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HOSPITAL SIGNAL DEVICE

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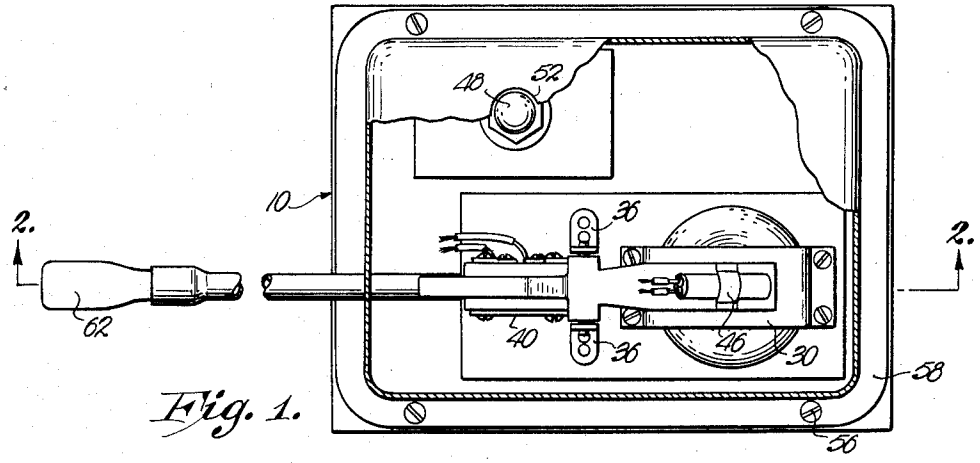


Fig. 1.

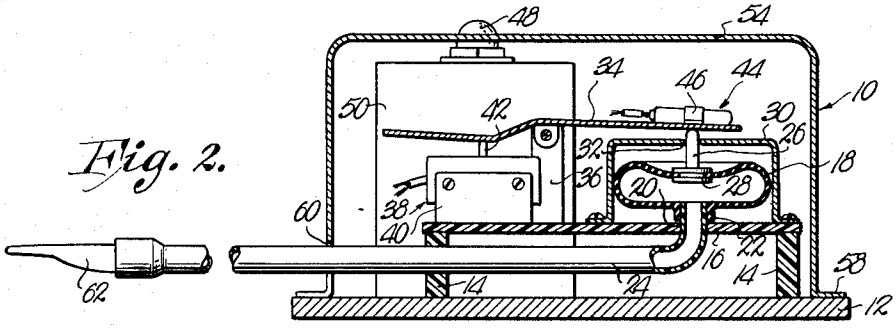


Fig. 2.

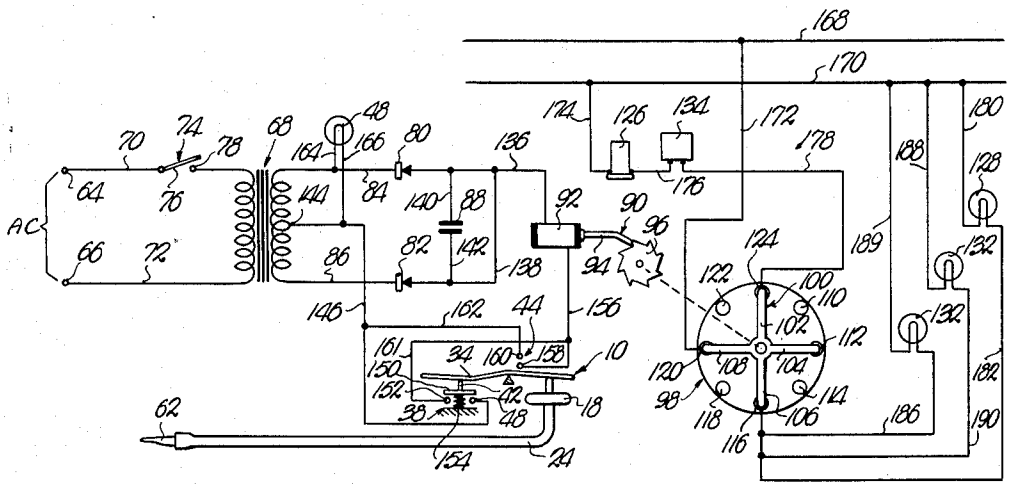


Fig. 3.

INVENTOR.
Robert W. Hutchison

BY

Avery, Schmidt, Johnson & Avery
ATTORNEYS.

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HOSPITAL SIGNAL DEVICE

Robert W. Hutchison, 301 W. Armour Blvd., Kansas City, Mo.

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This invention relates to signalling devices, and more particularly, to a breath-operated signalling device especially adapted for use by persons having greatly impaired ability of movement.

The need for means available to bedridden or other non-ambulatory persons to summon assistance when required, is well known. Often such patients do not have the necessary vocal strength or muscular ability to summon attendant personnel without the aid of electrically-operated audio or visual signalling devices. Further, such devices permit the personnel to be located some distance from the patient and yet be readily available when the signal is given. It is well known to provide switches near the patient for manual operation to initiate the activation of such signalling devices.

A common feature with conventional switches however, is that a certain amount of physical ability and manual dexterity is required to physically engage the switch for shifting it from its inoperated to its operated condition. Attempts have been made to minimize the effort necessary, but some ability to manipulate the switches has conventionally been required. There are, however, many persons who have not been able to avail themselves of the much needed signalling devices because their physical impairment has been of a degree which precluded even that amount of mobility required for manipulating the switches. Included in this group have been paralytics, victims of multiple sclerosis and other diseases where resultant disability may, in many cases, permit only slight movement of the head and no effective control of the movement of the arms or legs. Heretofore, so far as applicant has been able to determine, no effective signalling device has been provided for people lacking even the ability to physically manipulate the simplest of conventional switches.

It is, therefore, the most important object of the instant invention to provide a signal device operable solely by the breath of the patient and requiring substantially no physical ability or manual dexterity.

It is another important object of my invention to provide a signal device which may be returned to its unoperated condition by a second application of the breath of the patient.

A yet further object of this invention is to provide an electrically-powered signal device wherein an independent source of current may be utilized for energizing the signal lights from that employed in the control circuitry, thereby permitting the light to be conveniently located remote from the control unit.

Still a further object of my invention is the provision of a switching device operable with a minimum of air pressure to permit effective operation of the device by very weak persons.

Still a further object of the invention is the provision of a breath-conducting tube which may be positioned adjacent the mouth of almost immobile patients to permit operation of the device after only very slight movement to engage the mouth over the mouthpiece of the tube.

A yet further aim of the present invention is to provide a signal device having an inflatable bag as a part thereof, which bag may be inflated through the use of a tube communicating therewith, the bag having a plunger suitably carried thereby wherein, upon inflation of the bag, switching mechanism is operated whereby to actuate the signal device.

In the drawing:

FIGURE 1 is a plan view of the signal device, parts thereof being broken away to reveal details of construction;

FIG. 2 is a sectional view taken on line 2—2 of FIG. 1; and

FIG. 3 is a diagram of the signal device embodying the principles of the present invention.

Referring initially to FIGS. 1 and 2, the signal device of this invention includes a breath-operated switching device broadly designated 10, comprising a base 12 upon which rests a pair of upright supports 14 having a platform 16 secured thereto. An inflatable bag 18, which may be made of rubber, plastic or the like, is positioned on platform 16 adjacent an aperture 20 passing through platform 16, and bag 18 is provided with a neck portion 22 which receives one end of a tube 24 passing through aperture 20. A plunger 26 is secured to one wall of bag 18 and has an enlarged base 28 to insure that plunger 26 extends outwardly from the bag 18 at all times. A cover 30 is secured to platform 16 and is disposed in covering relationship with respect to bag 18 with plunger 26 passing through an aperture or opening 32 in the top of cover 30.

A lever 34 is pivotally coupled to platform 16 by means of a pair of upright standards 36, and is disposed in overlying relationship with respect to cover 30, whereby one end of lever 34 is in position to be engaged by plunger 26 as the latter is extended outwardly from cover 30 through aperture 32.

A switch 38 is secured to platform 16 by means of brackets 40 and includes an operating member 42 disposed in position to be engaged by lever 34 for depressing the member 42 when lever 34 is rotated in a counter-clockwise direction as viewed in FIG. 2, by the force of plunger 26 engaging the underside of lever 34. Switch 38 is adapted to be electrically coupled in the signal device in a manner to be hereinafter more fully described.

A switch 44 which may be a mercury switch, is rigidly secured to the top of lever 34 by a band 46 and shifts with lever 34 as the latter is swung under the influence of plunger 26. The integration of switch 44 into the signalling device will also be more fully explained.

A pilot light 48 is mounted on an upright bracket 50 secured to base 12 and extends through an aperture 52 in a housing 54 which surrounds all of the components of switching device 10 and is mounted upon base 12 by means of screws 56 in an outturned flange 58 of housing 54. A second aperture 60 in housing 54, permits tube 24 to pass therethrough and extend outwardly from switching device 10. A mouthpiece 62 is conveniently positioned in the outer end of tube 24 and is adapted to be disposed adjacent the location of a patient so that the latter may utilize the signal device in a manner to be hereinafter explained.

Referring now to FIG. 3, the signal device of this invention includes a source of alternating current of electricity emanating from contacts 64 and 66, which source is connected to the primary windings of a transformer 68 by lines 70 and 72. A switch 74 having a pole 76 and a fixed contact 78, is disposed in line 70 and is adapted to be closed when it is desired to provide operating power to the signal device.

The secondary windings of transformer 68 are coupled with a pair of rectifiers 80 and 82 by lines 84 and 86 respectively and, with condenser 88, comprise the basic components of a conventional center tap, full-wave rectifying device for providing direct current energy from

transformer 68. In addition to the components of the rectifying device and the switching device 10, the signal device includes a ratchet relay broadly designated 90, comprising a coil 92 having a plunger 94 operably coupled with a ratchet wheel 96 disposed to be rotated one notch by plunger 94 each time coil 92 is energized. A 4-pole, double-throw rotary switch 98 is operably coupled with ratchet wheel 96 and includes a four-pronged pole 100 having electrically intercoupled arms 102, 104, 106 and 108 which are disposed to successively engage fixed contacts 110, 112, 114, 116, 118, 120, 122 and 124 as pole 100 is rotated by ratchet wheel 96.

Also included in the signal device of this invention is a timer element 126 which may be of any conventional type adapted to pass electrical current therethrough for a predetermined interval of time following the energization thereof. Element 126 forms no part of the invention per se, and will not be described in more detail. Further components of the signal device are visual signal lamps 128, 130 and 132, as well as an audio signal component 134 which may be a buzzer, bell or the like.

Rectifier 80 is coupled with one side of coil 92 by line 136 and a line 138 connects one side of rectifier 82 with line 136. Lead 140 connects condenser 88 with line 136, and a lead 142 connects the condenser 88 to line 138. A center tap 144 is provided on transformer 68 in a well-known manner and is electrically coupled with a line 146 which is in turn connected with a fixed contact 148 of switch 38.

A pole 150 is normally maintained out of contact with fixed contact 148 and a second contact 152 of switch 38 by a coil spring 154. A line 156 connects the other side of coil 92 with a contact 158 of switch 44, while the other contact 160 thereof is connected to line 146 by line 162. A line 161 connects contact 152 of switch 38 with line 156. Pilot light 48 is electrically coupled to lines 84 and 146 by lines 164 and 166 respectively.

A second source of electrical energy may be utilized for energizing the audio and visual signalling components and is diagrammatically represented by main power lines 168 and 170. A line 172 connects power line 168 with fixed contact 120 of switch 98. A line 174 connects power line 170 with element 126 and a lead 176 connects audio signalling component 134 with element 126. A line 178 connects fixed contact 124 with component 134. A line 180 connects lamp 128 with power line 170, and a line 182 extends from the other side of lamp 128 to fixed contact 116. A line 184 connects lamp 132 with power line 170 and is connected to line 182 by a line 186. Likewise, lamp 130 is connected to power line 170 by a line 188 and to line 182 by a line 190.

When it is desired to operate the signalling device of this invention, switch 74 is closed with pole 76 engaging contact 78 to connect the primary windings of transformer 68 with the source of electrical energy from contacts 64 and 66. This in turn energizes the secondary windings of transformer 68 and the alternating current is permitted to pass first through rectifier 80 and then rectifier 82 through line 138 to provide full-wave direct current to line 136 in a conventional manner of rectification of alternating current into direct current.

Condenser 88 interconnects lines 138 and 136 to store the energy passing through the rectifiers 80 and 82 for dissipation and feeding into line 136 during the phases of the rectification cycle when a minimum of energy passes through rectifiers 80 and 82 to thereby smooth out the "ripple" of the provided direct current and to supply a substantially constant source of electrical energy. When it is desired to initiate a signal, the patient has but to dispose his lips over mouthpiece 62 at the end of tube 24, and blow into the tube 24. The breath is conducted by the tube to bag 18 which is expanded thereby. Plunger 26 is shifted outwardly through aperture 32 in cover 30 by the inflation of bag 18 and is caused to engage the underside of lever 34 for swinging the latter in a counterclockwise direction as viewed in FIG. 2 about its point of pivot on standard 36. The swinging of lever 34 changes the angle of inclination thereof with respect to the horizontal and causes the mercury within switch 44 to engage contacts 160 and 158, thereby closing switch 44.

Additionally, lever 34 engages member 42 of switch 38, thereby shifting pole 150 into engagement with fixed contacts 148 and 152 to effect closing of switch 38. The closing of either switch 44 or switch 38, energizes coil 92 through a control circuit which may be traced from the rectifier circuit through line 136, coil 92, line 156, contacts 158 and 160 of switch 44, line 162, line 146 to center tap 144 of transformer 68. Should switch 44 fail to properly effect closing of the control circuit, switch 38 is electrically coupled in parallel with switch 44 to effect closing of the circuit through line 161, contact 152, pole 150, contact 148, and line 146 to center tap 144.

Upon the energizing of coil 92, plunger 94 is shifted to rotate ratchet wheel 96 one step and effect the moving of the pole 100 into engagement with the next succeeding contacts of switch 98. Immediately upon the release of the pressure of the breath in tube 24, bag 18 collapses through its own inherent weight and that of plunger 26, plus the additional weight of lever 34, switch 44 and band 46. This opens switches 44 and 38 to de-energize coil 92 through the breaking of the control circuit. Assuming that the rotated position of pole 100 is that shown in FIG. 3, it may be readily seen that the shifting into its present position by wheel 96, effects a closing of a plurality of energizing circuits for both the visual and audio signalling components. The circuit to component 134 may be traced from power line 170 through line 174, element 126, lead 176, component 134, line 178, contact 124, pole 100, line 172 to the other power line 168.

Inasmuch as timer element 126 is interposed in series in the energizing circuit for component 134, the latter will be immediately energized, but will be de-energized after a predetermined interval of time to cease the audible response emanating therefrom. Such time response may serve as an emergency warning to initially attract the attention of attendant personnel should the visual signalling components be unnoticed for one reason or another.

The shifting of pole 100 into its present position, effects the energizing of the visual signal lamp 128 through a line 180 from power line 170, through lamp 128, line 182, contact 116, pole 100, contact 120, line 172 to power line 168. Additionally, lamp 130 is energized by a circuit traceable from power line 170, through line 188, lamp 130, line 190, contact 116, pole 100, contact 120, through line 172 to power line 168. Additionally, lamp 132 is energized by a parallel circuit traceable from power line 170, through line 184, lamp 132, line 186, contact 116, pole 100, contact 120 through line 172 to line 168.

It is visualized that lamps 128—132 will be disposed in positions to be seen by the attending personnel who may be summoned upon the energizing of the lamps to render the requested assistance to the patient who utilizes the signal device. It will be readily understood that as many lamps as are necessary to be disposed where they may be seen by the attending personnel, may be utilized and may be electrically coupled in parallel with the lamps 128—132. Additionally, fixed contact 112 is energized at the same time that contacts 124 and 116 are energized and may be utilized for connecting additional signalling components with power lines 168 and 170.

By utilizing an independent source of power, it is possible to have the signalling components disposed remotely from the control mechanism and it is visualized that the signal lamps may be utilized in a hospital or the like where it may be necessary to summon a number of different attendants or an attendant situated in any of a number of separate locations.

When the call initiated by the patient has brought forth the required response, the patient need but blow a second time into the mouthpiece **62** to effect de-energizing of the signal components. The introduction of the breath into bag **18** expands the latter and causes a closing of the control circuit in an identical manner with that previously described and which, in the interest of brevity, will not be further detailed here. This effects the energizing of coil **92** a second time and results in the shifting of ratchet wheel **96** one additional step to rotate pole **100** into engagement with the next succeeding contacts of switch **98**. It may be readily seen that this position disposes the arms **102** through **108** out of engagement with contacts **124**, **112**, **116** and **120** and breaks the energizing circuits for the lamps **128**—**132** and the audio signalling component **134**. With the lamps extinguished and component **134** silent, the signal device is in position to again emit signals upon the shifting of pole **100** into engagement with the next succeeding contacts. This may be effected by the patient by simply blowing a further time into tube **24** to again momentarily close the control circuit and energize coil **92**.

The steps of operating the signal device and shifting the same to its unoperated condition, may be repeated again and again to send the necessary signal to the attendant personnel and the entire operation requires nothing more than merely blowing into mouthpiece **62**. Thus, even those patients who are immobilized to a point where they are unable to manipulate even the simplest of switches, are able to operate the signal device of this invention with substantially no physical ability or manual dexterity required. Mouthpiece **62** may be positioned substantially immediately proximal the mouth of the patient whereby only the barest minimum of movement is necessary to engage the mouthpiece for conducting the breath to bag **18** to initiate the required signal.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. Hospital signalling apparatus comprising:
a base;
a tube provided with a mouthpiece at one end thereof adapted to be positioned adjacent the mouth of a patient;
a platform spaced above the base and secured thereto, said platform having an aperture therethrough receiving the other end of said tube;
an inflatable bag resting on the platform and in fluid communication with said other end of the tube;
a vertically reciprocable plunger attached to said bag and extending upwardly therefrom;

a generally U-shaped cover having a bight and a pair of legs, said bight overlying the bag and having an opening therethrough receiving the plunger, the legs being secured to the platform with opposed sides of the bag slidably engaged with corresponding legs to thereby prevent substantial lateral expansion of the bag when the latter is inflated;
a standard on the platform spaced from said cover;
a lever pivotally mounted on the standard with one end of the lever overlying the cover and engaging the plunger for swinging movement thereby during reciprocation of said plunger;
a normally open mercury switch mounted on the lever for movement with the lever to a position, upon upward movement of the plunger during inflation of the bag, where the switch is closed;
a source of electrical power;
a ratchet relay comprising a relay coil, a ratchet wheel responsive to energization of said coil, and a normally open, double-throw rotary switch operably coupled with the ratchet wheel for operation thereby;
an electrically responsive signalling device;
circuit means electrically coupling said mercury switch and said coil in series across said source; and
means electrically connecting said device and said rotary switch in series across said source, whereby successive blowing into the mouthpiece by the patient causes repeated, momentary energization of the relay coil to alternately actuate and de-actuate the signalling device.

2. The invention of claim 1, wherein the portion of said tube proximal to said other end thereof is disposed between the platform and the base, the other end of the tube extending upwardly through said aperture in the platform, said bag being provided with a neck receiving said other end.

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