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SWITCH AND ALARM DEVICE EMBODYING THE SAME
FOR USE IN A ROCKING BED OR THE LIKE
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Fig. 2

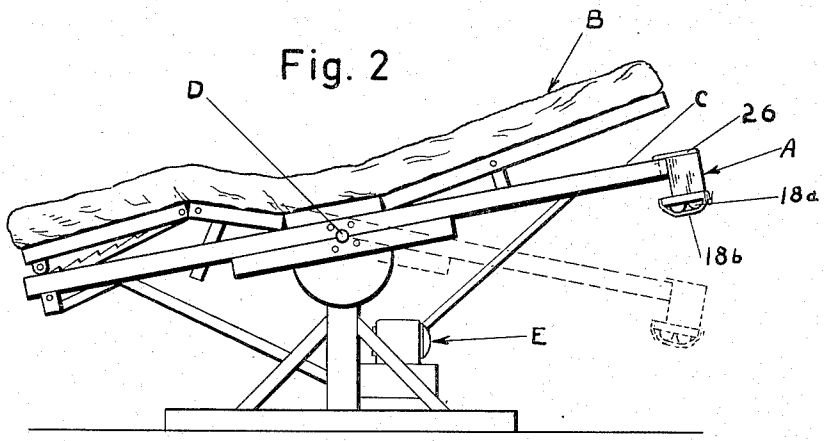


Fig. 3

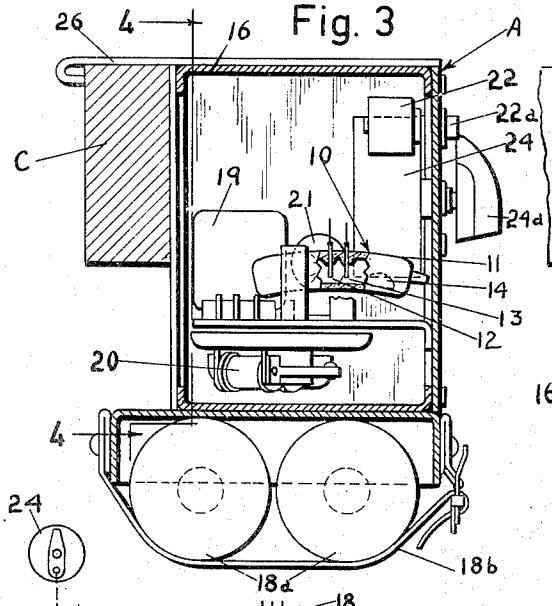
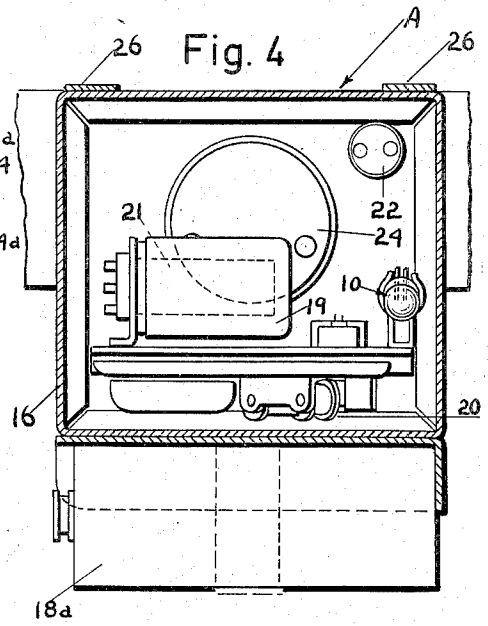


Fig. 4



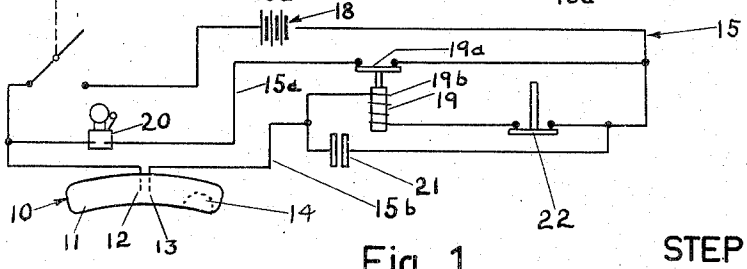


Fig. 1

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SWITCH AND ALARM DEVICE EMBODYING THE SAME FOR USE IN A ROCKING BED OR THE LIKE

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9 Claims. (Cl. 340—267)

The present invention relates to a switch which is responsive to rocking motion to close an electric circuit momentarily when the switch is rocked and also to an alarm which includes the novel switch in one of a pair of interconnected electric circuits therein and which is responsive to the cessation of a rocking motion to actuate a signal, such as an electrically operated bell.

The present invention is particularly adapted to provide an alarm for a rocking bed, such as is used for patients recovering from polio and having impaired breathing capacities. In this type of treatment the rocking motion of the bed and the force of gravity aid the patient in breathing when he is unable to breathe naturally without such aid. For example, rocking beds are used with polio patients who have been treated in tank respirators during periods when their muscles have regained some strength but not enough so that they can breathe independently for any appreciable time. When used on such a patient if the bed stops rocking for any substantial period, the patient, being unable to breathe independently of the aid afforded by the bed, will die. Therefore, it is desirable that an alarm be provided which will automatically immediately call assistance if the bed stops rocking for a predetermined period of time.

While the possibility that a rocking bed will fail to continue to operate may be remote, the consequence of its failure is so great that it is extremely desirable to have the cessation of the rocking motion noticed immediately so that the bed may be put back in operation or the patient returned to a respirator before it is too late. Another advantage which results from the provision of an alarm is that the alarm relieves the fear which a patient has that the bed will stop rocking and that he will be left in helpless condition, unable to breathe and hence unable to call for help.

While the construction and operation of the switch and alarm devices of the present invention are shown and described herein in connection with a rocking bed for the purpose of illustration, it will be appreciated that they may be used for other purposes without departing from the spirit of the present invention.

When the alarm of the present invention is used with a rocking bed it may be operated by batteries so that it is not dependent on the electric power supply which is usully used to operate the bed rocking mechanism. The components of the circuits of the alarm are adapted to cause the signalling device to be operated when the batteries become weak, even though the alarm is otherwise in operative condition and the bed is being rocked. This eliminates the danger of the batteries becoming too weak to operate the signalling device without being noticed.

In the preferred embodiment of the invention the circuits of the alarm include a test switch which is arranged to test the circuits and the components, including the test switch itself.

An object of this invention is to provide a novel switch having contacts which are momentarily closed upon rocking the switch.

A further object is to provide such a switch which is economical to manufacture and is reliable in use.

Further objects are to provide a novel and efficient alarm for use on a rocking bed, the signalling device of which is automatically actuated when the rocking of the bed is discontinued for a predetermined interval of time, to provide such an alarm the operativeness of which may be readily tested, and which may be temporarily made inoperative for a predetermined period of time while the patient is being cared for, but which will automatically be returned to operative condition upon the expiration of said period.

A further object is to provide such an alarm which is economical to manufacture and which is reliable in use.

Further objects and advantages of the present invention will be apparent from the following description and accompanying drawings in which:

Fig. 1 is a wiring diagram of the circuits of the alarm of the present invention, including a view in side elevation of a switch embodying the present invention;

Fig. 2 is a side elevation of a rocking bed showing an alarm embodying the present invention attached to one end of the bed;

Fig. 3 is a vertical longitudinal section of the alarm of Fig. 2 taken just inside the front side of the case of the alarm and showing a switch embodying the present invention and the component parts of the circuit; and

Fig. 4 is a section on the lines 4—4 of Fig. 3.

The switch **10** of the present invention comprises a sealed tube **11** made of any material which is a non-conductor of electricity, such as glass. A pair of spaced contacts **12** and **13** project part way into the tube **11** at the central portion thereof and a globule **14** of mercury inside the tube flows back and forth longitudinally of the tube when the tube is rocked end for end. When the globule **14** of mercury flows from one end of the tube to the other it momentraily contacts both of the contacts **12** and **13** as it passes the central portion of the tube **11** and thus momentarily closes a circuit in which the contacts are connected.

As shown, the tube **11** is formed in a generally arcuate shape with the ends below the central portion when the tube is in the level position of Figs. 1, 3 and 4, and the globule **14** of mercury is small enough so that it does not engage both contacts **12** and **13** when the tube is at rest, either in said level position or in any other stationary position. A suitable material is added to the mercury so that it will continue to remain in single globule form and will not separate into smaller globules as it flows back and forth from end to end of the tube.

The alarm is indicated generally by the letter A and it comprises an electric circuit **15** (Fig. 1), which, except for the batteries, is enclosed in the case **16**. The circuit **15** comprises two interconnected circuits **15***a* and **15***b*. The switch **10** is connected in the circuit **15***b* and controls the operation of the signalling device **20**, in the manner described hereafter.

The circuits **15***a* and **15***b* may be connected to a single source of electricity, which in the preferred embodiment is a battery **18** consisting of the two dry cells **18***a*. The circuit **15***a* is opened and closed by a normally closed relay **19**, which has a primary circuit **19***a* connected in the circuit **15***a* and a secondary circuit **19***b* connected in the circuit **15***b*. Thus the relay **19** opens the circuit **15***a* when current flows through the circuit **15***b* and closes the circuit **15***a* when no current flows through the circuit **15***b*. Connected in the circuit **15***a* is an electric bell **20** which is caused to ring by closing the circuit **15***a* and which thus indicates that no current is flowing through the circuit **15***b*. Instead of a bell the signalling device may be a visual signal located at the alert desk of a

hospital which, like the bell, is operated when the relay 19 closes the circuit 15a.

The switch 10 is connected in the circuit 15b and it functions to close the circuit 15b momentarily at regular intervals of a few seconds when the switch 10 is rocked at a regular rate. A condenser 21 is also connected in the circuit 15b and the primary circuit 19b of the relay 19 is connected between the terminals of the condenser.

Each time the switch 10 closes the circuit 15b momentarily, the condenser 21 becomes charged sufficiently to maintain a flow of current through the primary circuit 19b of the relay for a few seconds until the condenser is recharged by the next momentary closure of the circuit 15b by the switch 10. Thus the relay 19 is operated to maintain the circuit 15a open and to prevent actuating of the signalling device 20 as long as the switch 10 is rocked at a predetermined rate. When rocking of the switch is discontinued for a sufficient time interval, the condenser 21 discharges completely, the relay 19 closes the circuit 15a and the signalling device is actuated to indicate that the rocking has stopped and to cause an attendant to come to the patient.

In the preferred embodiment, a test switch 22, which may be a normally closed push button switch, is connected in the circuit 15b between the condenser 21 and the side of the primary circuit 19b opposite the side which is connected to the switch 10.

A normally closed time switch 24 is connected in the circuit 15 adjacent to the battery 18 in order to be able to open both the circuits 15a and 15b and to prevent the actuation of the signalling device 20 for a predetermined number of seconds. For example, when the alarm is used on a rocking bed, it may be necessary to stop the bed for a few seconds to adjust the bed or for some other reason. When the bed is stopped, the time switch is set to open the circuit 15 for the period of time required. After this time interval has elapsed, the switch 24 is automatically closed and the circuits are then reconnected to the battery 18 or other source of power. Use of such a time switch prevents leaving the switch 24 open.

It will be appreciated however that the time switch 24 may be eliminated from the circuit 15 without departing from the spirit of this invention.

When the bed is not in use, the circuits 15a and 15b are opened to shut off the alarm, preferably by disconnecting one terminal of the battery 18.

In Fig. 2 the alarm A is shown as it is used on the rocking bed B. The frame member C of the rocking bed is mounted to be rocked about the horizontal axis D by any suitable connection to the motor E. The frame C is thus periodically rocked from the position indicated in full lines to the position indicated in dash lines, and the alarm A is attached to the frame in such a manner that the tube 11 of the switch 10 is rocked end for end by this rocking movement of the bed.

Referring to Figs. 3 and 4, the pair of clamps 26 are attached to the top of the case 16 and they have projecting ends which are detachably secured to the frame C. At one side of the case 16 a push button 22a, which operates the test switch 22, extends outwardly from the case, where it is conveniently positioned for the attendant. The knob 24a is attached to the shaft of the spring operated time switch 24 and it is similarly attached on the control side of the case. The two dry cells 18a are detachably secured to the bottom of the case 16 by the strap 18b.

In the operation of the alarm the battery 18 is connected into the circuit by connecting the wires to its terminals and by leaving the time switch 24 closed. As the alarm device A is rocked by the motor E, the globule of mercury 14 in the switch 10 makes a periodic momentary connection between the contacts 12 and 13 of the switch as the globule flows from one end to the opposite end of the tube 11. Making this connection closes the circuit 15b and charges the condenser 21, causing the relay 19 to maintain the circuit 15a open so that the bell 20 will not ring. The capacity of the condenser is determined by the length of time the circuit 15b remains open during each normal rocking motion of the switch 10 and by the maximum number of seconds after the switch has stopped rocking before it is desired to have the signalling device 20 actuated.

Accordingly, condensers of different capacities may be used to adapt the alarm device for rocking motions of different amounts and different speeds. However, when the device A is to be used with a usual type rocking bed, as described above, a condenser having a capacity of 1000 microfarads operates effectively.

In practice a signalling device 20 is provided which is actuated by a less voltage than the relay 19. In this way the signalling device 20 will be actuated when the batteries become too weak to operate the relay 19 and thus it indicates that the batteries need to be replaced. It will be appreciated that this is a valuable safety feature when the alarm is used in connection with a rocking bed wherein the failure of the alarm might cause the death of a patient.

The test switch 22 provides means to test the circuits and the components of the alarm, including the test switch itself. When open the test switch 22 opens the primary circuit 19b of the relay. If the relay is in proper working order the relay will then close the circuit 15a and the bell 20 will ring, providing the wiring, the bell and the battery 18 are in working condition.

The time switch 24 is tested by opening it with the test switch 22 open. Then, when the time switch 24 closes, the bell will ring if the wiring, the bell 20, the time switch 24 and the batteries 18 are in working order.

If the above tests are satisfactory, it indicates that the battery 18, the circuit 15a and the primary and secondary circuits 19b and 19a of the relay 19 are in working condition. Then with the test switch 22 closed the alarm is rocked and then stopped to determine if the switch 10 and condenser 21 are functioning properly.

It will be appreciated that the switch 10 and alarm device A of the present invention may be used for purposes other than the purpose illustrated herein and that variations in the disclosed structure and arrangement may be made without departing from the spirit or scope of the present invention.

I claim:

1. An alarm device comprising means responsive to the cessation of a rocking motion of a rocking bed to energize an electrically actuated signalling device comprising first and second electric circuits, said first circuit having connected therein an electrically actuated signalling device and the secondary circuit of a normally closed relay, said second circuit having connected therein a condenser and the primary circuit of said relay, said primary circuit of said relay and said condenser being connected in parallel, and means responsive to any cessation of rocking motion by said rocking bed to open said second circuit, whereby the relay closes said first circuit and energizes said signalling device, said last mentioned means including means responsive to each of said rocking motions of said rocking bed to close said second circuit momentarily.

2. An alarm according to claim 1 in which a single source of electricity is connected to both the first and second circuits and in which the said signalling device is actuated by less voltage than said relay.

3. An alarm according to claim 1 in which a normally closed testing switch is connected in said second circuit between the primary circuit of the relay and the condenser at the side of the primary circuit which is opposite to the side thereof which is connected to said rocking switch.

4. An alarm according to claim 1 in which a normally

closed time switch is connected in said first circuit thereby to provide means for preventing actuation of the signalling device for a predetermined length of time.

5. A device comprising means responsive to the cessation of rocking motion of a rocking bed to energize an electrically actuated signalling device comprising first and second electric circuits, said first circuit having connected therein an electrically actuated signalling device, and the secondary circuit of a normally closed relay, said second circuit having connected therein a condenser and the primary circuit of said relay, said primary circuit of said relay and said condenser being connected in parallel and means responsive to any cessation of rocking motion of said rocking bed to open said second circuit, whereby the relay closes said first circuit and energizes said signalling device, said last mentioned means including a rocking switch comprising a tube sealed at the ends, a pair of spaced contacts projecting into the tube intermediate its ends, and a globule of electrically conductive liquid in the tube, said globule momentarily closing the space between said contacts as the liquid flows from one end of the tube to the other when the tube is rocked.

6. A device according to claim 5 in which a single source of electricity is connected to both the first and second circuits and in which the said signalling device is actuated by less voltage than said relay.

7. A device according to claim 5 in which a normally closed testing switch is connected in said second circuit between the primary circuit of the relay and the condenser at the side of the primary circuit which is opposite to the side thereof which is connected to said rocking switch.

8. A device according to claim 5 in which a normally closed time switch is connected in said first circuit thereby to provide means for preventing actuation of the signalling device for a predetermined length of time.

9. A device according to claim 5 in which said tube is of generally arcuate shape when viewed from the side and said contacts project into the interior thereof.

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