ABSTRACT

Apparatus is provided for alerting nurses that a patient is attempting to leave his bed, comprising members having a fluid filled passageway therein which can be attached to the top of the side rails and footboard of a bed. The members are coupled via lines to transducers which activate an alarm when a predetermined volume of fluid is displaced.

13 Claims, 7 Drawing Figures
BED GUARD SYSTEM

BACKGROUND OF THE INVENTION

Patients in hospitals often sustain injuries while attempting to leave their beds. This is especially true of patients who are either heavily sedated, as, for example, after an operation, or whose mental faculties are impaired. Presently hospital beds have side rails thereon to prevent a patient from falling out or easily leaving his bed. However, it is not that difficult to climb over the side rails and get out of bed or alternatively climb over the footboard. Restraining straps which are uncomfortable and psychologically depressive and nets which are cumbersome and awkward to both patient and nurses are currently in use to restrain a patient.

The prior art has suggested the use of switches coupled to the side rails wherein pressure on the side rails will cause a contact to close, sounding an alarm and signifying that a person is applying pressure to the side rails. This type of arrangement is troublesome from a safety viewpoint in that if fingers get near the contact, they could be pinched and, furthermore, this system requires electrical potentials to be brought within reach of the person, which is undesirable. Also, no notice is given that the person is going over the footboard. Further, this system may be subject to alteration to be made to the modern hospital bed. Another analogous system is an inflatable pad with alarm wherein the pad is placed under the user and connected to a pressure switch to activate an alarm. In this type of system, the lack of pressure is detected and activates the alarm. The disadvantage to this system for bedridden patients is that detection may not occur until the patient has left the bed, which may be too late to prevent injuries.

SUMMARY OF THE INVENTION

Accordingly, it is an object of this invention to provide apparatus which will alert others that a person in a bed is attempting to leave same.

It is another object of this invention to provide apparatus for sounding an alarm when a patient leaves his bed wherein the apparatus does not require the patient to come in contact with any electricity carrying elements.

It is a further object of this invention to provide apparatus having a fluid therein which fluid will be displaced when a patient attempts to leave his bed and will cause the actuation of an alarm.

It is yet another object of this invention to provide a bed guard system with sensitivity adjustment.

It is a still further object of this invention to provide a bed guard system which can be connected into present nurse call systems.

In accordance with one embodiment of the invention, a fluid carrying member is attached to the top of each side rail and footboard of a bed and connected to transducers by tubing. Each transducer employs a bellows which expands when fluid is forced into it, and the bellows expansion makes contact with and moves a trip arm to actuate an alarm. The alarm is actuated only when a predetermined amount of fluid is displaced by, for example, a patient applying sufficient force on one of the fluid carrying members.

BRIEF DESCRIPTION OF THE DRAWINGS

The above-mentioned and other features and objects of this invention will become more apparent by refer-
serted in the fluid coupling line to filter out transient type contacts to the bed rail detectors that might cause a false alarm. The bellows are contained within a box 52. Arranged above the bellows 48 is a trip arm 54 which is pivotally mounted in box 52 at point 56. Trip arm 54 is also pivotally mounted at point 58 in a plate 60 which divides box 52 into two compartments. Trip arm 54 is connected to a toggle arm 62.

Toggle arm 62 has a pin 64 connected thereto. A spring 66 is connected between pin 64 and a pin 68 on a sensitivity adjust arm 70. Sensitivity adjust arm 70 is pivotally mounted via a pin 72 to plate 60. The closest portion of sensitivity adjust arm 70 is mounted in a detent (not shown) on the front plate of box 52. Preferably, there are a number of detents on the front plate, and, thus, to alter the sensitivity required to trip the toggle arm 62 the user merely changes in which detent arm 70 is placed. This feature is desired since different size people will displace different amounts of fluid in the lines and it is not desirable that a false alarm be given when a person merely rests his hand on a detector or grips one of the detectors with one hand.

Trip arm 54 is reset by a reset button 74 which presses the trip arm 54 against the top portions of bellows 48. Reset button 74 can be spring loaded, if desired, to return it to its set position. As fluid is displaced from any of the bed guard rail detectors 10–14, one or more of the bellows 48 is caused to expand pushing up the trip arm 54 until it reaches the trip point of toggle arm 62 whereupon toggle arm 62 makes contact with contact pins 76 on a contact board 77.

Contact pins 76 are electrically connected to a pair of standoffs 78 and 79. One contact 81 of a toggle switch 80 is connected to standoff 78. Standoff 79 is connected to a contact 82 of a jack 86. A second contact 83 of jack 86 is connected to a second contact 85 of switch 80. The cord 34 is also connected to contacts 82 and 83. Cord 34 has a plug 84 at the other end thereof. Plug 84, which is at the end of the bed guard system output cord, is inserted in the normal patient call button jack in the wall patient call-box 38. The normal patient call button 40 is applied to jack 86 in the box 52 so that the bed guard system can be used in the bed guard mode and patient call mode, simultaneously. Switch 80 permits the bed guard system to be disabled and yet permit the patient call button to be still used. In other applications where there is no patient call box, the contacts can be used to actuate an alarm (not shown).

Operation of the system occurs when switch 80 is switched to the "enable" position and reset button 74 is depressed. The system is thus armed. As a patient tries to get over a side rail or footboard, he exerts enough pressure on the detector to force sufficient fluid into one of the bellows 48. As the bellows extends, trip arm 54 turns up and toggle arm moves toward contact board 77. At a certain position determined by sensitivity adjust arm 70, toggle action due to spring force from spring 66 takes over and snaps toggle arm 62 against contact pins 76 which sets off an alarm. Simultaneously, as toggle action occurs, the trip arm's upward movement forces the reset button to the uncocked position.

FIGS. 4A and 4B illustrate an alternate transducer which may be used in place of the bellows 48 in the bed guard control unit and comprises a housing 88 containing a rolling diaphragm 90. A rolling diaphragm is illustrated in FIG. 4B and it is inserted in the inverted position of the housing 88. A piston 92 sits in the rolling diaphragm 90. Fluid from a bed guard rail detector is applied to an inlet 94. The reason for using a rolling diaphragm rather than a conventional diaphragm is to get large displacement. On conventional diaphragms only minimal displacement can be obtained, wherein with a rolling type diaphragm displacement on the order of four tenths of an inch can be obtained. Applying fluid to the diaphragm 90 will cause piston 92 to move upward and cause trip arm 54 (FIG. 3), to be rotated as described hereinbefore. Piston 92 can be spring loaded, if desired.

In an alternate embodiment rather than merely making contact when sufficient displacement is achieved, a rotating cam can be used to provide a coded alarm which would be different from a mere patient's call and, therefore, promote a much quicker response from the listener. A control unit 100 of this type is illustrated in FIGS. 5A and 5B.

Control unit 100 comprises a number of transducers 102 arranged in a housing 101. In this embodiment rolling diaphragm pressure responsive transducers as previously described in FIG. 4 are used. Bed guard rail detectors are coupled to the inputs 104 of transducers 102. The system is set by providing counterclockwise rotation to a reset arm 104; that is, reset arm 104 is pressed down to reset the system. Reset arm 104 has a contact cam 106 and a reset arm extension 108 thereon. When reset arm 104 reaches the reset position (the position shown in the drawing), reset arm extension 108 engages a toggle arm 110, as shown. Toggle arm 110 pivots about a point 112 and is further coupled to housing 101 by way of a latch spring 114. When the reset arm 104 is pushed down, it is carried past center and pushes a trip arm 116 to its set position against the piston rods 118 of transducers 102. When the reset arm 104 is released after being reset, it will return to its center position, as shown in the drawing, being stopped thereby by latch spring 114. Also, when the reset arm is pushed down, a piston rod 120 of a timer 122 will fall down onto the reset arm setting timer 122, which is a pneumatic timer filled with air. Reset arm 104 also pulls down a power spring 124.

The control unit also contains a toggle arm 126, a toggle spring 128, and a sensitivity adjust arm 130, as in the embodiment of FIG. 3. Also as in the embodiment of FIG. 3, sensitivity adjust arm has a number of positions and is mounted in detents in the front plate of the control unit (not shown).

As fluid is displaced from any of the bed guard rail detectors 10–14, one or more of the transducers 102 is actuated causing piston rod 118 to move upwards rotating the trip arm 116 and thereby the toggle arm 126 attached thereto until the trip point of toggle arm 126 is reached whereupon toggle arm 126 is tripped, thereby releasing the latch by rotating the toggle arm latch 110 in a counterclockwise rotation. The trip arm 126 is shown in phantom lines in its tripped position. This will cause the reset arm 104 and its cam assembly 106 to rotate slowly in a clockwise direction at a rate determined by the air discharged from a timer orifice 132 of timer 122, and the spring-timer diaphragm-orifice combination. This slow rotation will provide a series of contact closures with contacts 134 and 136 with a rhythm determined by the cam shape of 106.
The contacts are connected in the same manner shown in the unit of FIG. 3. With this arrangement the alarm given to, for example, a nurse, will be distinctive from the patient call alarm. Furthermore, if desired, the cam surface 106 can be made to give a coded alarm.

In certain hospital systems the patient call system alarm latches after a single switch closure, and in these instances the patient call system would require minor modification to install the distinctive alarm feature.

While we have described the principles of our invention in accordance with specific apparatus, it is to be clearly understood that the description is made only by way of example and not as a limitation of the scope of our invention as set forth in the accompanying claims.

We claim:
1. Apparatus for indicating that a person is attempting to leave his bed, comprising:
   a transducer coupled to said bed guard rail detector having a fluid therein;
   a transducer coupled to said bed guard rail detector and responsive to fluid displaced from said bed guard rail detector; and
   means coupled to said transducer for providing an indication when a predetermined amount of fluid is displaced from said bed guard rail detector.

2. Apparatus as defined in claim 1, wherein said bed guard rail detector includes a length of resilient tubing closed at one end and means associated therewith for attaching said tubing to a bed.

3. Apparatus as defined in claim 1, wherein said bed guard rail detector includes a resilient member closed at one end and having a hollow portion filled with a fluid, said hollow portion being a predetermined size to displace a predetermined amount of fluid when a predetermined force is applied to said detector.

4. Apparatus as defined in claim 1, wherein said transducer is a bellows.

5. Apparatus as defined in claim 1, wherein said transducer includes a housing having a rolling diaphragm therein and a piston arranged in said rolling diaphragm whereby fluid entering said diaphragm will cause movement of said piston.

6. Apparatus as defined in claim 1, wherein said indicator means includes a trip arm arranged adjacent said transducer for movement therewith and a toggle device coupled to said trip arm whereby a predetermined movement of said trip arm will cause said toggle device to trip.

7. Apparatus as defined in claim 6, further including means for adjusting the sensitivity of said toggle device.

8. Apparatus as defined in claim 6, wherein said indicator means further includes contact means arranged proximate said toggle device to make electrical contact therewith when said toggle device is tripped.

9. Apparatus as defined in claim 6, wherein said indicator means further includes means for providing a distinctive alarm.

10. Apparatus as defined in claim 8, further including means coupling said contact means to an alarm.

11. Apparatus for providing a signal to a patient call-box signifying that a patient is attempting to leave his bed, comprising:
   at least one bed guard rail detector arranged on said bed said bed guard rail detector including a resilient member having a fluid therein;
   a bed guard control unit;
   first means for coupling said bed guard rail detector to said bed guard control unit; and
   second means coupling said bed guard control unit to said patient call-box.

12. Apparatus as defined in claim 11, wherein said bed guard control unit includes:
   at least one transducer coupled to said first coupling means;
   a toggle device;
   means coupling the motion of said transducer to said toggle device, whereby said toggle device will be tripped when a predetermined amount of fluid is displaced from said bed guard rail detector; and
   means closing an electrical contact upon tripping of said toggle device, said contact closure coupled to said second coupling means.

13. Apparatus as defined in claim 12, further including means for adjusting the sensitivity of said toggle device.