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S. M. SHANE

2,904,033

BREATHING INDICATOR

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FIG. 1.

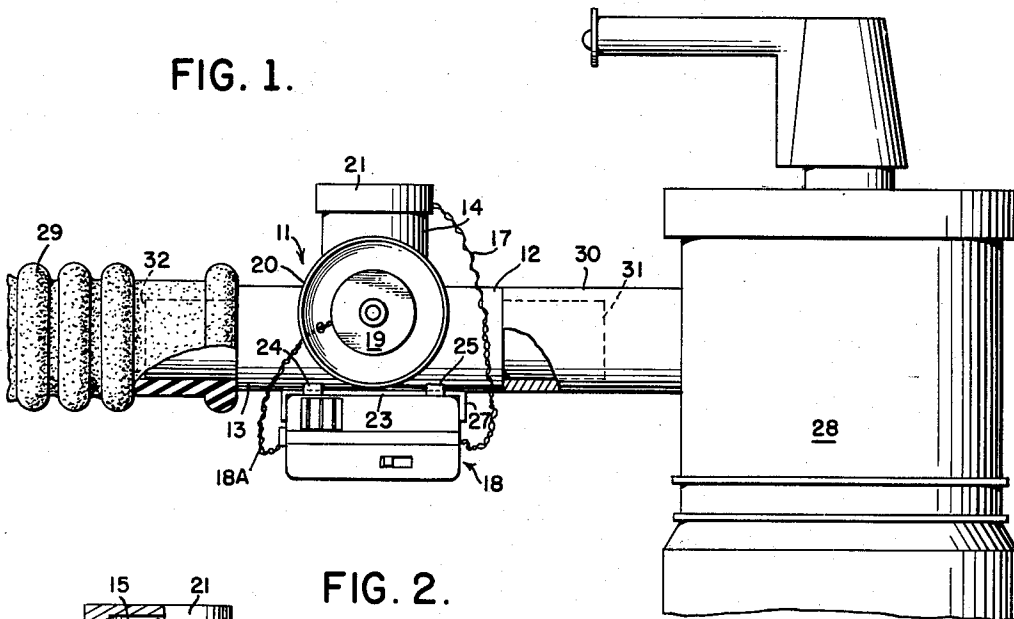


FIG. 2.

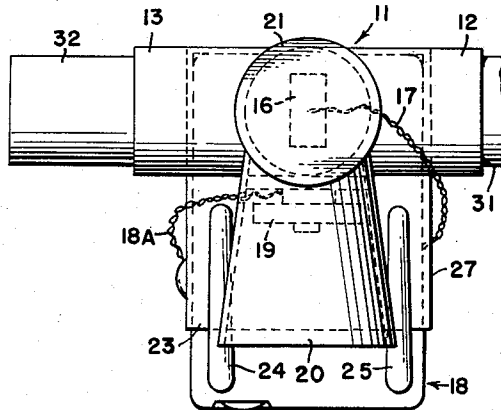
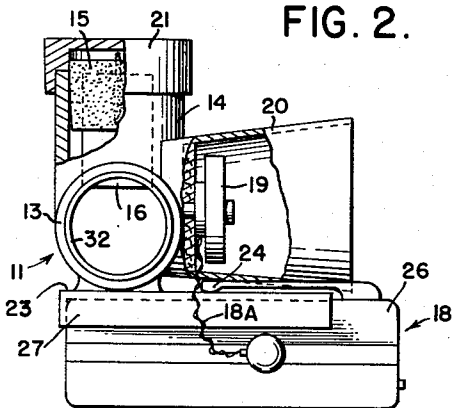


FIG. 3.

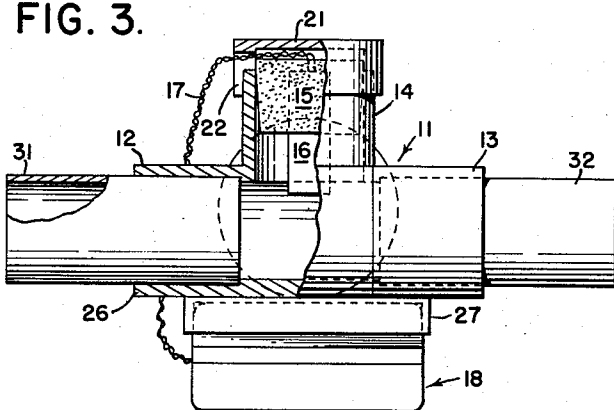


FIG. 4.

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2,904,033

BREATHING INDICATOR

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2 Claims. (Cl. 128-2)

This invention relates to breathing indicators and it is more particularly concerned with a device for use in an operating room in conjunction with the administration of anesthetics to indicate the breathing response of a patient undergoing surgery or other treatment.

The breathing characteristics of a patient undergoing surgery or other medical treatments is of importance to the surgeon and/or other members of a team administering to the patient. Certain breathing characteristics, for example, may indicate the requirement for collateral treatment or modifications of treatments being administered.

The breathing of a patient, however, is usually inaudible, or audible only to a limited degree. Also, a diversion of the attention of the surgeon or other member of a clinical team to visually observe the breathing response of the patient, cannot always be afforded or may be dangerous. Moreover, such visual observations lack sensitivity to a degree that makes it difficult to interpret readily the true respiratory condition of the patient.

Accordingly, one of the objects of this invention is the provision of a device which is highly sensitive to the breathing of a human and in which the breathing action can be interpreted either as a magnified sound from a loudspeaker or as a visual image on an oscilloscope, or by means of some other signaling device.

Another object of the invention is the provision of such a device which can be quickly attached to and be detached from conventional respiratory anesthesia equipment for use as needed.

A further object of the invention is the provision of such a device which can be sterilized and cleaned after each use to avoid transmission of contagious diseases among patients through the respiratory system, such as tuberculosis.

A still further object of the invention is the provision of such a device which does not interfere with or in any way obstruct or restrict a patient's breathing efforts and constitutes no breathing hazard to persons subjected to its use.

A still further object of the invention is the provision of such a device which does not contact the patient and hence does not interfere with any operations being performed.

These and other objects, advantages, and features of the invention will appear more fully from the following description, considered together with the accompanying drawing.

In the drawing:

Fig. 1 is a side elevational view of a portion of a respiratory anesthesia machine showing a front elevational view of an embodiment of the invention connected thereto and partly in section.

Fig. 2 is a side elevational view of the embodiment apart from the anesthesia machine, partly in section.

Fig. 3 is a rear elevational view of the embodiment.

Fig. 4 is a top plan view of the embodiment.

Referring with more particularity to the drawing in

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which like numerals designate like parts, the embodiment illustrated comprises a tubular member 11 of any suitable material, but preferably metal, such as brass, aluminum, copper, or metal alloys.

The tube 11 has three open branches 12, 13, and 14. One of these branches, say branch 14, is provided with a removable plug 15 of an electrical insulating material, such as cork, rubber or glass. The plug 15 fits tightly without leakage of air and on it there is mounted a highly sensitive electronic microphone 16 or other suitable device sensitive to velocity changes of respiration air passing through the member 11 between the other two branches 12 and 13. For this purpose, it has been found that any of the conventional pick-up microphones of electronic hearing aids that are in general use have the high degree of sensitivity needed for this purpose and are, therefore, suitable for use as the detecting member.

The microphone 16 should be so mounted as to project partway into the passage between the branches 12 and 13, so as to receive and be subjected to the effect of velocity changes of air gusts or surges therein caused by the respiration of the patient.

The microphone 16 is connected by electric wires 17 to a combined electronic amplifier and power pack unit 18 which in turn is electrically connected by wires 18A to a signaling device, such as a miniature loudspeaker 19. For this purpose, the earphones of any of the conventional electronic hearing aids in general use have been found to function satisfactorily. When such a miniature device is used, it is preferably mounted at the narrower closed end of a frusto-conical cup 20 which acts as a megaphone to further amplify the sounds, making it possible for them to be heard at remote distances, and clearly heard within the confines of even the largest of operating rooms.

The cup 20 may be secured directly to the tube 11, as shown, for convenience, or it may be located at any other place desired. The tube branch 14 is also provided with a removable cap 21 which fits over the end and is provided with a slot 22 or other opening for the wire 17.

The tube 11 is also provided with a mounting plate 23 which is firmly attached thereto by soldering, welding or otherwise. A pair of resilient cantilever clips 24 and 25 of the "fountain pen" type, are secured to the top of the casing 26 of the combined unit 18 and the plate 23 is slidably engaged between the clips and the casing, as shown, to removably connect the unit to the tube. The mounting plate 23 is provided with a skirt flange 27 on three sides which holds the two parts together against lateral slippage.

The tube branches 12 and 13 are adapted to be mounted in any passage where respiration air passes. For example, in the case of an anesthesia machine 28, having at least one air hose 29 connected to the face mask (not shown), the branches 12 and 13 may be interposed at any point in series with this air hose. The air hose is usually connected to the anesthesia machine by a nipple 30. Thus a convenient method of connecting the device into the system is to remove the hose 29 from the nipple 30, connect one of the branches 12 or 13, say the branch 12, directly or through an adapter 31 to the nipple 30, and then connect the other branch 13 directly or through another adapter 32 to the hose 29.

Anesthesia machines also usually have a return hose (not shown) from the face mask to carry exhaust or expiration air to the apparatus for reconditioning and recycling as an alternate to exhausting it directly to the atmosphere. When such recycling is used, the device of the present invention may be connected into this re-

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turn line hose as well as into the hose used as a feed line.

It is also to be understood that the invention is not limited to the use of audio signaling means, but may, where it is desired, be replaced by or augmented by a video signalling means, such as an oscilloscope or oscillograph (not shown).

Having thus described my invention, I claim:

1. The combination of an anesthesia machine having a passage through which respiration air being inhaled by a patient normally flows and a breathing indicator device, said device comprising a tubular unit removably inserted in said passage, said unit comprising a wall having an opening therethrough, a microphonic detector unit highly sensitive to velocity changes of air removably secured in said opening, said tubular unit and microphonic detector unit being structurally capable of sterilization as units and forming a complete noise barrier between the interior and exterior of the passage when the tubular unit is inserted in the passage, said microphonic detector unit being connected to an electric amplifier unit, said amplifier unit, in turn, being connected to an audible output signal device, said detector unit, amplifier and signal device being so designed as to constitute the indicator device as a whole highly sensitive to velocity changes of respiration air passing through the tubular unit, whereby signals indicating even slight variations of breathing of a patient, but free of environmental noise, are made constantly available in the audible form and whereby said tubular unit and detector unit may be readily removed for sterilization.

2. A breathing indicator device for attachment to an anesthesia machine, said machine having a passage through which respiration air being inhaled by a patient

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normally flows, said device comprising a tubular unit adapted for insertion in said passage, said unit comprising a wall having an opening therethrough, a highly sensitive microphonic detector unit sensitive to velocity changes of air removably secured in said opening, said tubular unit and microphonic detector unit being structurally capable of sterilization as units and forming a complete noise barrier between the interior and exterior of the passage when the tubular unit is inserted in the passage, said microphonic detector unit being connected to an electric amplifier unit, said amplifier unit, in turn, being connected to an audible output signal device, said detector unit, amplifier and signal device being so designed as to constitute the indicator device as a whole highly sensitive to velocity changes of respiration air passing through the tubular unit, whereby signals indicating even slight variations of breathing of a patient, but free of environmental noise, are made constantly available in the audible form and whereby said tubular unit and detector unit may be readily removed for sterilization.

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