

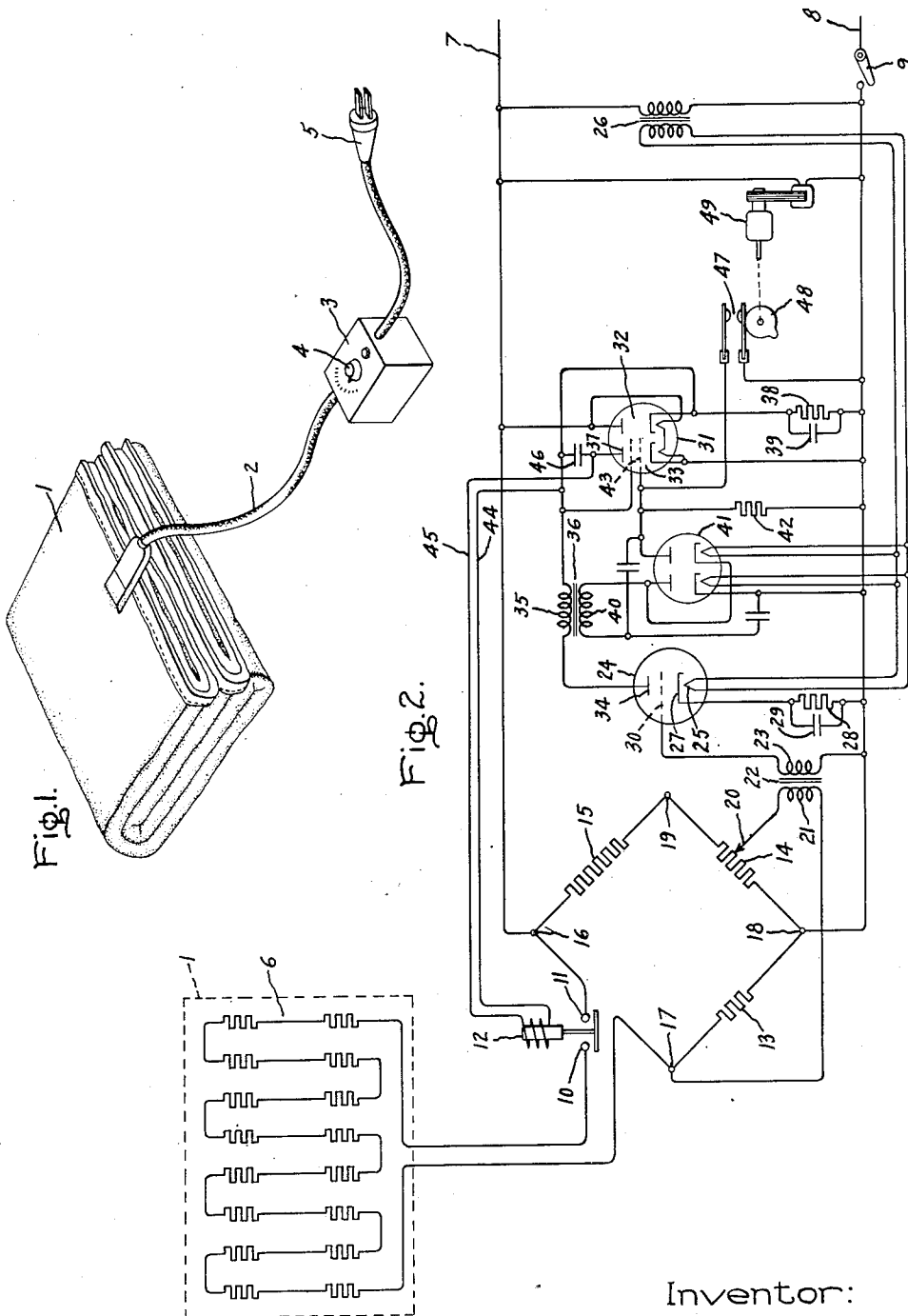
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ELECTRIC BLANKET AND CONTROL THEREFOR

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ELECTRIC BLANKET AND CONTROL THEREFOR

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9 Claims. (Cl. 219—20)

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The present invention relates to an electric blanket or the like and to a control device therefor for regulating and maintaining the temperature of the blanket.

It is an object of the present invention to provide such a control device which operates by reason of the temperature of the electric heating element itself and, more specifically, by reason of the change in the electric resistance of the heating element due to a change in temperature.

It is a further object of the invention to provide a control device for an electric blanket or the like, all the operating parts of which can be placed outside of the blanket itself.

These and other objects of the invention will best be understood from the following description taken in connection with the accompanying drawing in which Fig. 1 is a representation of an electric blanket with a control device attached thereto, and Fig. 2 is a schematic diagram of the blanket and control device.

Fig. 1 illustrates an electric blanket 1 having attached thereto, by a suitable cable 2, a control box 3 having an external adjustable temperature selecting knob 4. A power input connection plug is illustrated at 5.

Referring now to Fig. 2, the electric blanket or other heating apparatus represented at 1 is provided with a heating winding 6. Where the device 1 is an electric blanket, the heating winding 6 will preferably be uniformly distributed within the blanket over substantially the entire blanket area; for example, a blanket body may be used like that described in Patent 2,203,918 to I. O. Moberg issued June 11, 1940. The winding 6 is made of a material having a high temperature coefficient of resistance, for example, copper or a suitable alloy thereof. It is supplied with alternating current power from supply lines 7 and 8 through line switch 9. One terminal of the heating element 6 is connected through contacts 10 and 11 of a relay 12 to line conductor 7, while the other terminal of the element 6 is connected in series with a low ohmic resistor 13 to line conductor 8. The relay 12 is normally open and is closed by excitation of its operating coil. In the particular embodiment of the invention illustrated in the drawing, operating current for the relay is provided by a control circuit which is operable at regular intervals to effect excitation of the relay operating coil, and to maintain such excitation, following each such operation for a period of time which is determined by the temperature of the element 6 and with relation to the temperature selected by the operator. To this end, the heating element 6 forms one leg of a resistance bridge network whose unbalance voltage is amplified and rectified and is used to determine the length of time the relay 12 is held closed following each of its periodic closing opera-

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tions. When starting up, the relay, having once been closed, does not open until the element 6 reaches its predetermined temperature; at that point the bridge voltage will be zero and the relay 12 will become deenergized, opening contacts 10 and 11 and disconnecting the heating element from the line until the next successive closing operation. In practice, the bridge voltage does not have to be zero, but of such value that the relay 12 becomes deenergized; the exact voltage value used depends upon the particular circuit design and its parameters, as will be understood by those skilled in the art.

The bridge network, of which the heating element 6 forms one leg, consists further of resistances 13, 14 and 15. The element 6 is connected across terminals 16, 17; the resistance 13 between terminals 17, 18; the resistance 14, which is preferably variable, is connected between terminals 18 and 19; while the fixed resistance 15 is connected between terminals 16 and 19. Voltage is applied to the bridge network from conductors 7 and 8 across terminals 16 and 18. The control voltage appears across terminals 17 and 19 when all of resistor 14 is used. Since this resistor is preferably variable and is provided with an adjustable contact arm 20 operable by knob 4, the control voltage is actually taken between terminal 17 and the arm 20.

This voltage is supplied to the primary 21 of a transformer 22 having a secondary winding 23, whereby the unbalance voltage of the bridge is magnified. The voltage of the transformer secondary 23 is amplified by vacuum tube 24. This has a filament 25 supplied with power from a transformer 26 connected across the line in conventional manner. The cathode 27 of the tube 24 is connected in series with resistance 28 to line conductor 8. The resistance 28 is shunted by a condenser 29 and this combination is for the purpose of adjusting the voltage in the grid cathode circuit of the tube 24 for best operation. The grid 30 of the tube 24 is connected to transformer secondary 23, whose other terminal is connected to line conductor 8 and thereby to the cathode. The rectifier section 32 of a vacuum tube 31 provides direct current for the anode circuit of tube 24, the anode 34 and cathode 27 being connected across resistor 38 in the cathode circuit of rectifier 32. The resistor 38 is shunted by condenser 39 for smoothing out the half wave rectified pulses.

In series with the anode 34 is the primary 35 of the transformer 36, the secondary winding 40 of which is connected to a voltage doubler rectifier 41 whose output voltage appears across a resistance 42. The drop across resistance 42 is supplied to the grid 43 of the beam power amplifier section 33 of tube 31. The screen grid and the anode circuit of amplifier 33 are likewise sup-

plied with D.-C. from the rectifier 32. The anode current of amplifier 33 is used to operate the relay 12, whose operating coil is connected by conductors 44 and 45 to the cathode resistor 38 of the rectifier and to the anode 37 of the amplifier, respectively. A condenser 46 is connected across the relay winding to suppress possible chattering of the relay which may occur where the tube 32 is a half wave rectifier.

Closing of the relay 12 independently of the condition of the other parts of the control circuit is necessary, because the bridge circuit is not energized and is non-operative when the relay 12 is open. For this purpose, there are provided contacts 47 which are closed periodically by a cam 48 driven by a motor 49. The contacts 47, when closed, short resistor 42 and thereby reduce the bias on grid 43, permitting tube 33 to pass current and energize the relay 12 to close its contacts.

The operation of my control circuit is therefore as follows: When the line switch 9 is closed, the cam 48 will close the contact 47, thereby connecting the control grid 43 to the cathode of the tube 33 and permitting current to flow through tube 33 to energize relay 12, which closes contacts 10, 11 and energizes the heating element 6. The bridge circuit, being simultaneously energized, will produce only a low voltage in the primary of transformer 21 so long as the heating element 6 has not reached its proper temperature as determined by the adjustment of the arm 20 on the resistor 14. Thus the bias developed on the control grid 43 of the relay tube will not be sufficient to cause the relay 12 to open when the contacts 47 are opened by operation of the cam 48 until the heating element 6 reaches the selected operating temperature. As the heating element 6 becomes hotter, its resistance increases, reducing the voltage drop across resistor 13. The voltage across primary 21 therefore increases. This voltage, being magnified by transformer 22 and amplified by vacuum tube 24 and again magnified by transformer 36, is rectified by the voltage doubler rectifier 41 and appears across resistor 42 to place a negative bias on the operating grid 43 of the tube 33 during periods when the contacts 47 are opened, thereby cutting off the flow of plate current through this tube. The relay 12, therefore, becomes deenergized, permitting contacts 10, 11 to be opened and thereby deenergizing the heating winding 6. Relay 12 remains open until cam 48 again closes contacts 47, after which the operating cycle is repeated. It will thus be seen that the periodically closed contacts 47 provide for periodic connection of the heating element 6 to the power supply, and that the length of the period during which the element 6 is energized is controlled by its temperature and the adjustment of resistor 14.

It will thus be seen that I have provided a direct control of the electric energy delivered to the heating element of an electric heating device such as an electric blanket, which control can be placed entirely outside of the heating device itself. My invention requires only that the heating element have a sufficiently high temperature coefficient of resistance to provide an appreciable current change in the heating element circuit in response to a change in the element's temperature.

My invention contemplates in the control system a device for producing a voltage change in response to a change in the heating element resistance, this voltage change being compared to a reference voltage to obtain a control voltage for

controlling an electron tube circuit which in turn provides holding current for a relay or switch having contacts in the heating element circuit, the relay in the illustrated embodiment being periodically closed by operation of a cam switch, as previously described.

In the embodiment of my invention as shown and described, the heating element is connected so as to comprise one arm of a four armed resistance bridge, and the heating element current is conducted through a second arm of the resistance bridge. The voltage drop across the second arm is thus proportional to the change in heating element resistance and temperature. While I have illustrated motor operated, cam controlled contacts for effecting periodic application of the control potential to the power tube in the circuit, it will be understood that the purpose of this is to produce the closing of the heating circuit relay which is necessary to the operation of the circuit of my invention, and that this result can also be obtained by other arrangements; for example, the contacts can be operated by a temperature responsive thermostat device such as is used in flasher circuits.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A control for an electric heating device having a heating winding adapted to change its resistance with change in its temperature, relay means having contacts in circuit with said heating winding, means for intermittently momentarily closing said contacts for energizing said heating winding and means including an electron tube circuit responsive to the resistance of said heating winding for energizing said relay to hold said contacts closed until said heating winding reaches a predetermined temperature.

2. A control for an electric blanket having a heating winding with a high temperature coefficient of resistance comprising, in combination therewith, means for establishing a change of potential in response to a change in resistance of said winding, means for comparing said potential with a reference potential and thereby deriving a control potential, an electron tube circuit, means applying said control potential to the input of said circuit and thereby producing a change in the output current thereof, relay means having contacts in circuit with said heating winding and adapted to be operated by said output current to disconnect said heating winding from a supply source and means operable at the beginning of each heating interval to close said contacts.

3. A control for an electric blanket having a heating winding with a high temperature coefficient of resistance comprising, in combination therewith, a resistor in series with said winding whereby the potential drop across said resistor varies in accordance with current flow through said winding, means comparing said potential drop with a reference potential and thereby deriving a control potential, an electron tube circuit, means applying said control potential to the input of said circuit and thereby producing a change in the output current thereof, relay means having contacts in circuit with said heating winding and adapted to be operated by said output current to disconnect said heating winding from a supply source and means operable at

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the beginning of each heating interval to close said contacts.

4. A control for an electric blanket having a heating winding with a high temperature coefficient of resistance comprising, in combination therewith, a resistor in series with said winding whereby the potential drop across said resistor varies in accordance with current flow through said winding, a resistance bridge network having said winding in one leg and said series resistor in an adjacent leg, means applying a potential to said network, an electron tube circuit, means applying the unbalance bridge potential to the input of said circuit and thereby producing a change in the output current thereof, relay means having contacts in circuit with said heating winding and adapted to be operated by said output current to disconnect said heating winding from a supply source and means operable at the beginning of each heating interval to close said contacts.

5. A control for an electric blanket having a heating winding with a high temperature coefficient of resistance comprising, in combination therewith, a resistor in series with said winding whereby the potential drop across said resistor varies in accordance with current flow through said winding, a resistance bridge network having said winding in one leg, and said series resistor in an adjacent leg, resistors in the other two legs of said bridge, means applying a potential to said bridge, and across said heating winding and first resistance in series, a transformer having primary and secondary windings, said primary being connected across said series resistor and an adjacent resistor of said bridge, an electron tube circuit having its input connected across said secondary winding and a relay in the output thereof, said relay having contacts in circuit with said heating winding and being adapted to be operated by a change in the output current to disconnect said heating winding from a supply source and means operable at the beginning of each heating interval to close said contacts.

6. A control for an electric blanket having a heating winding with a high temperature coefficient of resistance comprising, in combination therewith, a resistor in series with said winding whereby the potential drop across said resistor varies in accordance with current flow through said winding, a resistance bridge network having said winding in one leg, and said series resistor in an adjacent leg, resistors in the other two legs of said bridge, one of said latter resistors being adjustable in accordance with a desired temperature to be maintained by said heating winding, means applying a potential to said bridge across said heating winding and series resistance legs, a transformer having primary and secondary windings, said primary being connected across said series resistor and said adjustable resistor of said bridge, an electron tube circuit having its input connected across said secondary winding and a relay in the output thereof, said relay having contacts in circuit with said heating winding and being adapted to be operated by a change in the output current to disconnect said heating winding from a supply source and means operable at the beginning of each heating interval to close said contacts.

7. A control for an electric blanket having a heating winding with a high temperature coefficient of resistance comprising, in combination therewith, a resistor in series with said winding

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whereby the potential drop across said resistor varies in accordance with current flow through said winding, a resistance bridge network having said winding in one leg and said series resistor in an adjacent leg, means applying a potential to said network, an electron tube circuit, having an output tube normally biased to produce an output current, relay means having contacts in circuit with said heating winding and an operating coil connected to said output tube and adapted to be operated by said output current to close said contacts thereby connecting said heating winding to a supply source, means applying the unbalance bridge potential to the input of said electron tube circuit, said circuit being adapted to cut off said normal output current in said output tube and thereby open said relay contacts in response to a predetermined increase in said heating winding resistance and means operable at the beginning of each heating interval to close said contacts.

8. A control for an electric blanket having a heating winding with a high temperature coefficient of resistance comprising in combination therewith, a resistor in series with said winding whereby the potential drop across said resistor varies in accordance with current flow through said winding, a resistance bridge network having said winding in one leg and said series resistor in an adjacent leg, an electron tube circuit having an output normally biased to produce an output current, relay means having contacts in circuit with said heating winding and an operating coil connected to said output tube and adapted to be operated by said output current to close said contacts thereby connecting said heating winding and said network to a power supply, means applying the bridge potential to the input of said electron tube circuit, said circuit being adapted to cut off said normal output current in said output tube in response to a predetermined increase in said heating winding resistance, and intermittently closed contact means in said electron tube circuit for intermittently reestablishing said normal output current flow through said output tube.

9. A control for an electric blanket having a heating winding with a high temperature coefficient of resistance comprising in combination therewith, a resistor in series with said winding whereby the potential drop across said resistor varies in accordance with current flow through said winding, a resistance bridge network having said winding in one leg and said series resistor in an adjacent leg, an electron tube circuit having an output tube normally biased to produce an output current, relay means having contacts in circuit with said heating winding and an operating coil connected to said output tube and adapted to be operated by said output current to close said contacts thereby connecting said heating winding and said network to a power supply, means applying the bridge potential to the input of said electron tube circuit, said circuit being adapted to cut off said normal output current in said output tube in response to a predetermined increase in said heating winding resistance and contact means in said output tube circuit for reestablishing when closed said normal output current flow through said output tube, and a motor operated cam for periodically opening and closing said contact means.

LEONARD W. COOK.

Disclaimer

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Hereby disclaims claims 1, 2, 3, 4, 5, and 7.

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