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Rose

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[54] **BODY NOISE DETECTOR**

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[52] **U.S. Cl.** ..... **128/2.05 S,** 128/2 K

[51] **Int. Cl.** **A61b 5/02**

[58] **Field of Search** ... 128/2.05 S, 2 K, 418, 2.05 P, 128/2.06 E, 2.1 E, DIG. 4, 404–405, 410–411, 416–417, 278, 300, 172.1

[56] **References Cited**

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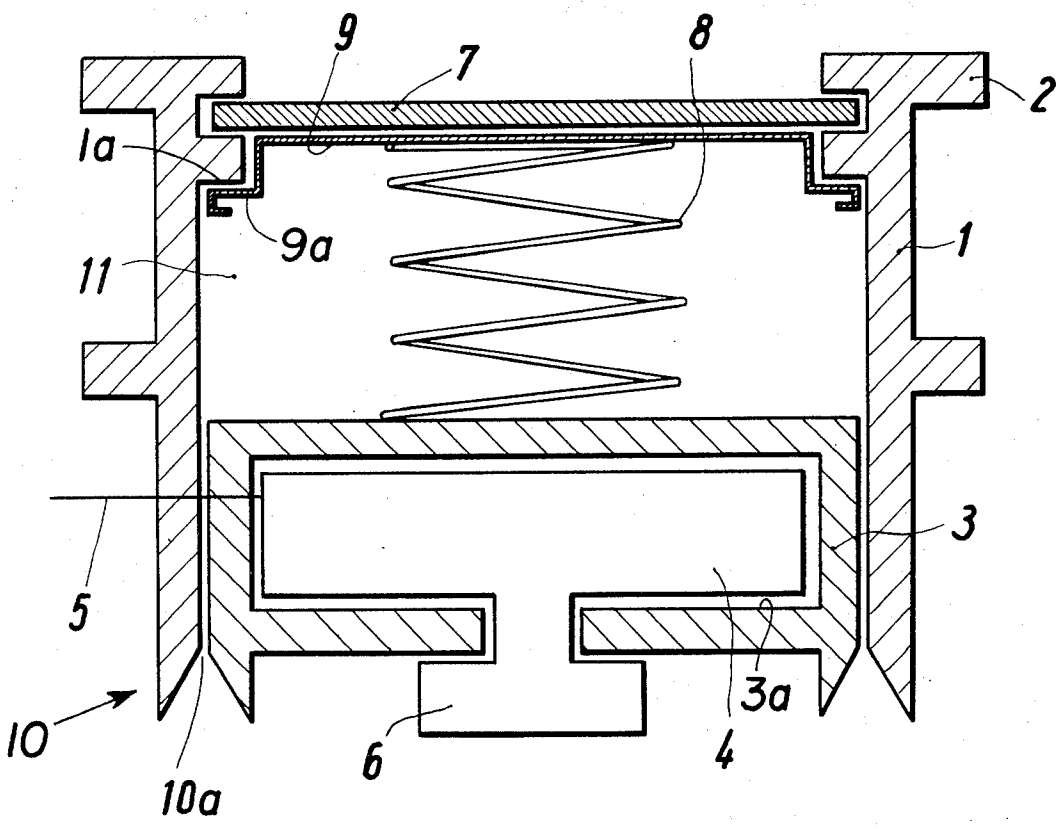
[57] **ABSTRACT**

A body noise detector, includes a housing having a first chamber therein containing a microphone capsule and a second reduced-pressure chamber therein closed on one side by a resilient deformable wall, and connected to an annular groove surrounding a pad attached to the microphone capsule. The deformable wall is loaded by a spring against pressing into the reduced-pressure chamber. In one embodiment a lever carrying a pressure roller is pivoted on the housing so that the pressure roller can press upon the deformable wall.

4 Claims, 2 Drawing Figures



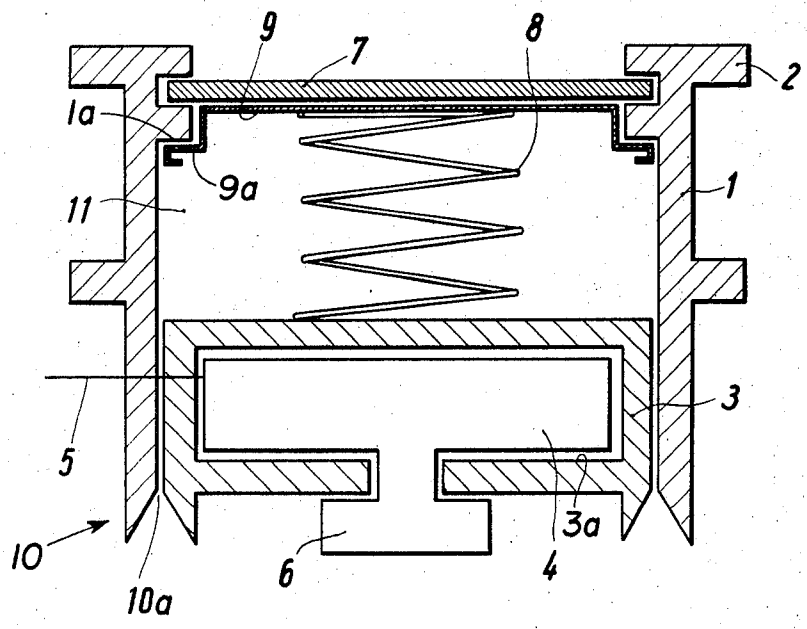


Fig. 1

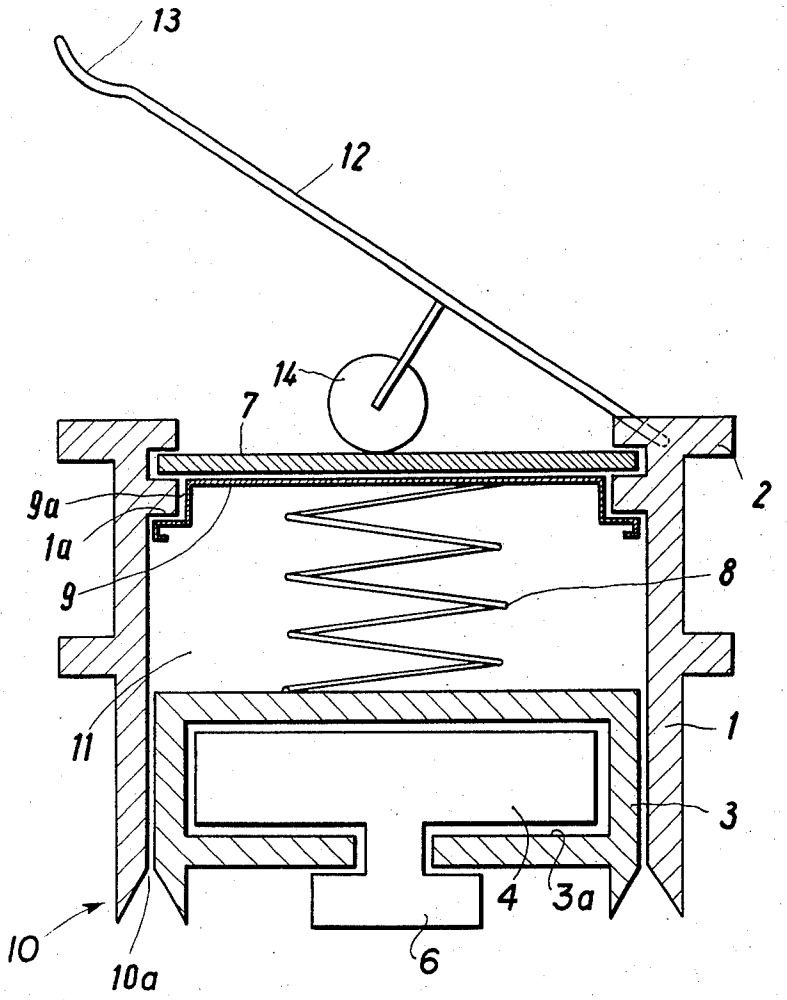


Fig. 2

BODY NOISE DETECTOR

BACKGROUND OF THE INVENTION

The invention relates to a device for detecting heart-noise and other bodily noises for diagnostic purposes. The human body has skin which is, generally speaking, loose or flaccid as it is supported on a layer of fat.

Devices of this kind have been proposed consisting of a housing having a chamber which is open to the skin and carries, for example, a microphone capsule, and has an annular contact surface with an annular channel therein which is connected to a device producing suction. This serves to tauten the skin of the patient to enable bodily sounds to be detected.

Measurements have shown that the energy content of the sound transmitted by the taut skin is dependent upon the level of its tension. This could lead to heart noise being recorded with differing amplitudes and intensities due entirely to differences in skin tension. Similarly, real differences could be masked by such differences of skin tension. Faulty diagnosis leading to wrong treatment or the omission of treatment could result from this.

In order to obtain results which are comparable, it is necessary to ensure that the tension of the skin is the same when each reading is taken. In effect this means that the underpressure or suction must be exactly reproducible from one use of the device to the next.

It is accordingly an object of the invention to provide a detector for detecting bodily sounds such as heart noises in which the underpressure or suction is exactly reproducible from one use of the detector to the next.

SUMMARY OF THE INVENTION

The invention provides, to achieve this object, that the housing of the detector encloses a chamber connected to the annular channel. This chamber is separate from the chamber containing the microphone capsule and is provided on one side with a resilient deformable wall which can be pressed into the chamber and then return to its former state.

The resilient deformable wall may be an elastic rubber diaphragm, and a spring may be disposed in the chamber to oppose depression of the diaphragm, and to act to retain the diaphragm after depression thereof. The spring may abut at one end against the wall of the chamber opposite the diaphragm and at the other, against a contact plate which contacts the diaphragm. A stop for the pressure plate is arranged on the interior of the wall of the chamber.

In a further development, finger supports or grips are provided on the exterior of the housing. A lever may also be pivoted on the housing at one side thereof, and the lever has a free end which is designed as an actuation handle. The lever carries a pressure roller located between the pivot and the free end so that it will press upon the centre of the resilient deformable wall on movement of the lever towards the housing.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view of a first embodiment of detector in accordance with the invention; and

FIG. 2 is a sectional view of a second, modified, embodiment of detector in accordance with the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

The detector device shown in FIG. 2 comprises a

generally cylindrical housing **1** having encircling finger supports or grips **2** on its exterior.

Disposed within housing **1** is an inner body **3** having a hollow space **3***a* therein, in which a microphone capsule **4** is accommodated. A lead **5** connecting the microphone capsule **4** to apparatus outside of the housing **1** passes through the wall of inner body **3** and the wall of housing **1.** The openings provided in the walls for this purpose are sealed in air-tight manner. A sensing pad **6** is mounted on the microphone capsule **4.** The pad **6** picks up body noises and transfers the sound vibrations to the microphone capsule **4.**

Alternatively to the electrical lead **5,** the hollow space **3***a* enclosing the microphone capsule **4** can be connected to a hearing tube if the detector is to be used as a stethoscope.

The housing **1** also encloses, above the central body **3,** an underpressure chamber **11.** The chamber **11** is sealed in air-tight manner at the top by a resilient elastic rubber membrane **7.** Below the membrane **7** is disposed a spring **8** which carries a pressure plate **9,** which is in contact with the under-surface of the membrane **7.** The pressure plate **9** has a rim **9***a* which extends there around to provide a step which abuts a circular stop **1***a* provided on the surrounding wall of the chamber **11** to limit the upward movement of the pressure plate **9.**

The walls of the housing **1** and body **3** extend downwardly to form an annular ring **10** and are shaped to provide an annular channel **10***a* which is in communication with the chamber **11.** The communication may be effected by an annular gap between the housing **1** and body **3,** the spacing therebetween being maintained by spacing elements, or by way of bores or passages, or other air channels.

In the embodiment shown in FIG. **2,** corresponding parts have the same reference numerals as in FIG. **1.** The embodiment of FIG. **2** differs from that of FIG. **1** in that a lever **12** is pivotally mounted at one end on the housing **1** and is formed to provide a handle **13** at its other, free, end.

The lever **12** carries a pressure roller **14** which is positioned so as to engage the centre of the deformable wall **7** when the lever is depressed.

The device is used as follows:

The user holds the detector between his fingers so that the fingers lie between the finger supports or grips **2.** In the case of the FIG. **1** embodiment, he presses the membrane **7** into the housing using his thumb. The spring **8** is compressed in this way, and the volume of the chamber **11** is reduced, driving out some of the air. The detector is then placed on the patient's body and held against it and the thumb pressure on the membrane is relieved. The membrane is returned to its relaxed position by the spring **8** and pressure plate **9** and returns the chamber **11** to its former volume. As, however, no air can enter the chamber when the housing is pressed onto the patient's body, an underpressure arises in the chamber and this causes the skin underlying the detector to be pulled tight by being drawn into the channel **10.** In the FIG. **2** embodiment, instead of pressing directly on the membrane **7,** the lever **12** is depressed so that pressure roller **14** presses in the membrane **7.** This achieves the same effect as already described.

A body noise detector according to the invention has the advantage that no special suction device needs to

be provided outside the housing, which would alter the balance of the detector. The entire detector is a self-contained unit without attached suction hoses or other accessories. A further advantage of the device of the invention lies in the fact that, even in a series of measurements, the underpressure acting in the channel **10** is always the same so that the results are comparable, and not invalidated by different transmission intensities caused by different skin tensions.

If, for example, an underpressure of 100 mm/Kg is to be achieved consistently at each examination at normal atmospheric pressure, the volume of the chamber **11** has to be reduced by 13.16 percent on condition that the membrane **7** returns to its initial position. If the membrane has a diameter of 4 cm. then the spring must exert a pressure of 1,654 g. so that an underpressure of 100 mm/Kg is achieved under normal atmospheric pressure.

I claim:

1. A body noise detector comprising a housing enclosing an underpressure chamber, said housing including a rigid wall portion and a deformable wall portion, an annular ring projecting from the housing and forming a contact surface engageable with a patient's body, said annular ring having a passage therethrough communicating between the contact surface and the underpressure chamber, said annular ring defining a cavity, microphone means carried by said housing and disposed in said cavity for engagement with a patient's body, means for transmitting the noise detected by the microphone means, a pressure plate within said underpressure chamber and engageable with said deformable wall and spring means connected between said rigid housing wall and said pressure plate for urging said deformable wall into substantially undeformed condition by said pressure plate.

2. The detector defined in claim **1,** and stop means interposed between the deformable wall and the pressure plate for limiting movement of the pressure plate.

3. The detector defined in claim **2,** in which the pressure plate includes a stepped rim engageable with the stop means.

4. The detector defined in claim **1,** lever means pivotally connected to the housing and having a free end spaced from its pivotal connection, said lever means overlying said deformable wall portion, and a pressure roller carried by said lever and engageable with the central portion of the deformable wall by movement of said lever means free end toward the housing.

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