K. M. TURNER.

STETHOSCOPE.

APPLICATION FILED SEPT. 10, 1912.

1,147,282. Patented July 20, 1915.

Fig. 1.

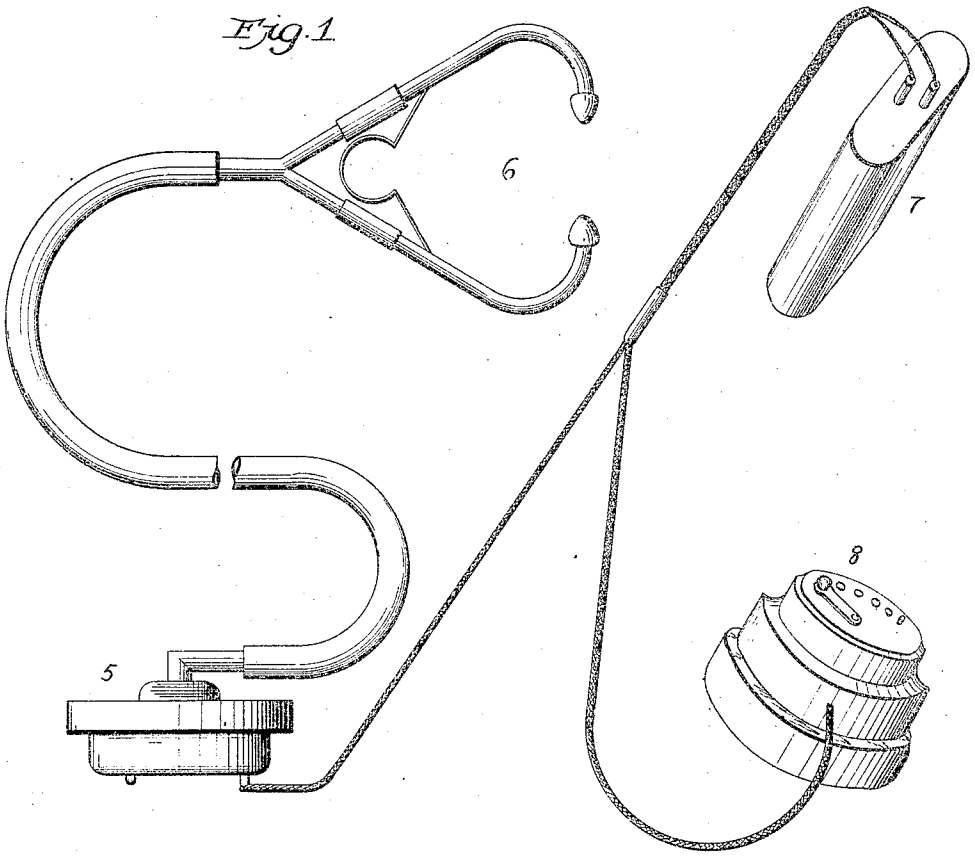


Fig. 2.

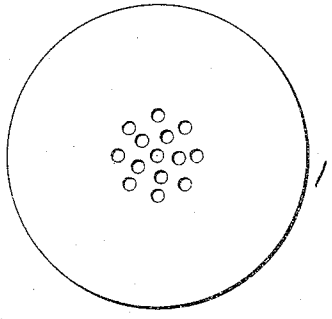
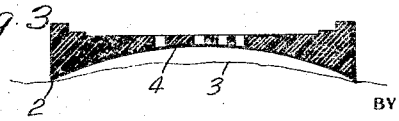


Fig. 3.



WITNESSES

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STETHOSCOPE.

1,147,282. Specification of Letters Patent. Patented July 20, 1915.

Application filed September 10, 1912. Serial No. 719,573.

To all whom it may concern:

Be it known that I, KELLEY M. TURNER, citizen of the United States, and resident of Jamaica, in the county of Queens and State of New York, have invented certain new and useful Improvements in Stethoscopes, of which the following is a specification.

This invention relates to stethoscopes.

Hitherto stethoscopes have been made in various ways, but have universally lacked certain qualities which they could possess to great advantage. Foremost among these qualities which the ordinary stethoscope has lacked is sensitiveness. The heart is like a pump, but its operations are on a comparatively small scale, and are furthermore insulated from observation by the surrounding tissues, so that only an ear of abnormal delicacy is capable of hearing enough to derive all the information which might be derived.

It is the purpose of this invention to so transmit the sounds, or in other words, to provide such a stethoscope, that a person of normal hearing may get practically all the information which is capable of being obtained by the use of this method of observation.

For this purpose the invention consists in an improved stethoscope making use of a special telephonic transmitter, receiver and ear tubes.

In the drawings:—

Figure 1 is a view showing the parts and general arrangement of a stethoscope embodying the principles of this invention. Fig. 2 is a face view of the transmitter. Fig. 3 is a sectional view of the face of the same.

It will be understood that the heart, in beating, contracts and expands, and in so doing produces two or more sources of sound vibrations, or vibrations analogous to sound vibrations. There is, first, the vibration due to the rush of the blood against and through the operating walls, which produces the usual sound of any rushing liquid, except to such a slight extent in point of magnitude as to be virtually inaudible. Besides this there is the effect of a tap due to the rather sudden muscular contraction and expansion. This tap is a matter of much greater energy than the actual sound vibrations first mentioned, but is rather too sluggish or low in pitch to be audible as sound, or to be transmitted through the air by the phenomenon of radiant or wave energy, as sound is actually transmitted. In other words, the tap is more in the nature of those vibrations which are too slow, or in other words too few in number or frequency to be audible to the human ear, or to carry their energy at all through the air by a wave action. In carrying out the present invention particular care is taken to obtain the full effect of both of these sources of sound or energy.

I employ a very sensitive transmitter known as the dictograph transmitter, and familiarly employed in ordinary secret and detective service under this name. A transmitter of this type is disclosed in patent to Turner *et al.*, No. 844,635. This patent, however, merely shows the general telephonic features of this transmitter as distinguished from its features more particularly related to its present purpose of use.

I provide a casing 1 having a comparatively sharp rim portion 2 which can be pressed against the skin over the heart so as to primarily make an air tight joint around this annular rim. This rim furthermore so stretches the skin into a kind of membrane or drumhead formation 3, as to render the skin capable of vibrating somewhat like a drumhead by virtue of the tap transmitted from the heart. This casing furthermore has a cavity 4 which is very shallow and of a form which will closely follow the curvature given to the skin, but without actually touching the latter. In this way there is an air pocket formed which is of comparatively large area, but small capacity. The result is that slight movements of the skin result in a comparatively large increase in pressure of the air in the cavity, as distinguished from a very small increase of pressure which would be the case if the cavity were not so small in its capacity. It must be borne in mind that these slow movements or vibrations are not like sound vibrations in the sense that they can be carried along by individual particle vibrations in the air. But the change of the air pressure produced by any skin movement will vary in proportion to the capacity. By the construction already described the air chamber is so small and at the same time so great in area, that there is a comparatively large increase of pres-

sure resulting from a faint heart beat. This increase of pressure is productive of a proportionate displacement of the diaphragm, as illustrated in the patent above referred to, and the corresponding movement of the extremely small carbon balls which are employed. During this movement of the carbon balls there is a slight sound audible in the receiver of the telephone circuit, and its intensity varies directly with the force and energy of the skin vibration which produces the sound. This is on account of the stretched condition of the skin and the expansive area and small capacity of the air cavity employed, all of which conditions tend to produce an ultimate movement among the carbon balls of the transmitter which is about proportionate to the intensity of the heart beat. This is of course the result desired. By it the energy of the heart can be plainly heard in its contractions and expansions, and on account of the magnification of sensitiveness the sound is similar to the sound of heavy pumping machinery in which, on account of the large size, there is a dull heavy sound by which a trained ear can tell much about the operation. The same thing is true of the heart with this stethoscope. I am aware that the actual sound heard is not really the sound of the heart, but merely a rubbing movement between very small carbon balls which is caused by movements of the heart. But the actual sound received is significant and shows the operations of the heart as well as if it was the actual sound of the heart. Of course, in addition to this there is the actual sound of the rushing blood which is transmitted to some degree on account of the sensitiveness of the dictograph transmitter.

The receiver 5 and stethoscope ear pieces 6 and battery 7 present no novel features. As a part of the stethoscope transmitter, however, I have provided a regulating resistance device 8 since it is found in practice that only certain current strengths give thoroughly satisfactory results, so delicate is the operation of this device on account of the great difficulty of the work to be performed.

After the instrument has been properly adjusted it of course produces electrical vibrations in the telephone circuit, which vibrations are capable of being recorded by a telegraphone or similar device, or are capable of being heard by a plurality of persons simultaneously, through separate receivers and stethoscope ear pieces. Thus, in the clinic where a patient is receiving an operation, and where it has hitherto been impossible for all or even any of the students to use the stethoscope, it is now possible by the present invention to have the whole class share in the full benefits of the operation throughout. Obviously, this result could not be had by any prior art devices because the patient's condition changes from moment to moment, and even if the students listened by turns at a single stethoscope, each would get a different result, and each result would be different from the one received by the instructor or operating physician. For the use of such clinics the switch 8 is particularly desirable, since it permits an adjustment of sensitiveness suitable to the number of receivers used.

What I claim is:—

1. A telephonic stethoscope comprising a transmitter having in combination with its diaphragm and electrode, a mouth-piece having a shallow cavity of relatively large area in the face thereof which is adapted to be placed against a portion of the body of the patient.

2. A telephonic stethoscope comprising a transmitter having in combination with its diaphragm and electrode, a mouth-piece consisting of a disk having a shallow saucer shaped cavity of relatively large area in the face thereof adapted to fit against a portion of the body of the patient, and a passage way leading from said cavity to the diaphragm exposing the latter to the variations of air pressure in said cavity.

Signed at Jamaica, in the county of Queens and State of New York, this 6th day of September, A. D. 1912.

KELLEY M. TURNER.

Witnesses:
EDGAR LOWE,
E. DOUGLAS DE GRUCHY.