

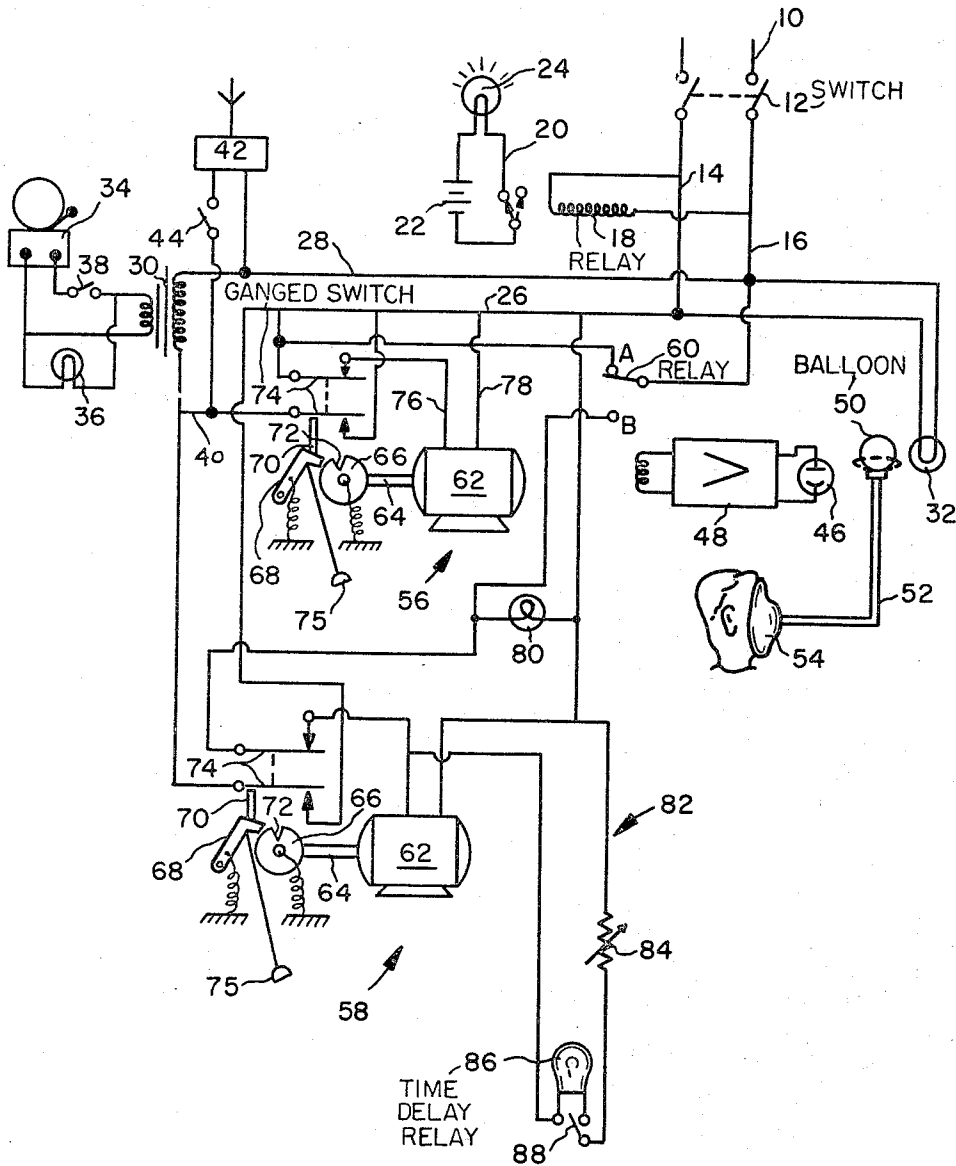
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RESPIRATION MONITOR

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RESPIRATION MONITOR

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ABSTRACT OF THE DISCLOSURE

A respiration monitor to signal by means of an alarm the stoppage of breathing of a patient. The alarm system has both visual and audible means and incorporates an inflatable-deflatable device with photo-electric cells and time delay relays.

This invention relates to a device for monitoring a patient's breathing and activating an audio and visual alarm upon the stoppage of breathing for a predetermined period. In addition, the device incorporates an alarm which will indicate when there is an obstruction in the patient's airway.

It is an object of the present invention to provide an inflatable-deflatable device with a photo-electric cell and time delay relays so constructed and arranged that the result sought for above is achieved with relatively few operating parts.

It is a further object of the present invention to provide a radio transmitter which will send out a signal upon the ceasing or impairment of the patient's breathing whereby a radio receiver will pick up the signal and warn the party charged with the responsibility of watching the patient of the patient's condition.

Another object of the present invention is to provide a relay-operated switch which, when electric power fails, activates a battery operated alarm.

A further object of the present invention is to provide a sensitive respiration monitor which is instant acting and is relatively simple and inexpensive to construct, and is reliably effective for the purpose intended.

The invention will now be described more fully with reference to the accompanying drawing which is a schematic diagram of the respiration monitor constructed in accordance with the teachings of the present invention.

The power source 10 is preferably 117 volt A.C. which is provided with a double throw switch 12 in the lines 14 and 16 in order to interrupt the power supply when the operator considers this necessary. In addition, a relay 18 is connected across the lines 14 and 16. The relay maintains the auxiliary circuit 20 in an open position as shown in dotted lines when there is current flowing in power lines 14 and 16, however when power fails and there is no current in lines 14 and 16 the relay will assume the full line position completing the auxiliary circuit 20 and permitting the battery 22 to supply D.C. current to the warning light 24.

The lines 14 and 16 are connected to lines 26 and 28 which in turn are connected to a step-down transformer 30 and also a light source 32. The step-down transformer is stepped down to 6-10 volts and is provided with a buzzer or bell 34 and a light 36 arranged in a parallel circuit. The parallel circuit for the bell 34 is provided with a switch 38 for interrupting the bell warning sound when it is desired to use only the light 36 as a warning signal.

Connected across the power lines 28 and 40 is a radio transmitter 42 which may be utilized in conjunction with a radio receiver (not shown) to send a radio signal to the person charged with responsibility for the patient to thereby warn him of difficulties in the patient's respiration. In that event the person preferably carries a

pocket receiver to receive the aforesaid signal. A switch 44 in the circuit enables one to interrupt the transmission of the radio signal if so desired.

The circuit incorporates a photo-electric cell 46 having an amplifier 48. Located between the light source 32 and the photo-electric cell 46 is an inflatable-deflatable device 50 in the form of a balloon or bellows. The inflatable-deflatable balloon is responsive to the patient's breathing since it is connected through an airway 52 in the form of a pipe to a mechanical respirator face mask 54; or in the alternative to a nasal cannulae or a catheter applied to the patient's nostrils. The balloon 50 will operate on approximately 0.5 centimeter of water pressure and is extremely sensitive so that the respiration monitor is an instant-acting device. Naturally, when the balloon 50 is deflated to its dotted line position light from light source 32 will impinge on the photo-electric cell and if the balloon remains deflated over the pre-set period on the time delay relays these units will commence to function as fully explained hereinafter. Thus, two time delay relays indicated generally by the reference numerals 56 and 58 respectively are electrically connected to the amplifier 48 of photo-electric cell 46. The relay 60 has its arm in either the A or B position at any given moment while the inflatable-deflatable balloon 50 is in operation. If the arm is in the A position the time delay relay 56 is in operation while time delay relay 58 is inoperative. However, if the arm is in the B position the time delay relay 58 is in operation while the time delay relay 56 is inoperative. Each time delay relay 56 and 58 includes a motor 62, a camshaft 64 and a cam 66. Also, each pawl 68 is provided with an upstanding projection 70. The cam 66 has a peripheral notch 72. In addition, each pawl 68 has a release button 75 for manually releasing the pawl 68 from its corresponding notch 72. Relay 56 is furthermore provided with a ganged switch 74 which in its "up" position permits current from power line 10 to flow through lines 76 and 78 to the motor 62. However, when the pre-set period is exceeded on the time delay relay 56 (for example 15 secs.) the pawl 68 drops into the corresponding notch 72 of the ganged switch 74 and the latter is in its "down" position with a voltage being placed across the transformer 30 which in turn places a voltage across the turns 37 of the transformer 30 and causes the buzzer 34 and the light 36 to sound the warning. Time delay relay 58 operates in the same manner as that explained above in connection with time delay relay 56. Light 80 in the circuit of relay 58 indicates inspiration of the patient and should be lit continually while the patient is breathing.

An auxiliary time delay circuit is referred to generally by the reference numeral 82 and comprises a variable rheostat 84 and a tube type time delay relay 86 such as an amperite tube, the latter being a heater-actuated time delay thermostatic relay operating on the thermal heat principle with a 10 second delay time. The tube 86 is provided with contacts 88 that are normally open. The rheostat 84 is adjusted to the patient's rate of respiration so that rapid breathing in the patient may be detected to monitor any obstruction in the patient's airway 52 by means of the contacts 88 closing and the tube 86 flashing a signal to the operator.

It should be noted that the time delay relays will function also when the balloon 50 remains inflated over a pre-set period. Thus, a prolonged deflation or inflation of the balloon 50 will activate the alarm system in the present construction.

It should be apparent, therefore that the present invention is a respiration monitor that warns the operator of the stoppage of the patient's breathing as well as visually indicated obstructions which might exist in the patient's airway.

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While I have shown and described the preferred embodiment of my invention, it will be understood that the latter may be embodied otherwise than as herein specifically illustrated or described and that in the illustrated embodiment certain changes in the details of construction and in the arrangement of parts may be made without departing from the underlying idea or principle of the invention within the scope of the appended claims.

What I claim is:

1. A respiration monitor comprising a power source, a light source and a photo-electric cell connected to said power source, a time delay relay also connected to said power source, a breathing airway adapted to be operatively connected to a patient, an inflatable-deflatable device secured to and in communication with one end of said airway and located in the path of the light from said light source to said photo-electric cell, said time delay relay being operatively connected to said amplifier, an alarm indicator operatively connected to said delay relay, said time delay relay having a motor provided with a rotatable shaft, a notched cam mounted on said motor shaft, a pawl provided with a projection thereon, a switch operatively connected to said alarm indicator and being controlled by said projection, said pawl when engaged in the notch of said cam causing the projection thereon to close said switch and activate said alarm indicator, said pawl being engaged in said notch only when

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said device remains deflated or inflated over a predetermined period of time.

2. A respiration monitor as set forth in claim 1 wherein said alarm indicator constitutes both a visual and audio alarm, the latter being provided with a switch in order to open the audio alarm circuit when desired.

3. A respiration monitor as set forth in claim 1 wherein said alarm indicator is a radio transmitter.

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