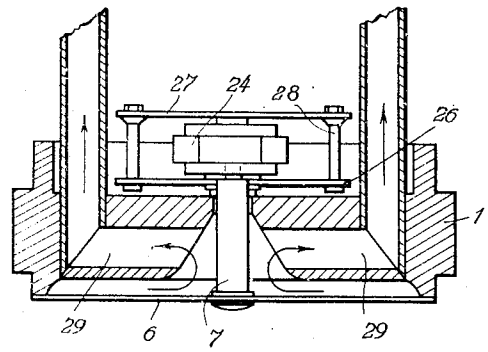
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Fig. 5



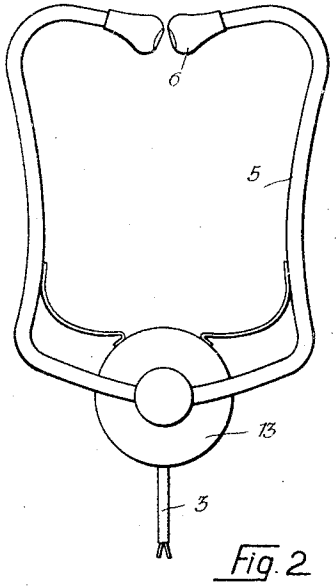


Fig. 2

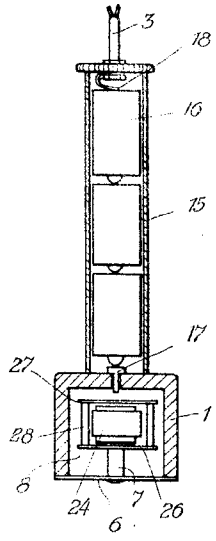
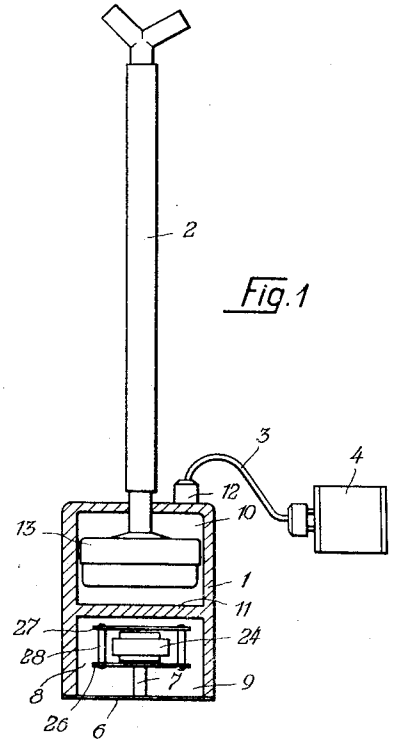


Fig. 1



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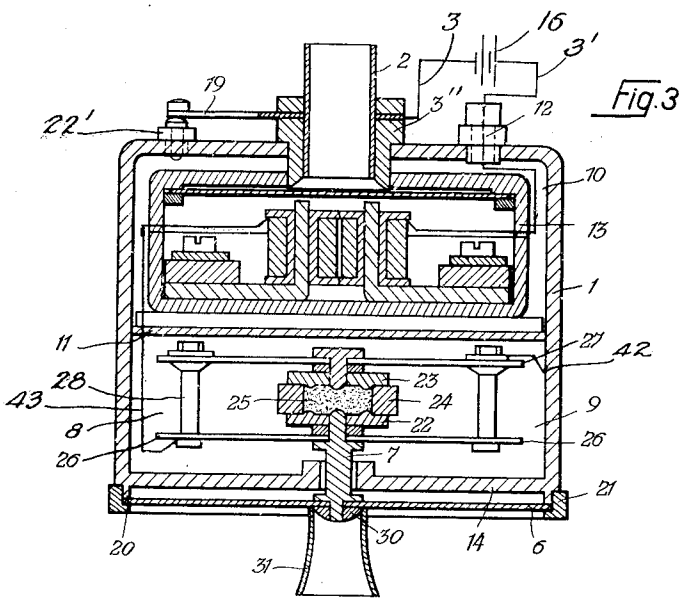


Fig.3

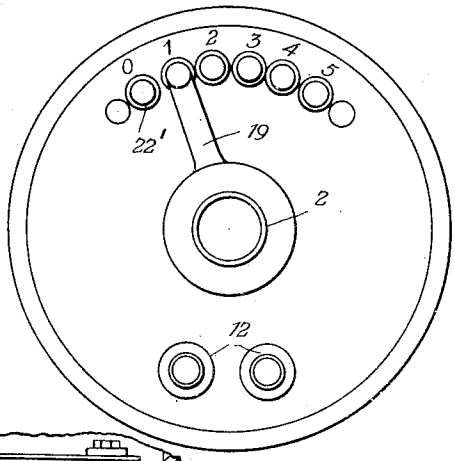


Fig.4

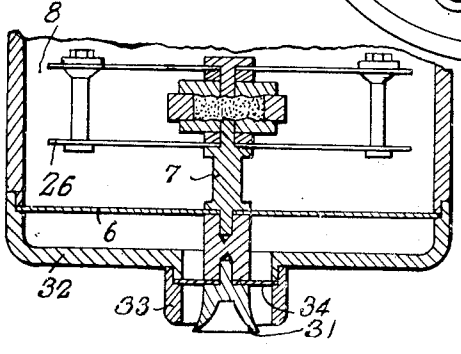


Fig.6

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UNITED STATES PATENT OFFICE

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STETHOSCOPE

Hans von Baüssen, Nowaves, near Potsdam, Germany

Application August 3, 1935, Serial No. 34,617
In Germany August 4, 1934

3 Claims. (Cl. 181—24)

My invention relates to stethoscopes and it is an object of my invention to provide an improved instrument of this kind.

To this end, I arrange, in combination with a casing and a stethoscope diaphragm on the casing, a microphone which is arranged in the casing and spaced from its inner wall and equipped with a membrane, and I further provide means for securing the microphone exclusively to the stethoscope diaphragm.

Acoustic stethoscopes are still used for the auscultation of the heart and the lungs, in which the sound is simply transmitted. Doctors use the old wooden stethoscopes, or membrane stethoscopes with rubber tubes extending to both ears, which are better than wooden stethoscopes. However, the sound intensity is frequently not sufficient in the old stethoscopes, particularly, if very low noises in the body are auscultated.

It has been proposed to provide electric stethoscopes with amplifying valves for radio reception, but such apparatus are only suitable for lecture rooms or the like, and not for the daily use of the practitioner.

My novel microphone stethoscope is without the drawbacks of the old stethoscopes and is adapted for practical use.

The stethoscope diaphragm is placed on the part to be auscultated directly or indirectly, by means of an extension. This stethoscope diaphragm supports the microphone which is exclusively secured to, and held by, the diaphragm. Preferably, the stethoscope diaphragm is connected to at least one membrane of the microphone by means of a pin.

Preferably, I provide a microphone with two membranes spaced by adjustable stays, screws or the like. The membranes support two electrodes, and a body of carbon powder is held between the two electrodes by a ring of felt or cotton wool forming a cavity for its reception.

In the accompanying drawings, several stethoscopes embodying my invention are illustrated by way of example.

In the drawings

Fig. 1 is an axial section of a stethoscope in which a microphone and a telephone receiver are housed in separate compartments of a casing,

Fig. 2 is an axial section of a stethoscope in which the telephone receiver is arranged outside the casing,

Fig. 3 is an axial section of a casing with a microphone and a telephone receiver housed therein, substantially as shown in Fig. 1, but modified in some details,

Fig. 4 is a plan view of Fig. 3,

Fig. 5 is an axial section of a stethoscope casing with means for direct sound transmission, without using the microphone,

Fig. 6 is an axial section of a modification of the construction shown in Figs. 1 and 3, with a part of the casing containing the telephone receiver broken away.

Referring now to the drawings, and first to Fig. 1, a stethoscope casing 1 is subdivided into two compartments 9 and 10 by a transverse partition 11. A microphone 8 is housed in the lower compartment 9 of the stethoscope casing 1 and connected to a stethoscope diaphragm 6 at the lower end of the casing by a pin 7. The diaphragm 6 may be of any suitable material, such as textile fabric under strong tension.

A telephone receiver 13 is arranged in the upper compartment 10 of the casing 1, and a rubber tube 2 conducts the sound to the ears of the stethoscopist. Current is supplied by a battery 4, a cable 3, and plug contacts 12 on the casing 1.

Referring now to Fig. 2, the casing 1 of this stethoscope has only a single compartment for the reception of the microphone 8 which is connected to the diaphragm 6 by the pin 7, as described with reference to Fig. 1. The telephone receiver 13 is arranged outside the casing 1, and equipped with rubber tubes 5, each with an end member 6 for inserting it into the auditory passage.

The casing 1 is equipped with a hollow handle 15 in which the elements 16 of an electric battery are inserted. The electrodes at the ends of the battery are connected to the microphone by a contact 17, and to the conductor 3 by a contact 18.

The walls of the casing 1 are comparatively thick and the mass of the casing plus the battery is very considerable as against the mass of the microphone 8. By these means, the casing is rendered practically free from oscillations.

Referring now to Figs. 3 and 4, the microphone 8 and the telephone receiver 13 are arranged in the respective chambers 9 and 10 of the casing 1, as described with reference to Fig. 1 but the lower end of the casing is closed by a transverse partition or end wall 14. The stethoscope diaphragm 6 is secured to a flange 20 projecting from the end wall 14 by an annular holder 21. The pin 7 which supports the microphone 8, enters the lower compartment 9 through a central hole in the end wall 14.

The microphone 8 will now be described in detail. It has two membranes 26 and 27 which may be of mica. The lower membrane 26 has a central hole for the reception of the reduced upper end of pin 7. The two diaphragms are connected by any number, for instance, three, stays 28 at the perimeter. The stays are quipped with screws for holding the diaphragms 26 and 27. Electrodes 22 and 23 are secured to the respective membranes 26 and 27. A ring of felt or the like is placed between the two electrodes, as shown at 24, and defines a compartment 25 for the reception of carbon powder.

The lower end of pin 7 projects beyond the lower surface of the stethoscope diaphragm 6, and a head 30 is placed on the projecting end. The head supports an extension 31 which is placed on the body, or member, to be auscultated. This extension of the stethoscope diaphragm 6 may be tubular, as shown.

The telephone receiver 13 in the upper compartment 10 is connected to a sleeve 3'' which is inserted in the top wall of the casing 1, and the tube 2 is inserted in the sleeve 3''.

The plug contacts 12 for connecting the battery 4 have already been described. A contacting arm 19 is mounted to rotate about the axis of the casing 1 and cooperates with a set of fixed contacts 22' designated by the numerals 0–5, Fig. 4, for cutting in various resistances by which the intensity of the sound reproduction is increased or reduced.

The connections for the electric current are shown in Fig. 3. The current passes from battery 16 through wire 3 over contacting arm 19, the fixed contacts 22' into the casing 1, then through a wire 42 into the microphone 8, and from the microphone through a wire 43 to the telephone, and from the telephone through wire 3' to battery 16.

The stethoscope illustrated in Figs. 3, 4, and 6 may be modified in various ways. Thus, as shown in Fig. 6 the lower end of casing 1 may be closed by an end wall 32 below the diaphragm 6 which has a central opening in which the extension 31 is free to move. Preferably, a tubular guard 33 is placed on the end wall 32 to surround the extension 31 in spaced relation. The tubular guard 33 should be somewhat shorter than the extension 31, so that, when the stethoscope is placed on the patient's body, the extension 31 first bears against the body. The tubular guard engages the body only after the extension 31 has been forced back, so that the stethoscope is held against the body very steadily.

A guiding membrane 34 is preferably inserted between the extension 31 and the tubular guard 33. The guide membrane 34 is of elastic material, for instance, soft rubber, and extends substantially in parallel relation to the stethoscope diaphragm 6. It is held in the tubular guard 33 at its perimeter and connected to the extension 31 at its centre, at some distance from the stethoscope diaphragm 6. The object of the guiding membrane 34 is to prevent lateral oscillations of the extension 31 which involve corresponding oscillations of the microphone, while it does practically not interfere with the movement of the extension 31 in its longitudinal direction, i. e., at right angles to the stethoscope diaphragm 6 and the microphone membranes 26 and 27.

Referring now to Fig. 5, this casing 1 which may be a cap or plug for connection with a principal casing is provided with the stethoscope diaphragm 6, the pin 7, and the microphone 8, as described but in addition it has two passages 29 at opposite sides of the pin 7 between the stethoscope diaphragm 6 and the microphone 8, for transmitting the sounds directly and without the microphone.

Each one of the stethoscopes which have been described, may be equipped with the tubes 5 and end pieces 6, as shown in Fig. 2, or the telephone may be connected directly to the ears of the stethoscopist, like a head receiver.

By means of the stethoscopes according to my invention, the noises in the body of the patient are reproduced extraordinarily clearly and intensely. It has been found that such stethoscopes are especially suitable for making sound records of the noises. Heretofore, extra amplifying means were required between the stethoscope and the electric receiver which normally also amplifies the sound. With the stethoscope according to my invention, the extra amplifying means are dispensed with, and the stethoscope can be directly connected to a normal electric sound receiver, thereby facilitating very much the making of sound records. The same battery may supply the electric sound receiver and the stethoscope.

Sound records of the kind described may be used for recording phenomena of disease in hospitals, for lectures, investigations, etc.

I claim:

1. In a stethoscope, a casing having an opening therein, a stethoscope diaphragm secured to said casing to close said opening, a microphone arranged in the casing and spaced from its inner wall, said microphone comprising a membrane in the microphone, a telephone receiver connected to the microphone, a source of current connected to the receiver, means for securing said microphone with its membrane to said stethoscope diaphragm so that said microphone and its membrane are freely movable with said diaphragm, and a member projecting from the outer surface of said diaphragm and secured to said diaphragm for engaging the body of the patient.

2. In a stethoscope, a casing having an opening therein, a stethoscope diaphragm secured to said casing to close said opening, a microphone arranged in the casing and spaced from its inner wall, said microphone comprising a membrane, a telephone receiver connected to the microphone, a source of current connected to the receiver, means for securing said microphone with its membrane to said stethoscope diaphragm, a member projecting from the outer surface of said diaphragm and secured to said diaphragm for engaging the body of the patient, and a tubular guard secured to said casing and somewhat shorter than said projecting member and surrounding it in spaced relation for engaging the body only after said projecting member has been forced back.

3. In a stethoscope, a casing having an opening therein, a stethoscope diaphragm secured to said casing to close said opening, a microphone arranged in the casing and spaced from its inner wall, said microphone comprising a membrane, a telephone receiver connected to the microphone, a source of current connected to the receiver, means for securing said microphone with its membrane to said stethoscope diaphragm, a member projecting from the outer surface of said diaphragm and secured to said diaphragm for engaging the body of the patient, a tubular guard secured to said casing and somewhat shorter than said projecting member and surrounding it in spaced relation for engaging the body only after said projecting member has been forced back, and a membrane of elastic material inserted between the projecting member and the guard and extending substantially parallel to said stethoscope diaphragm at some distance therefrom.

HANS VON BAÜSSEN.