RESPIRATION-SIGNALLING DEVICE

This invention pertains to respiration monitoring and/or detecting devices, and in particular to a novel respiration-signalling device.

In the prior art there are available respiration monitoring devices which are used with a bed-ridden patient to insure that the patient is manifesting normal breathing. However, what has been a long-sought need is a monitoring device which can signal respiration of a patient during transportation from an operating room to a recovery room; i.e., a portable, patient-worn respiration-signalling device for monitoring the patient's breathing.

Additionally, there is a need for a respiration-signalling device which can efficiently detect airflow in the trachea to positively locate the trachea for guiding an intubation tube for anesthesia.

It is an object of this invention to set forth a respiration-signalling device which meets the aforesaid needs.

Particularly, it is an object of this invention to set forth a respiration-signalling device comprising a housing; means coupled to said housing for admitting breath into said housing and discharging breath out of said housing; a sensory component coupled to said housing, and electrically-operative, for signalling respiration; electrically-operative means, coupled to said component, and responsive to respiration for operating said component; and a source of electrical potential coupled to said component-operating means for effecting operation thereof.

It is further an object of this invention to disclose a respiration-signalling device comprising a face mask; means for admitting breath into, and for discharging breath out of, said mask; first and second sensory components, coupled to said housing and electrically-operative, for signalling inspiration and expiration, respectively; first and second electrically-operative means, coupled to said first and second components, respectively, for operating said components; and a source of electrical potential coupled to both said first and second component-operating means for effecting operation thereof.

Further objects of this invention, as well as the novel features thereof, will become more apparent by reference to the following description, taken in conjunction with the accompanying figures, in which:

FIG. 1 is a perspective illustration of a first embodiment of the invention which takes the form of a face mask;

FIG. 2 is a depiction of the face mask of FIG. 1 in place on a patient during transport of the patient from surgery, or the like, to a recovery room;

FIG. 3 is a block diagram of the circuitry of the first embodiment of the invention;

FIG. 4 is a perspective illustration of a second embodiment of the invention which takes the form of a trachea-locating handled probe;

FIG. 4A is a fragmentary view, considerably enlarged, of the end of the probe to show the air passages formed therein;

FIG. 5 is an illustration of the second embodiment of the invention set upon a battery charger when not in use;

FIG. 6 is a block diagram of the circuitry of the second embodiment of the invention;

FIG. 7 is a perspective depiction of an embodiment of the novel respiration-signalling device for use with standard anesthesia equipment; and

FIG. 8 depicts the embodiment of FIG. 7 in association with an intubation tube and anesthesia and oxygen tubes.

As shown in FIGS. 1-3, the first embodiment of the respiration-signalling device **10** comprises a face mask **12** having straps **14** for affixing thereof to the face of a patient **16**. The mask **12** has a circuitry enclosure **18** for housing therewithin electrical components of the device. Enclosure **18** has a pair of lenses **20** behind which are light-emitting diodes **22** and **24** for evidencing normal breathing, as will be explained in the ensuing text. Too, the enclosure **18** has a louver **26** set over a buzzer **28** (therein) which will signal the cessation of breathing. At and end of the enclosure **18**, supported on projecting lobes **30**, are a pair of respiration openings **32**, the latter having screens **34** fixed thereon.

The enclosure **18** contains a battery **36** which provides the electrical power for the device **10**. An inspiration or inhale sensor **38**, and an expiration or exhale sensor **40**, each comprising a thermistor are coupled to the battery **36**. The thermistor sensors **38** and **40** are heated to a stable level by current flowing through resistors **42** interposed between the sensors and the battery **36**. Sensors **38** and **40** are independently coupled to voltage amplifiers **44** and **46**. The latter, sequentially, are coupled to signal comparators **48** and **50**. A threshold or reference level of potential is supplied to the comparators **48** and **50** by a common connection **52** via a potentiometer **54** which is coupled to the battery **36**. Consequently, differential signals illuminate the diodes **22** and **24**. Sensors **38** and **40** are heated, to achieve the aforesaid stable level, to a temperature above that of the patient's ingested and exhaled breath, and are disposed, within the mask **12**, for the passage of the patient's breathing thereacross. Sensor **38** is cooled, then, by the inhaled air, and sensor **40** is cooled by the exhaled air or breath. As a result, all the while that the patient is being transported, and experiencing normal breathing, the diodes **22** and **24** illuminate in proper sequence. The potentiometer **54** accommodates for the adjustment of the device **10** for heavy or shallow breathing. Of course, if there is a cessation of breathing, the diodes will fail to illuminate, and the buzzer **28** will sound to alert medical personnel to institute remedial action.

The buzzer **28** is activated by a timer **56** which receives signal outputs from lines **58** and **60**, respectively, joined to diodes **22** and **24**. The timer **56** monitors the breathing cycle as well, and has a pre-set response time, for example: five seconds. Hence, if either output, from lines **58** and **60**, is absent for over five seconds, the timer **56** will operate to power the buzzer **28** and/or a communications interface **62** for signalling an external alarm device such as may be located in a nurses station, for instance.

An alternate embodiment **64** of a respiration-signalling device, depicted in FIGS. 4, 4A, 5 and 6, serves as a tracheal locating device. It comprises a handle **66** in which are confined the operating circuitry components. A projecting end **68** latchingly receives a tubular probe **70**. One probe **70** is shown latched to the handle **66**, and another is shown in isolation for purposes of clarity of perception. The remote end **72** of the probe **70** has a void **74** formed therein and a plurality of air guides **76** which define narrowed, venturi-like trackways **78** for inducing acceleration of respiration therethrough. Con-