

April 2, 1940.

W. K. KEARSLEY

2,195,958

ELECTRICALLY HEATED BLANKET

Filed Sept. 4, 1936

2 Sheets-Sheet 1

Fig. 1.

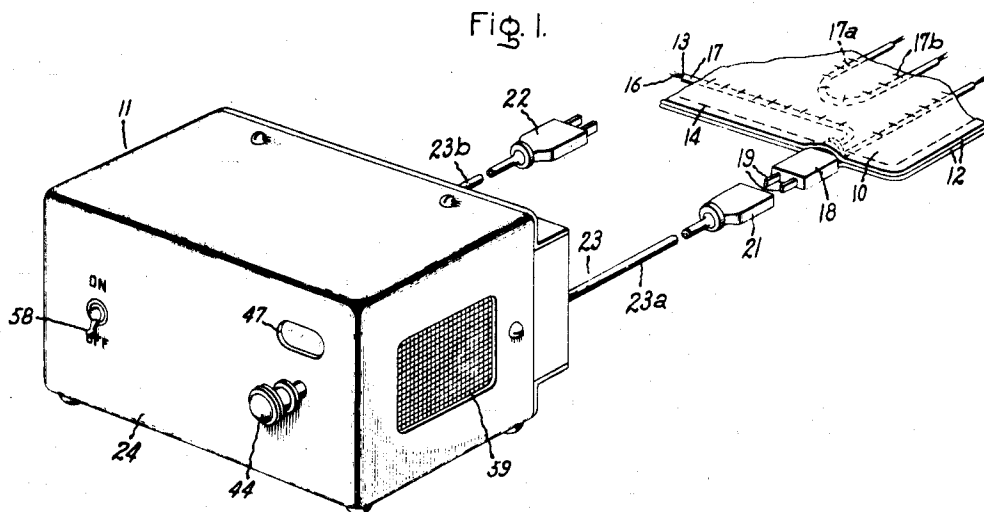


Fig. 2.

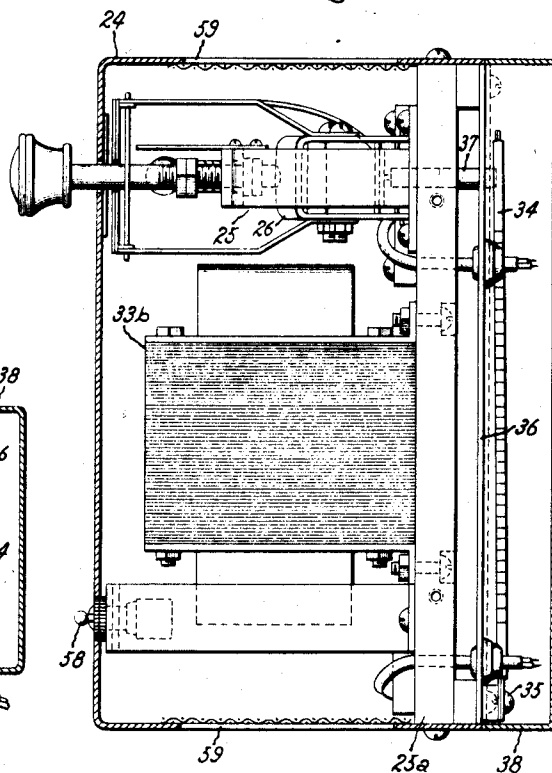
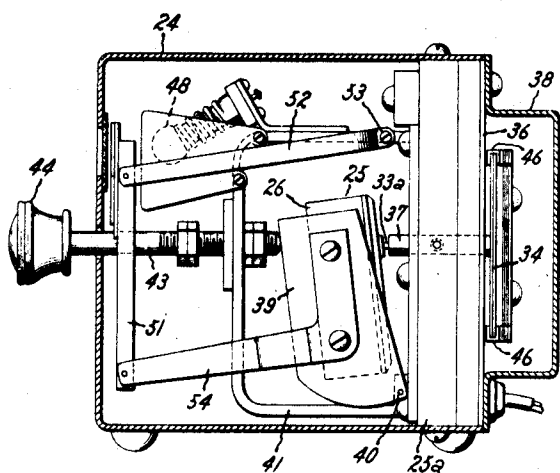


Fig. 3.



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2 Sheets-Sheet 2

Fig. 4.

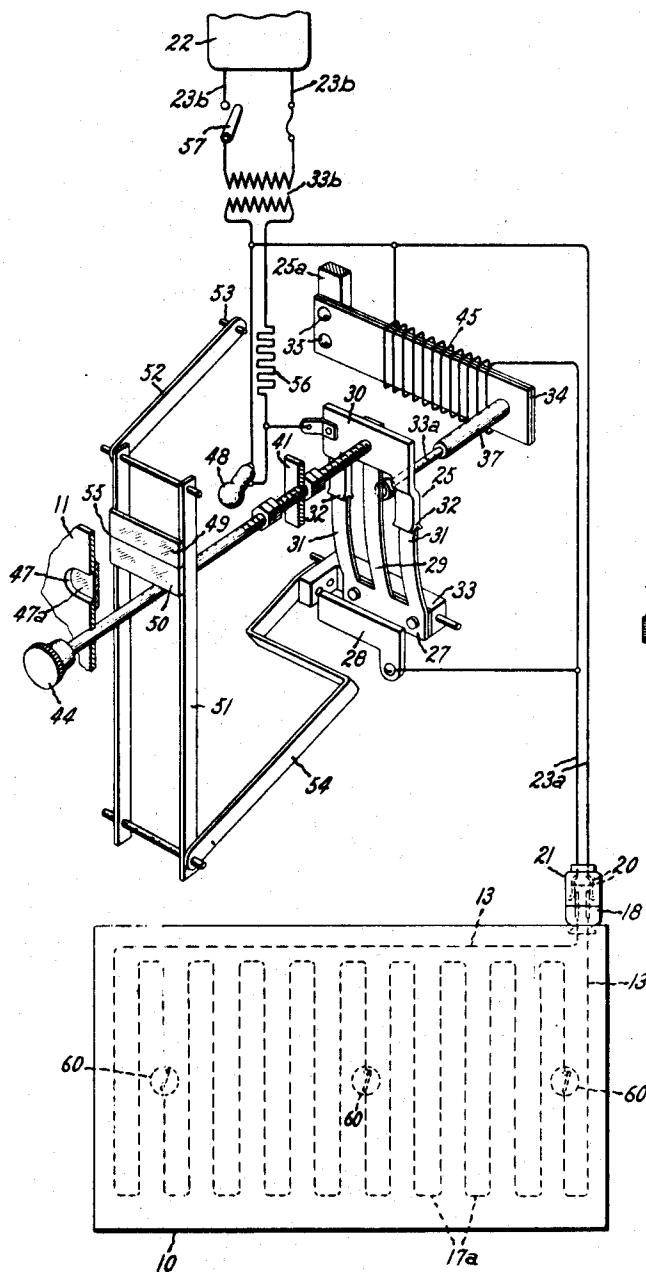
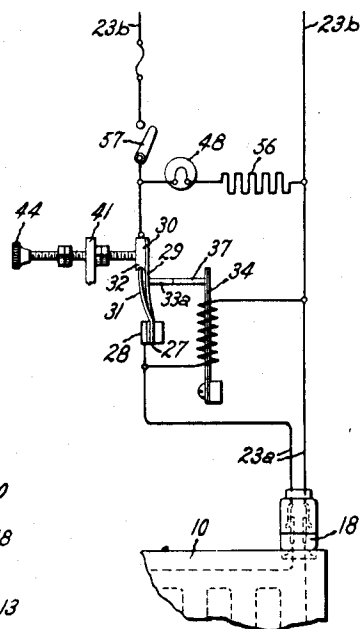


Fig. 5.



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UNITED STATES PATENT OFFICE

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ELECTRICALLY HEATED BLANKET

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New York

Application September 4, 1936, Serial No. 99,459

8 Claims. (Cl. 219—20)

This invention relates to electrically heated blankets, and it has for its object the provision of an improved device of this character.

This invention contemplates the provision of an improved electrically heated blanket intended to take the place of blankets heretofore generally used in the home, in hospitals, etc.

These latter blankets generally are relatively heavy, and in very cold climates, it is generally necessary to use so many of them that the weight becomes quite objectionable.

Moreover, it is a common experience for one to find the bedroom relatively warm when going to bed, and that the weight of the blanket or the number required to give comfortable sleeping conditions at this time is not nearly sufficient to keep the sleeper warm later on in the night when the room cools off. If one wishes to be comfortable when first going to bed, he must use a relatively light covering and take the chance on waking up to provide more blankets as the room temperature falls. This practice is troublesome, and at times, is actually dangerous in that it is conducive to colds.

This invention contemplates the provision of an improved electrically heated blanket so light in weight as to be comfortable at the highest room temperatures it is desired to use a covering at all, and of suitable means for adding sufficient heat energy to the blanket as the room cools to maintain a comfortable temperature, irrespective of how low the room temperature falls and irrespective of how it varies through the night.

In accordance with this invention, the blanket in one form thereof is made of a suitable light-weight fabric, such as a cotton cloth. Attached to the cloth is a suitable heating element, preferably in the form of a resistance conductor. The conductor is so distributed and arranged that the heat generated is distributed relatively uniformly throughout the area of the blanket.

The temperature of the blanket is controlled by governing the heat energy input to the blanket responsively to the ambient temperature of the blanket, that is, in accordance with the temperature of the room in which the blanket is located.

In one form of this invention, the temperature control means comprises a suitable temperature responsive element controlling a switch in the heating circuit of the blanket to apply heat to and cut it off from the blanket in accordance with the temperature of the responsive element. The temperature responsive element is removed thermally from the blanket and is positioned in the room to respond to the room temperature. In

addition to receiving heat from the room, the thermostat is arranged to receive heat from a suitable auxiliary heating device arranged in thermal relation with it. The quantity of heat energy imparted to the thermostat by the auxiliary heating device and by the air in the room determines the proportionate amount of time that the thermostat permits the switch to supply heat to the blanket as compared with the time that the heat is shut off. These time periods are varied as the action of the thermostat varies responsively to changes in the room temperature so as to hold a substantially constant temperature in the blanket.

Suitable means are provided for adjusting the control device to hold different temperatures in the blanket. In one form of this invention, a suitable indicating device is provided to assist in adjusting the temperature. Preferably, the indicating device will be visible at night so that a person in a dark room can conveniently adjust the device to the desired temperature.

For a more complete understanding of this invention, reference should be had to the accompanying drawings in which Fig. 1 is a perspective view illustrating a portion of an electrically heated blanket arranged in accordance with this invention, and illustrating a temperature control device therefor also arranged in accordance with this invention; Fig. 2 is a horizontal sectional view of the control device shown in Fig. 1; Fig. 3 is a vertical sectional view of this control device; Fig. 4 is a diagrammatic representation of the control device of Figs. 1, 2 and 3, and of the blanket shown in Fig. 1; and Fig. 5 is a view similar to Fig. 4 arranged to illustrate certain details of construction.

Referring to the drawings, this invention has been shown in one form as applied to an electrically heated blanket 10 which is controlled by means of a suitable temperature responsive element 11 that is thermally removed from the blanket and arranged to respond to the ambient temperature of the blanket. As shown in Fig. 1, the blanket comprises a pair of sheets 12 arranged in superimposed relation and receiving between them a resistance conductor 13. The sheets 12 may be formed of any suitable light-weight material, such as a soft plain cotton cloth, and the two sheets will be secured together in any suitable manner as by stitching 14 at the periphery and where else in the body of the pad that it is deemed advisable to use it to hold the sheets together. The resistance conductor 13 will have a suitable resistance conducting element 16 pro-

vided with an insulated water-proof covering 17 formed of any suitable material, such as a suitable synthetic rubber compound. The conducting element and covering are very light and do not add appreciably to the weight of the cloth sheet 12.

The resistance conductor 13 preferably will be arranged in a plurality of convolutions 17a, shown more clearly in Fig. 4, so as to be distributed substantially uniformly throughout the area of the blanket 10. In other words, the resistance conductor is so arranged that the heat generated thereby is distributed uniformly over the blanket surface whereby all portions of the blanket are maintained substantially at the same temperature. This, of course, is very desirable in that all parts of the bed will have substantially the same temperature. This is in striking contrast to the usual condition wherein the portions of the bed not in immediate contact with the body are cold. The resistance conductor 13 may be and as shown is secured to the sheets 12 by stitches 17b looped over the conductor.

A suitable electrical terminal plug 18 is attached to the blanket, preferably at one corner thereof, as clearly shown in Figs. 1, 4 and 5. This plug receptacle has a pair of terminal pins 19 connected to the ends of the resistance conductor respectively and adapted to engage a pair of contacts 20 in a supply plug 21 when the plug is applied, as clearly shown in Fig. 4. The plug 21 is connected to a supply plug 22 by means of a cord 23.

The temperature control device 11 for the blanket 10 is interposed in the cord 23 between the supply plug 22 and the plug 21 attached to the blanket, dividing the cord into two branches 23a and 23b.

This control device 11, as shown more clearly in Figs. 1, 2 and 3, comprises an outer casing 24 which may have any suitable shape, but which preferably will have a rectangular box-like form, as shown in Fig. 1. The casing 24 may be formed of any suitable material, such as pressed steel or wood. Housed within the casing 24 is a suitable switch 25 adapted to be connected in the heating circuit of the pad. The switch 25 may have any suitable construction, but preferably will be of the snap action type. The switch is mounted upon a base 25a mounted in the rear of the casing.

The switch 25 has a housing or casing 26 in which is mounted a movable contact 27 (Fig. 4) arranged to cooperate with a fixed contact 28. Contact 27 is carried by a suitable flexible switch arm 29 formed of conducting material, and rigidly secured at one end to a fixed support 30 mounted in the housing and at its other end rigidly secured to the contact 27. Arranged on opposite sides of the flexible switch member 29 are a pair of springs 31 secured to the movable contact 27 at one end and at their opposite ends are received in knife-edge bearings 32. The members 31 are in longitudinal compression thereby putting the switch arm 29 under tension. The springs 31 normally bias the movable contact 27 away from the fixed contact 28. A suitable stop 33 is provided to limit the movement of the contact arm away from the fixed contact. The movable contact arm 29 when moved to the left, as viewed in Figs. 4 and 5, snaps through a neutral position to close the contacts. However, if the force which moves the switch arm 29 to the closed position is relieved, the switch will automatically move with a snap action to its open position. The

switch arm 29 is moved to its closed position by means of a plunger 33a protruding from the casing 26, as shown in Fig. 3.

As shown, diagrammatically in Figs. 4 and 5, one conductor of the supply cord section 23a connects one side of the heating element 13 to the fixed contact 28. From here, the circuit through the control device may be traced from the switch arm 29 when the switch is closed through the plate 30, which is conducting, and to one side of a transformer 33b mounted in the casing 24; the function of this transformer will be described in greater detail hereinafter. The other conductor of the section 23a connects the other side of the heating element to the opposite side of the transformer.

The switch arm 29 is controlled by means of a bimetallic thermostat bar 34. This bar, it will be understood, is formed of two metals having dissimilar coefficients of expansion, such as Invar and brass secured together lengthwise in any suitable manner, as by welding. The bimetallic bar 34 is positioned on the rear of the casing 24, as shown in Figs. 2 and 3, having one end rigidly secured to the back of the base 25a by means of screw fastening means 35 and its other end free to move in response to changes in temperature. Preferably, a metallic plate 36 will be mounted on the rear of the base, and preferably, the thermostatic bar 34 will be arranged on the outside of this plate in substantially parallel relation with it. A suitable stud or rod 37 is interposed between the free end of the bimetallic thermostat bar and the switch operating plunger 33a. The rod 37 enters the casing 24 through an aperture provided for it in the plate 36, and abuts the end of the plunger, as shown in Figs. 3, 4 and 5.

The bimetallic bar 34 is so arranged that it will move outwardly from the casing upon an increase in temperature and toward the casing upon a decrease in temperature, and when its temperature is below a predetermined minimum it applies a sufficient force to contact arm 29 to hold the switch closed. When the temperature of the bar rises to a predetermined maximum, it will have moved outwardly sufficiently to permit the switch to open. Conversely, when it cools to the predetermined low temperature, it will have moved inwardly sufficiently to close the switch. Preferably, the bimetallic thermostat bar 34 will be inclosed by means of a suitable relatively thin casing member 38 secured to the base plate 25a.

The adjustment of temperature of the control device is effected by changing the position of the switch 25 in the casing 24. This is accomplished by mounting the switch member for pivotal movement. For this purpose, the switch 25 is mounted in a suitable saddle or support 39 which at its lower right hand corner, as viewed in Fig. 3, is mounted upon pins 40 which in turn are mounted on a suitable supporting bracket 41 in the casing. Preferably, the bracket 41 will be attached directly to the base plate 25a at the rear of the casing, as shown in Fig. 3. It will be observed that the switch because of the location of the pivot pins 40 always tends to move in a counter-clockwise direction, as viewed in Fig. 3, under the influence of gravity.

Threaded in the bracket 41 is an adjusting screw 43 having its inner end bearing against the saddle 39. It will be clear that the position of the switch 25 in the casing is varied when the position of the screw is changed. When the screw 43 is turned outwardly to permit the switch

25 to move in a counter-clockwise direction, as viewed in Fig. 3, it reduces the temperature setting of the device. Conversely, when the screw 43 is turned inwardly to move the switch in the opposite direction it increases the temperature setting of the device. The adjusting screw projects outwardly from the front wall of the casing through a suitable aperture provided for it in this wall, and on the projecting end of the screw there is a suitable knob 44 whereby the screw can be conveniently adjusted.

In view of the foregoing, it will be observed that the bimetallic thermostat bar responds to the temperature of the room in which the control 11 is placed. In addition to this, the thermostat bar is caused to respond to a local heat source which is obtained by winding the thermostat bar with an auxiliary resistance conductor 45. Preferably, the two side edges of the bimetallic thermostat bar will be provided with U-shaped insulating coverings 46 about which the resistance conductor is wound. The auxiliary heating coil 45, as shown, is connected at one side to one side of the transformer 33b and at the other side to the switch contact 28 so that when the switch is closed, the heating coil is energized, whereas when the switch is opened the coil is deenergized.

The electrical energy input to the blanket 10 is controlled by the proportion of time that the switch 25 is closed to the time it is open. These times are controlled by the temperature of the thermostat bar which is jointly dependent upon the auxiliary heater 45 and the room temperature. The heat applied by the auxiliary heater 45 to the thermostat bar is delivered at a constant rate, whereas that supplied by the room is variable. For a given unchanging room temperature, the thermostat controls the switch 25 to deliver an invariable amount of energy to the blanket which then delivers a constant heat energy. Under these conditions, the temperature of the blanket is constant. When the room temperature varies, however, the heat energy delivered by the blanket changes. Thus, if for a given setting of the thermostat, the room temperature should decrease, the heat that will be imparted to the thermostat bar from the room is reduced and it will require a longer period of time for the auxiliary heater 45 to heat the bar 34 to the temperature at which it opens the switch than it did before; and after the switch has been opened and the auxiliary heater 45 is deenergized, the thermostatic bar 34 will cool quicker to reclose the switch due to the increased cooling action of the room. The two actions in delaying the opening of the switch and in advancing its closing, cooperate to increase the proportion of time that the switch is closed. In other words, as the room cools, a greater amount of energy is supplied to the blanket 10 to hold its temperature constant in spite of the decrease in room temperature. Conversely, when the room warms up, the proportion of the time that the switch is closed to the time that it is opened is reduced so as to reduce the energy input of the blanket sufficiently to hold a constant temperature. The foregoing control is very important because it provides an energy input to the blanket which is inversely related to the temperature of the room.

It is to be understood that the control is so arranged that a substantially uniform temperature is maintained in the blanket for any given setting of the control device, irrespective of

variations in the room temperature. The temperature of the blanket 10 can be adjusted to any suitable value by the knob 44. However, for any given setting, the inverse relationship between the energy input to the blanket and the temperature of the room is maintained by the control device. Moreover, it will be clear that the blanket temperature will remain substantially uniform irrespective of variations in the voltage of the electrical supply source. Should the voltage drop below the normal, the voltage will drop in the auxiliary heater 45, and as a result, it will function to increase the proportion of the time that the switch is closed to the time that it is open to compensate for the dip in line voltage. Conversely, should the supply voltage increase above the normal, the control will function to decrease the proportion of time that the switch is closed to the time that it is open to compensate for the voltage rise.

A suitable indicating device is provided to assist in adjusting the temperature of the control device. This indicating device comprises a window 47 in the front wall of the casing adjacent the adjusting knob 44, as clearly shown in Fig. 1. The window 47 preferably will be covered by a translucent piece of glass, or similar material. Arranged back of the window is a suitable source of light shown as an incandescent lamp 48. This lamp, as shown, is mounted on the bracket 41. Interposed between the window and the incandescent lamp are a pair of transparent sheet-like members 49 and 50 having different colors. For example, the member 49 may be green, whereas the member 50 may be red. They may be formed of pieces of glass, Celluloid or like materials. The members 49 and 50 are mounted upon a suitable carriage 51 which supports them in substantially the same plane and in a plane substantially parallel to the plane of the window 47. The carriage 51 at its upper end is pivotally attached to a link 52 which has a fixed pivotal connection 53 with the base 25a. The lower end of the carriage 51 is secured to a bracket arm 54 which is rigidly secured to the saddle 39 of the switch. Thus, when the switch saddle 39 is moved on the pivot 40, the carriage 51 is moved vertically of the casing so as to move the colored members 49 and 50 vertically in the casing. Preferably, the line 55 (Fig. 4) defined by the meeting edges of the colored members 49 and 50 will be perpendicular to the line of movement of the colored members.

It will be observed in view of the foregoing arrangement that when the adjusting knob 44 is turned to set the temperature of the control device, the colored members 49 and 50 are moved so that one or the other or a part of each will appear in the field of vision of the window 47. The parts are so arranged that on the very low temperature settings of the device, the green member 49 alone will appear in the window, and as the temperature setting is raised the green color will advance upwardly and eventually the red color will enter the field of vision. As the temperature settings increase, the meeting line 55 of the two colors will be elevated on the field of vision, the increasing amount of red appearing denoting an increasing temperature setting. At the very high temperature settings, the green color will have disappeared and the red only will show.

The lamp 48 as shown in Fig. 4, is connected to the two sides of the transformer 33b and is

continuously energized while the device is operating. Preferably, a suitable resistance 56 will be inserted in the lamp circuit as a protective device.

- 5 It is preferable that a suitable control switch 57 (Fig. 4) be mounted in the casing 24 and connected in the energizing circuit of the blanket to open and close this circuit, as desired. This switch preferably will be of the snap action type
10 and will have a control member 58 (Fig. 1) accessible on the exterior of the casing for convenience of operation.

- At times, it is desired to operate the blanket on a relatively low voltage in order to eliminate danger of shocks, and it is for this purpose
15 that the transformer 33b is provided. The transformer is arranged to reduce the voltage of the supply source attached to the plug 22 to the desired low value. Where this low voltage is not desired, the transformer is omitted. As shown in Fig. 2, where the transformer is used it is preferable to ventilate the casing so that the thermostat 24 will not be influenced by heat generated in the transformers. For this purpose
20 screened windows 59 are provided in the end walls of the casing. The wall 25a also thermally insulates the transformer 23 from the thermostat.

- If desired, and it is generally preferable to do
30 so, a suitable number of protective devices 60 will be incorporated in the blanket and will be connected in series with its heating circuit, as shown in Fig. 4. These devices may be any suitable thermostatic devices arranged to open the
35 heating circuit in case of an abnormal high temperature condition, such as a temperature of 180° to 200° F.

- It will be observed that I have provided an electrically heated blanket which is very light
40 in weight, and which is arranged to heat all parts of the bed inasmuch as the heat energy developed in the blanket is uniformly distributed. Moreover, it will be observed that I have provided a temperature control for the blanket
45 arranged to vary the heat energy input to the blanket inversely with variations in the room temperature so that as the room cools off during the night, the heat energy input to the blanket is increased, and conversely, if the room
50 should become warm the heat energy will be reduced, all to hold a substantially uniform temperature in the blanket.

- Moreover, I have provided a temperature control which embodies an improved visual signal
55 so that the device can be readily adjusted in the dark at any time during the night if it is found desirable to do so.

- This invention is particularly applicable also to airplanes, trains, ships and the like where
60 individual sleeping compartments are provided. In such applications a separate blanket 10 and control 11 will be provided for each compartment, the control being located so as to respond to the temperature of the air in the vicinity
65 of the sleeping person. Where a low voltage operation is desired, separate transformers 33b may be used, as shown in the drawings, or one transformer may be used for the whole system.

- While I have shown particular embodiments
70 of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made, and I, therefore, contemplate by the appended claims to cover any such modifications as fall within the
75 true spirit and scope of my invention.

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

1. In an electrically heated blanket for a bed, a temperature control device for said blanket comprising a temperature responsive element out
5 of heat conducting relation with said blanket and responding to the air temperature of the bed room in which the blanket is placed controlling the energy input to the blanket to vary it in the inverse order with variations in said air
10 temperature so that a substantially constant temperature is held in said blanket irrespective of said variations in said air temperature.

2. An electrically heated blanket having a heating circuit and a temperature control device
15 comprising a switch connected in the heating circuit of said blanket, a temperature responsive element for operating said switch to shut off and reapply energy to said blanket, the temperature responsive element being thermally removed from the influence of the temperature of
20 said blanket and exposed to the air temperature of the room in which the blanket is located, an auxiliary heating element also thermally removed from the influence of the temperature of said
25 blanket arranged to apply heat locally to said thermostatic switch in addition to that received from said air of said room, the auxiliary heating element being connected in said heating circuit of said blanket so as to be energized and deenergized when said circuit is energized and deenergized, the heat imparted to said temperature responsive element by the air of the room and said auxiliary heating element jointly controlling the operation of said temperature responsive element to operate the switch to vary
35 the energy input to the blanket in the inverse order with variations in said air temperature so as to hold a substantially constant temperature in the blanket irrespective of said variations in said air temperature.

3. An electrically heated blanket comprising a blanket formed of a light weight material, a heating element associated with said blanket, an electrical supply circuit for said heating element, a thermostatic switch connected in said
45 supply circuit movable between controlling positions to open and close said supply circuit responsively to increases and decreases in temperature, said thermostatic switch being out of heat conducting relation with said blanket and responding to the temperature of the room in which said blanket is located, an auxiliary heating element connected in said supply circuit
50 arranged to apply heat locally to said thermostatic switch only when said switch is in its controlling position to close said supply circuit so that the heat imparted to said thermostatic switch from said auxiliary heating element and room controls the period of time said switch is in
55 said position and thereby the energy input to said blanket, said period varying in the inverse order with variations in the temperature of said room to maintain a substantially uniform temperature condition in said blanket irrespective of said variations in said room temperature.

4. A temperature control device comprising a casing, a pivotally mounted switch in said casing having an operating element to open and close said switch, a temperature responsive element engaging said operating element to open
70 and close said switch depending upon the temperature of said temperature responsive element, an adjusting screw in said casing for adjusting the position of said switch and thereby the tem-
75

peratures of said temperature responsive element at which said switch is opened and closed, a knob accessible on the exterior of said casing controlling the position of said screw, a window in a wall of said casing, a lamp in said casing back of said window, a pair of transparent members in said casing having different colors arranged substantially in the same plane and parallel to said window between the window and said lamp, means supporting said members for movement in said plane across the field of vision defined by said window, and a bracket connecting said switch with said colored members arranged to move said members in said field of vision when the position of said switch is adjusted.

5. A temperature control device comprising a casing, a pivotally mounted switch in said casing having an operating element to open and close said switch, a temperature responsive element on the exterior of said casing to respond to the ambient temperature thereof, a member operated by said temperature responsive element entering said casing and engaging said operating element of said switch to open and close said switch depending on the temperature of said temperature responsive element, an adjusting screw in said casing for adjusting the position of said switch and thereby the temperatures of said temperature responsive element at which said switch is opened and closed, a knob accessible on the exterior of said casing controlling the position of said screw, a window in a wall of said casing adjacent said knob, a lamp in said casing back of said window, a pair of transparent members in said casing having different colors arranged in substantially the same plane and parallel to said window between the window and said lamp, means supporting said members for movement in said plane across the field of vision defined by said window, and a bracket connecting said switch with said colored members arranged to move said members in said field of vision when the position of said switch is adjusted.

6. A temperature control device comprising a

switch having cooperating relatively movable contacts, a housing for said contacts, a plunger entering said housing cooperating with the contacts to control the relative movement between said contacts, a temperature responsive element controlling the operation of said plunger, means mounting said housing for movement to vary the position of said plunger with reference to said temperature responsive element, and means for adjusting the position of said housing.

7. A heat control device for an electrically heated blanket and the like comprising a housing, a thermally insulating wall closing one side of said housing, a switch in said housing adapted to control the energizing circuit of said blanket, a thermostatic element mounted outside of said wall and having an operating connection through the wall with said switch to operate the switch responsively to the temperature changes in said thermostatic element, a voltage reducing transformer within said housing arranged to be connected in said energizing circuit, and windows in said housing to ventilate it and carry away heat generated in said transformer, the ventilation of said housing and said thermally insulating wall preventing a transfer of heat from the transformer to the thermostatic element whereby the latter's temperature is uninfluenced by the heat generated in said transformer.

8. An electrically heated blanket for a bed comprising a blanket, a heating element for applying heat to said blanket, and a temperature control device for said blanket having control means for controlling the electrical energy input to said heating element and a bimetallic temperature responsive device out of heat conducting relation with said blanket and exposed to the air temperature of the compartment in which said blanket is functioning operating said control means so as to vary said energy input to said heating element in the inverse order with variations in said air temperature so that a substantially constant temperature is held in said blanket irrespective of said variations in said air temperature.

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