April 12, 1966 C. F. JACOBSON 3,246,086

SWITCH ASSEMBLY AND CIRCUIT FOR ELECTRICALLY HEATED BEDCOVERS

Filed April 30, 1963

Fig. 1.

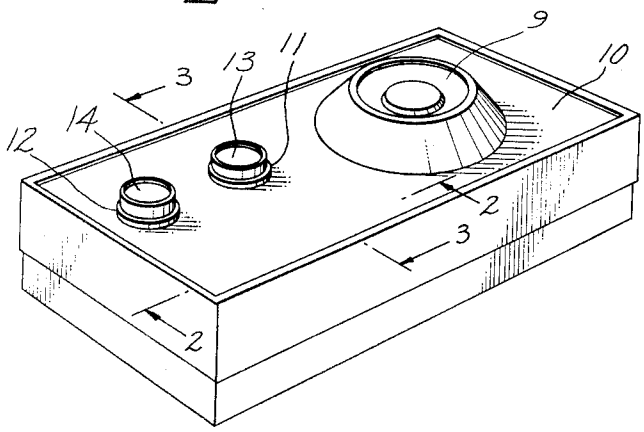


Fig. 3.

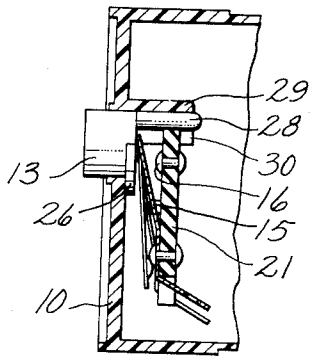


Fig. 2.

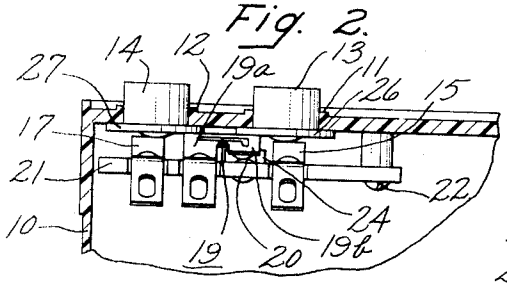


Fig. 5.

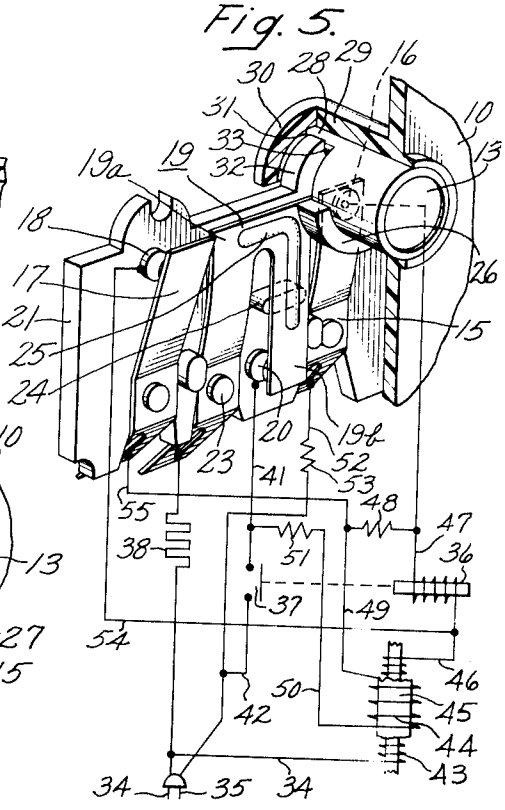
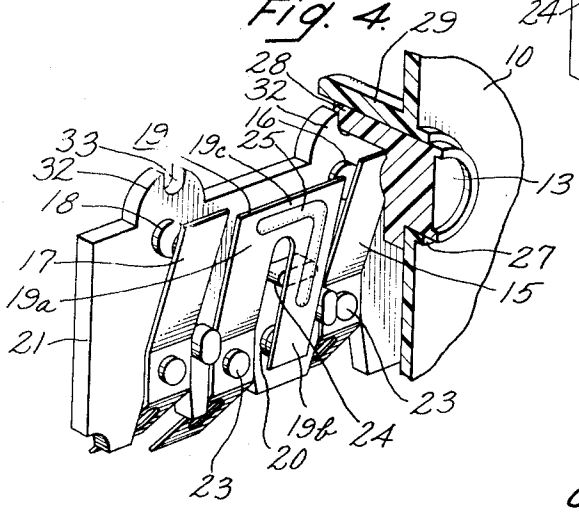


Fig. 4.



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SWITCH ASSEMBLY AND CIRCUIT FOR ELECTRICALLY HEATED BEDCOVERS

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8 Claims. (Cl. 200—5)

This invention relates to integrated multiple switch constructions, and in particular to an electrical control switch assembly to energize an electrically heated device, such as a bedcover, and a safety control circuit therefor.

For electrically heated bedcovers and the like, an over-temperature protective circuit is a highly desirable safety feature for its operation to deenergize the electrical heater upon any over-temperature condition. Typically, such a protective circuit includes an electromagnetically operated switch to maintain the circuit closed for normal operating conditions, but which releases and opens the electric heater circuit upon any abnormally high operating temperature. The manual actuator used to energize initially the electromagnetic means, for complete protection, must be arranged so that the heating device can be operated only when the protective circuit is fully operative. Even intentional "jamming" of the manual actuator must not be effective to defeat the safety control.

Accordingly, it is an object of my invention to provide an improved, manually operated, switch assembly and circuit for an electrically heated bedcover and safety control therefor.

It is a further object of this invention to provide a switch assembly wherein the operation of one or more push buttons to close their respective switches additionally insures proper sequential operation of a safety control switch.

It is yet another object of this invention to provide such an assembly wherein the push buttons are designed to preclude accidental jamming of the control switches.

It is a still further object of this invention to provide a durable push button switch assembly capable of withstanding repeated push button operation and at a minimum manufacturing cost.

In carrying out the objects of this invention in one form thereof an electrically heated bedcover switch assembly is provided utilizing a pair of manual actuators for respective, normally open, "on" and "off" switches in an assembly housing. Additionally a normally closed safety switch is provided having a movable contact arm positioned between the movable elements of the "on" and "off" switches to open the heater or load circuit upon initial movement of either or both of the manual actuators. Thus, the load circuit remains open upon any attempt to hold or jam either of the manual controls in an actuated or closed position. Means are provided on the terminal board to which the fixed contacts of the "on" and "off" switches are secured so that the operating force of the push button or manual actuator is transmitted through the terminal board to the assembly housing. Furthermore, each push button, the terminal board and portions of the assembly housing cooperate to insure substantially axial reciprocal motion of the push buttons in the housing.

Further objects and advantages of my invention may best be understood by reference to the following description taken in connection with the accompanying drawings in which:

FIG. 1 is a perspective view of the control switch assembly;

FIG. 2 is a partial sectional view of the control switch assembly taken on line 2—2 of FIG. 1;

FIG. 3 is a partial sectional view of the control switch assembly taken on line 3—3 of FIG. 1;

FIG. 4 is a perspective view of certain elements of the control switch assembly showing all switch elements in their normal position; and

FIG. 5 is similar to FIG. 4 except that the switch elements are shown in their position upon depression of one push button and a typical electric bedcover heating circuit in which the switches may be used is shown.

Referring now to the drawings, FIG. 1 shows a control housing **10** of plastic or other suitable rigid, insulated, material. The device shown by FIG. 1 is, typically, the bedside control unit for an electric bedcover having a rotatable knob **9** for temperature selection. Housing **10** also includes a pair of apertures **11** and **12** which respectively accommodate actuators or push buttons **13** and **14** of "on" and "off" switches to be described.

FIGS. 2–5 reveal the structure and operation of the elements of the control switch assembly within housing **10**. Push button **13** is positioned so that the manual depression thereof through aperture **11** closes an "on" switch comprising a resilient conductive switch arm **15** and a fixed contact **16**. Likewise, the depression of push button **14** closes an "off" switch comprising a resilient conductive switch arm **17** and a fixed contact **18**. A safety switch, including a generally U-shaped conductive contact member **19** and a fixed contact **20** is operable to an open position, upon depression of either push button **13** or **14**. These movable and fixed switch elements are secured to a terminal board **21**. Terminal board **21**, in turn, is secured to housing **10** by a single suitable fastener **22**.

As is clear from FIGS. 4 and 5, safety switch member **19** is generally U-shaped and provides one arm **19***a* secured at **23** to the terminal board and a second arm **19***b* which may carry a current contact at its free end or contact portion for normal engagement with fixed contact **20**. Arms **19***a* and **19***b* are joined by a base **19***c*. A fulcrum **24**, which may be integrally formed with terminal board **21**, is intermediately positioned beneath arm **19***b* over which arm **19***b* pivots. A reinforcing rib **25** is provided along base **19***c* and arm **19***b* of switch member **19**. It is to be understood that fulcrum **24** is utilized in cooperation with reinforcing rib **25** to increase reliability of switch operation. Fulcrum **24** may be omitted when the reinforcing rib is used, as arm **19***b* will still pivot about a fulcrum in space upon depression of base **19***c*.

The corners of base **19***c* of the safety switch member lie adjacent the free ends of switch arms **15** and **17** and are engaged by radial flanges **26** and **27** of their respective push buttons. It is therefore clear that flanges **26** and **27** provide means for respectively linking or interconnecting actuators **13** and **14** to the base **19***c* of the safety switch so that inward movement of either of the actuators pivots the arm **19***b* to separate the contacts of the safety switch. The corners of base **19***c* may normally assist switch arms **15** and **17** in biasing the push buttons to their outer inoperative positions.

To insure the axial motion of each push button within its respective aperture, and to transmit the forces of depression of the push buttons from the switch elements to the housing, each push button, the terminal board **21** and the assembly housing **10** provide interfitting elements. As the structure relating to each push button is exactly the same, only the features of one push button will be described.

Push button **13** is cylindrical and provides an eccentrically located axial projection **28** as well as radial flange **26**. Preferably, projection **28** and flange **26** are integrally molded with the cylindrical portion of push button **13**. Housing **10** provides a semi-cylindrical guide **29** which extends coaxially with push button **13** to partially encompass the push button. The internal end of guide **29** incorporates a radial flange or support surface **30** which defines a groove **31**.

As best seen in FIGS. 4 and 5, terminal board **21** pro-

vides an ear 32, having a recess 33, for each push button. Terminal board 21 is secured to housing 10 so that ear 32 lies within guide 29, in juxtaposition with radial flange 30 so that recess 33 is axially aligned with groove 31 to form an aperture therewith.

FIGS. 5 shows schematically a typical electrically heated bedcover circuit for which this switch assembly is particularly adapted. Power is supplied for operation through terminals 34 and 35 arranged to be connected in the usual manner to an electrical power source. The control circuit includes a relay having coil 36 for operating a switch 37 when the relay coil is energized. For an electric blanket application, a suitable resistance heating element 38 is distributed in a well-known manner over the heating area. The load circuit for supplying power to electric heater 38 may be traced from line terminal 34, through the heater, a terminal of the safety switch, U-shaped conducting arm 19, through safety switch contact 20, conductor 41, relay switch 37, and conductor 42 to the other terminal 35 of the power source. It may be noted from this circuit that both the safety switch, comprising U-shaped member 19 and contact 20, and the relay switch 37 must be closed for power to be supplied to heater 38.

Overtemperature protection for this electrically heated device is provided by a temperature sensor arrangement including distributed conductors 43 and 44, which extend in proximity to one another, separated however, by a layer of material 45 which is an insulator at normal operating temperatures and a conductor of electric current of control magnitude upon occurrence of any abnormally high temperature. During normal operation, relay coil 36 is energized through a control circuit commencing with power terminal 34, sensor conductor 43, a connecting lead 46, relay coil 36, conductor 47 to a resistor 48. From the other terminal of resistor 48, a connection is made through lead 49 to the other conductor 44 of the temperature sensor assembly, then through conductor 50 to a voltage dropping resistor 51 and through relay contacts 37 to the other side of the power source. From this circuit, it may be noted that the relay may remain closed even though "on" switch 15–16 is in its normally open condition. Upon occurrence of any abnormally high temperature, conduction takes place through the temperature sensing layer 45, which results in a drop in the voltage applied to relay coil 36, and the relay coil, therefore, releases its armature, and switch 37 opens the circuit to both heater 38 and the blanket control system.

"On" switch 15–16 provides a means for initially energizing relay coil 36 through a circuit commencing with power line 34, conductor 43 of the temperature sensor assembly, connecting line 46, relay coil 36, and conductor 47, to "on" switch contact 16. When "on" button 13 has been depressed, the circuit is completed through spring arm 15 of the "on" switch, a conductor 52, a current limiting resistor 53 to the other terminal of the power source 35. The size of the resistor 53 is, of course, selected to apply adequate voltage to the relay coil, so that it will close the relay switch 37. Thereafter, the relay remains closed under normal operating conditions through the circuit previously described. It should be noted particularly, however, that the heater 38 is ineffective as long as the "on" switch is even partially depressed, since the initial movement of the "on" push button opens the safety switch at contact 20.

The user occasionally desires to deenergize the heater and control circuit manually by means of push button 14. While the "off" button could operate in several different ways, as shown in FIG. 5 the closing of the "off" switch provides a shunt circuit around relay coil 36, conductor 47 and resistor 48. The shunt circuit is through conductor 54, "off" switch contacts 18 and 17 and conductor 55. Hence, when the "off" switch is closed, there can be essentially no voltage on the relay coil, upon which the relay switch opens.

In accordance with this invention, it should be noted particularly, however, that the actuation of "off" push button 14 opens the heater circuit through the safety switch at contact 20 prior to the time that relay switch 37 opens. This is a desirable feature, since the relay for this purpose must be very carefully calibrated. This calibration will remain accurate for a longer period of time if its switch is not required to frequently interrupt heater line current. With this arrangement, as above described, the safety switch interrupts line current on any manual actuation of the "off" push button; whereby relay switch 37 is required to interrupt line current only upon an abnormal overtemperature condition. Of course the release of "on" pushbutton 13 also closes the heater circuit through the safety switch.

The sequence of switch operation, whereby the safety switch member is pivoted to an open position prior to closing of the switch arms 15 or 17 against their respective fixed contacts, is obtained by the interrelation of the switch elements, particularly the position of fixed contacts 16 and 18 on one side of fulcrum 24 and the mounting of contact 20 on the other side of the fulcrum. By this arrangement depression of either push button immediately opens the safety switch, a complete depression of the push buttons being required for closing of the respective "on" and "off" switch.

During the axial motion of the push buttons through their respective housing apertures, axial projections 28 are are accommodated in the aperture provided by the relationship of groove 31 and recess 33. This controls the path of the push buttons thereby insuring substantially axial motion thereof to prevent accidental jamming of the push buttons, which might otherwise result from application of an off-center force to a push button.

It can be seen that the depression of push button 13 to close switch member 15 against its fixed contact 16 applies a pressure to the terminal board 21. The positioning of ear 32 of the terminal board against radial flange 30 transmits this push button pressure to the housing 10. Also, the inward movement of the push buttons is thus limited by the engagement of the switch members with their respective fixed contacts. The outward movement of the push buttons is limited by the engagement of respective radial flanges 26 and 27 with the inner surface of the housing which defines apertures 11 and 12 respectively. The upper surfaces of radial flanges 26 and 27 also serve to limite the rotation of the push buttons by engagement with the lower surfaces of housing guide 29.

I have thus provided a manually operated control switch assembly, which prevents the user's accidental or intentional defeat of a safety circuit by jamming an actuator in a closed position. Furthermore the switch assembly elements are designed to cooperate to insure substantially axial motion of the push buttons and to transfer the forces of operation of the push buttons from the terminal board to the assembly housing.

While I have shown and described a specific embodi- of my invention, I do not desire my invention to be limited to a particular construction shown and described. Instead, I intend, by the appended claims, to cover all modifications within the spirit and scope of my invention.

I claim:

1. In an electric bedcover control a switch assembly comprising:

(a) a housing defining a pair of apertures;

(b) first and second push buttons received in the apertures of the housing for movement of said push buttons to outer and inner positions;

(c) an "on" switch including an electrically conducting member cooperating with said first push button for movement therewith and an electrical contact, said electrically conducting member and said contact being engaged with each other when said first push button is moved to an inner position, and disengaged

when said first push button is moved to an outer position;

(d) an "off" switch including an electrically conducting member cooperating with said second push button for movement therewith and an electrical contact, said electrically conducting member and said contact being engaged with each other when said second push button is moved to an inner position, and disengaged when said second push button is moved to an outer position;

(e) a safety switch including a pair of contacts which are engaged with each other when said push buttons are in an outer position, and further including a movable arm carrying one of said safety switch contacts; and

(f) means linking each of said push buttons to said movable arm of said safety switch for separating said safety switch contacts prior to engagement of the electricaly conducting members and their respective contacts when either one of said push buttons is moved from an outer to an inner position.

2. The switch assembly as set forth in claim **1** wherein said electrically conducting members of said "on" and "off" switches each comprises a flexible arm.

3. The switch assembly as set forth in claim **1** wherein said safety switch comprises a resilient U-shaped contact member including a first arm connected to the housing, a second arm pivotally mounted about a fulcrum, and a base portion connecting said arms, said second arm providing a contact carrying portion on one side of the fulcrum and said base portion being on the other side of the fulcrum for said linking means to engage said base portion and pivot said arm about said fulcrum upon inward movement of either of said push buttons.

4. The switch assembly as set forth in claim **3** wherein said U-shaped contact member includes a re-inforcing rib extending along said base and along said second arm.

5. The switch assembly as set forth in claim **1** wherein said switches are mounted on a terminal board secured to the housing, and said fulcrum comprises a projection spacing the center portion of said movable arm of said safety switch from the surface of said board.

6. The switch assembly as set forth in claim **1** wherein said housing provides means for guiding a movement of each of said push buttons and for receiving the force of said movement upon actuation of switches.

7. In an electric bedcover control, a switch assembly comprising:

(a) a housing defining an aperture;

(b) a push button received in said aperture for movement of said push button to outer and inner positions;

(c) a first switch including an electrical conducting member and a contact separated from each other when said push button is in an outer position, said electrically conducting member cooperating with said push button to engage the contact when said push button has been moved to an inner position;

(d) a second switch including a pair of contacts engaged with each other when said push button is in an outer position, said second switch comprising a resilient U-shaped contact member including a first arm connected to the housing, a second arm pivotally mounted about a fulcrum, and a base portion connecting said arms, said second arm carrying one of said contacts on one side of said fulcrum, and said base portion being located on the other side of said fulcrum;

(e) linking means for linking said push button to said base portion of the U-shaped contact member for pivoting said second arm to disengage said second switch contacts when said push button is moved from an outer to an inner position.

8. The switch assembly as set forth in claim **7** wherein said switches are mounted on a terminal board secured to the housing.

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