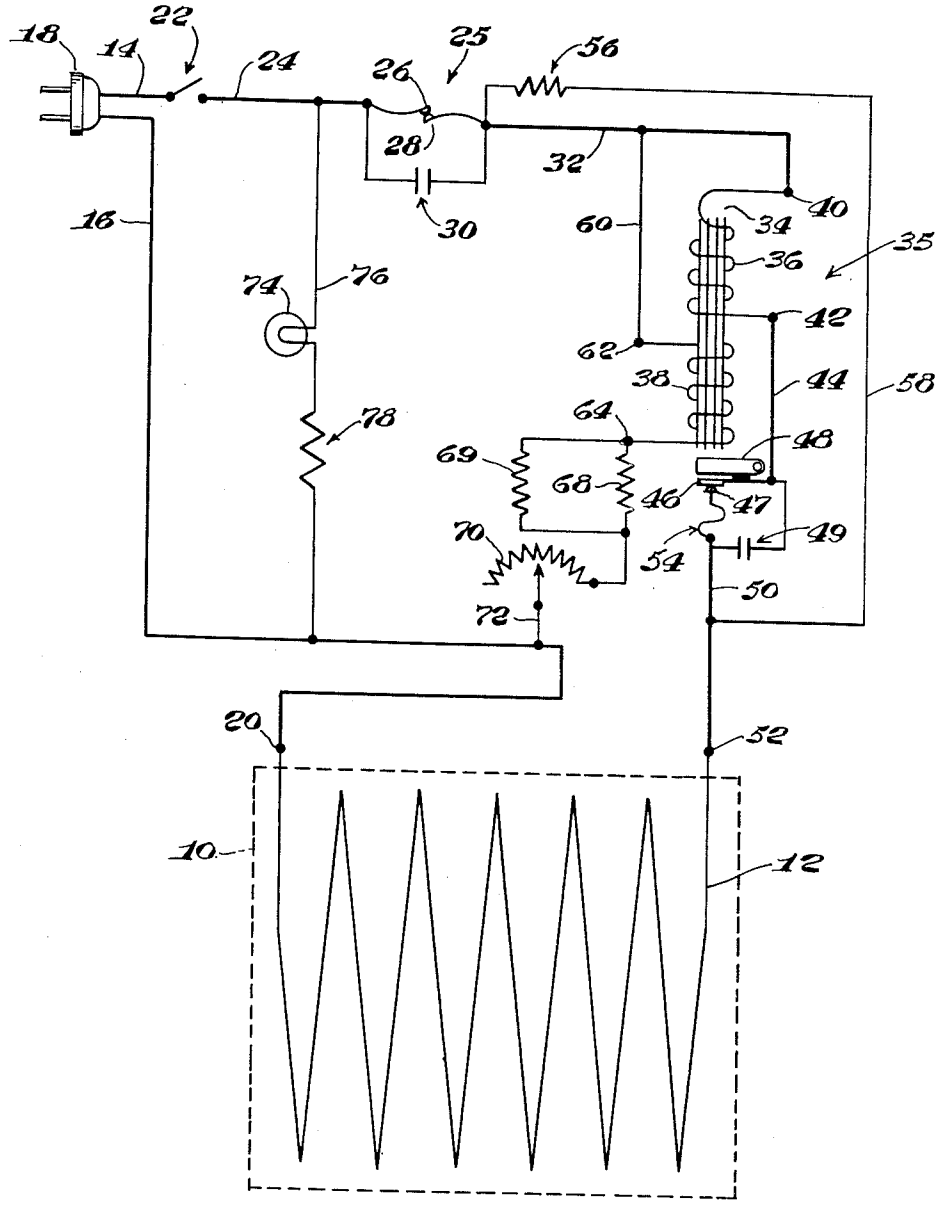
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TEMPERATURE CONTROL FOR ELECTRIC BLANKETS

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TEMPERATURE CONTROL FOR ELECTRIC BLANKETS

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3 Claims. (Cl. 219—20)

This invention relates to a temperature control for electric blankets.

The object of the invention is to provide a novel and improved temperature control for electric blankets with which the temperatures of the blanket may be regulated in use in a novel and superior manner.

With this general object in view and such others as may hereinafter appear, the invention consists in the temperature control hereinafter described and particularly defined in the claims at the end of this specification.

In the drawing illustrating the preferred form of the invention, the single figure is a diagrammatic view of the circuit arrangement for the present novel temperature control.

In general, the illustrated embodiment of the present invention contemplates a novel temperature control for an electric blanket wherein the heating circuit includes a normally balanced dual coil relay having opposed windings including a series coil and a shunt or parallel coil arranged so that the magnetic forces oppose each other and wherein an increase in the resistance of the blanket heating element, upon heating thereof, reduces the current in the series coil so that the shunt or parallel coil overbalances the series coil and causes sufficient magnetization of the core of the relay to operate a normally closed switch to discontinue the current in the blanket heating element. Upon opening of the normally closed relay switch, provision is made for actuating a normally closed thermal time-delay switch arranged to be operated by a heater which is energized when the relay switch is opened so that after a predetermined time the thermal switch is opened to discontinue the current in the entire heating circuit, whereupon the relay switch is again closed in readiness for a succeeding cycle upon cooling and closing of the thermal switch.

Provision is also made for manually varying the point at which the two coils become unbalanced, as by a rheostat placed in the shunt circuit, so as to change the temperature at which the blanket heating element will be cut off, and in order to compensate for ambient temperature, a heat-responsive resistor having a negative coefficient of resistance is also provided in the shunt circuit so that when the resistor element is cool the resistance therethrough is relatively high, and as the temperature increases the resistance decreases, thereby automatically changing the current flow in the shunt circuit with the ambient temperature.

Referring now to the wiring diagram shown in the drawing, 10 represents a blanket, indicated in dotted lines, and 12 represents the heating element associated with the blanket. The heating element 12 is connected in a circuit including wires 14, 16 extended from a conventional electric-service plug 18, the wire 16 being connected directly to one terminal 20 of the blanket heating element 12. The wire 14 is connected to a main-control switch 22 for closing the circuit through a wire 24 which

is connected to a thermal time-delay switch, indicated generally at 25, forming a part of the control mechanism. The switch 25 is provided with contacts 26, 28 and a condenser 30 may be connected between the terminals thereof, as shown.

A wire 32 leading from the time-delay unit is connected to a dual control relay, indicated generally at 35, having a core 34 and provided with opposed windings including a series winding 36 and a shunt or parallel winding 38 arranged so that the magnetic forces oppose each other. The wire 32 is connected to one terminal 40 of the series winding 36 and the other terminal 42 is connected by a wire 44 to a contact 46 carried by the armature 48 of the dual control relay. The contact 46 normally engages a contact 47 having a wire 50 extended therefrom and connected to the other terminal 52 of the blanket heating element 12 through a fuse 54. A condenser 49 is placed across the contacts to prevent arcing of the points. When the relay is energized the pivoted armature 48 is rocked to open the circuit at the contacts 46, 47. A time-delay unit heater 56 arranged for cooperation with the thermal time-delay switch 25 is provided in a line 58 placed across the contacts of the relay so as to be energized when the circuit is opened at the contacts 46, 47.

The shunt circuit includes a wire 60 extended from the wire 32 and connected to one terminal 62 of the shunt winding 38, the second terminal 64 being connected to the wire 16 through a heat-sensitive resistor 68, rheostat 70 and wire 72. The heat-sensitive resistor 68 has a negative coefficient of resistance so that when cool the resistance therethrough is relatively high, and as the temperature increases the resistance decreases, thereby automatically changing the current flow through the shunt winding 38. A suitable resistance 69 is placed across the resistor 68 in order to limit the maximum resistance value at low ambient temperatures. This is desirable to permit starting of the blanket circuit at low ambient temperatures. A signal lamp 74 is provided in a line 76 extended between the wires 24, 16 and provided with a resistance 78, the lamp being lighted when the main-control switch 22 is closed. In operation, when the main-control switch 22 is closed, current may flow to the blanket heating element 12, and the blanket temperature may be set by the user by adjusting the rheostat 70 to vary the current in the shunt winding 38. A higher resistance reduces the effect of the shunt winding 38 relative to the series winding 36 giving a higher blanket temperature, and a lower resistance to ampere flow increases the magnetic effect of the shunt winding 38 giving a cooler temperature. In practice, the rheostat 70 may be calibrated for different temperatures of the blanket heating element.

The two windings 36, 38 of the relay 35 are arranged in approximate balance over the operating ranges selected so that when the blanket is cool the coils produce a minimum of magnetization in the core 34 of the relay. When the blanket heating element 12 becomes heated, the resistance increases, thus reducing the current in the series winding 36 so that the shunt coil 38 overbalances the series coil 36, and when the unbalance reaches the ampere turns required to operate the relay 35 the normally closed relay contacts 46, 47 are opened to discontinue heating of the blanket.

Opening of the relay contacts 46, 47 causes the current to flow through the heater unit 56 of the thermal time-delay switch 25 which after a predetermined time effects separation of the thermal contacts 26, 28 to open-circuit the entire unit. Opening of the circuit at the thermal switch 25 allows the relay contacts 46, 47 to close again for the next cycle. When the thermal time-delay unit has cooled sufficiently, its contacts 26, 28 again close and

the heating cycle is repeated. If the average temperature of the blanket has dropped, the series relay circuit will remain closed until the blanket is again up to the predetermined selected temperature. If the temperature of the blanket is the same as when the heat was previously shut off, the relay contacts will immediately reopen and recycle through the time-delay units, this action being repeated until the blanket has cooled slightly whereupon the relay contacts 46, 47 will remain closed, as above described. The thermo-fuse 54 is preferably mounted very close to the relay contacts 46, 47 and has two important functions. In case of overload or short circuit in the blanket it opens the circuit. Defective circuitry or components which cause the relay contacts to overheat will blow this fuse 54 instead of fusing the relay contacts.

Temperature compensation or automatic increase in blanket temperature with lowering ambient is accomplished by the temperature characteristic of the shunt resistor 68 and to some extent by the heat-transfer characteristics of the relay coils and the design of the thermal time-delay unit. The temperature-responsive resistor 68, having a negative coefficient of resistance, operates automatically to increase the resistance through the shunt winding 38 when the temperature ambient is lowered, thus shifting the balance point of the windings 36, 38 so that with lowering ambient the relay contacts will remain closed for a longer time before the unbalanced point is reached to effect operation of the relay and discontinuance of the current to the blanket heating element. Conversely, when the temperature ambient increases, the resistance through the shunt winding 38 decreases, thereby changing the current flow in proportion to the temperature ambient change.

The resistance 68 also serves, in addition to temperature compensation, as a means for correcting blanket temperature variations due to line voltage fluctuations. If the line voltage is low the current has to be applied to the blanket for a longer time to obtain a given blanket temperature. In other words, as the circuit goes on and off it spends more "on-time." The balance characteristic of the relay is such that the blanket temperature tends to increase with decreasing line voltage. However, due to the longer "on-time" resistance 68 heats up more which reduces the effective resistance and shuts off the blanket sooner. The opposite is true of higher line voltage.

From the above description, it will be seen that the present electric-blanket control permits the user to adjust the rheostat 70 to the desired setting to effect discontinuance of the current to the blanket heating element 12 at a predetermined safety cut-off temperature, and that upon lowering ambient the resistance through the shunt winding 38 is automatically changed by the provision of the temperature-responsive resistor 68 to compensate for lowering ambient temperature. It will also be seen that the thermal time-delay unit is operated only when the relay contacts 46, 47 are opened, and that the present control unit employs the relay as the temperature-control component as well as a safety device.

This application is a division of our application, Serial No. 264,772, filed January 3, 1952, for Temperature Control for Electric Blankets, now Patent No. 2,709,216.

While the preferred embodiment of the invention has been herein illustrated and described, it will be understood that the present invention may be embodied in other forms within the scope of the following claims.

Having thus described the invention, what is claimed is:

1. In a temperature control for an electric blanket, a heating circuit including a blanket heating element having a positive temperature coefficient of resistance, a primary heating control including a differential relay having normally closed contacts in said circuit in series with the blanket heating element, said differential relay comprising a series winding in said circuit in series with said heating element and a shunt winding connected in parallel with said heating element, said windings being arranged in opposed and normally balanced relation, said windings assuming an unbalanced relation to effect opening of the relay contacts, so as to prepare said heating circuit to end a heating cycle, upon an increase in resistance of said heating element due to heating of the blanket to a predetermined temperature, a secondary control which becomes operative only after said heating circuit has been prepared for control thereof by the opening of said relay contacts, said secondary control including a thermal time-delay switch in series with both of said windings, and a heater, whose energization is controlled by said thermal time-delay switch and which is connected in parallel with the series winding of the differential relay and with the contacts of said relay, cooperating with the thermal switch and being effectively energized in series with said blanket heating element to thereby reduce current flow through said blanket heating element upon opening of the relay contacts, said heater upon being so energized heating the thermal switch and effecting opening of the thermal switch after a predetermined time and terminating energization of said heater, said relay contacts again closing upon opening of the thermal switch to condition said heating circuit for another heating cycle upon subsequent cooling and closing of the thermal switch.

2. In a temperature control for an electric blanket: a heating circuit including a blanket heating element having a positive temperature coefficient of resistance; a primary heat control including a differential relay having normally closed contacts in said circuit in series with the blanket-heating element, said differential relay comprising a series winding in said circuit in series with said heating element and said normally closed contacts and a shunt winding connected in parallel circuit relation with said heating element and said contacts, whereby opening of the contacts de-energizes the series winding without de-energizing the shunt winding, said windings being arranged in opposed and normally balanced relation, said windings assuming an unbalanced relation to effect opening of the relay contacts, so as to prepare said heating circuit to end a heating cycle, upon an increase in resistance of said heating element due to heating of the blanket to a predetermined temperature and locking in the contact-open position upon opening of the contacts; and timing means, operative only after said heating circuit has been prepared by the opening of said relay contacts, being operable to interrupt current flow through the shunt winding to restore the differential relay to the normally closed condition for the next blanket heating cycle.

3. In a temperature control for an electric blanket: a heating circuit including a blanket heating element having a positive temperature coefficient of resistance, a primary heat control including a differential relay having normally closed contacts in said circuit in series with the blanket heating element, said differential relay comprising a series winding in said circuit in series with said heating element and said normally closed contacts and a shunt winding connected in parallel circuit relation with said heating element and said contacts whereby opening of the contacts de-energizes the series winding without de-energizing the shunt winding, said windings being arranged in opposed and normally balanced relation, said windings assuming an unbalanced relation to effect opening of the relay contacts, so as to prepare said heating circuit to end a heating cycle, upon an increase in resistance of said heating element due to heating of the blanket to a predetermined temperature and locking in the contact-open position upon opening of the contacts; a secondary control which becomes operative only after opening of said relay contacts including a time-delay switch, having switch elements in series with both of said windings, and having actuating means connected in parallel with the series winding of the differential relay and with the contacts of the relay, and being effectively energized in

series with said blanket heating element to thereby reduce current flow through said blanket heating element upon opening of the relay contacts, said actuating means upon being so energized operating the switch elements and effecting opening thereof after a predetermined time, said switch elements upon opening thereof being operative to terminate energization of said actuating means, and said relay contacts again closing upon opening of the time relay switch to condition said heating circuit for another heating cycle upon subsequent closing of the time delay switch.

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