

April 20, 1948.

E. K. CLARK

2,439,795

THERMOSTAT

Filed Jan. 9, 1942

3 Sheets-Sheet 1

FIG. 1.

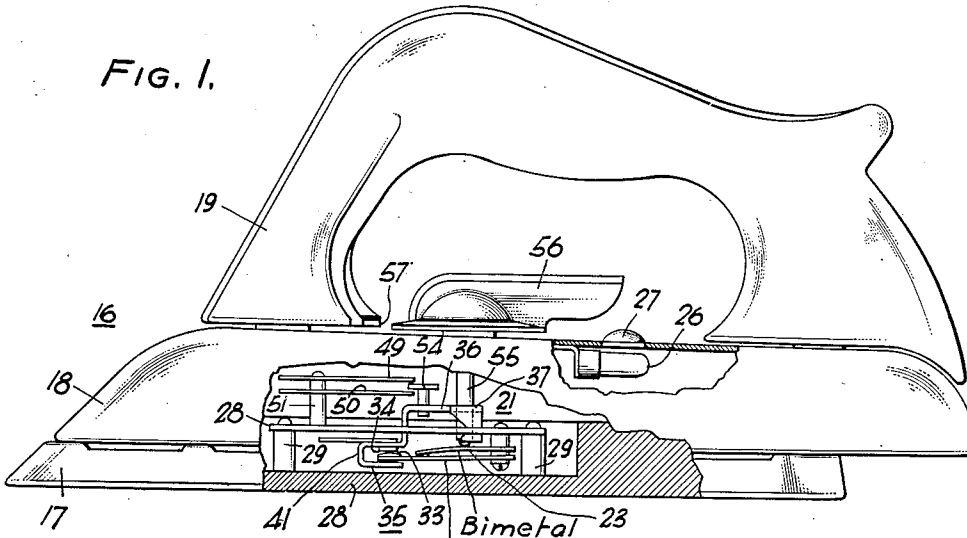


FIG. 2

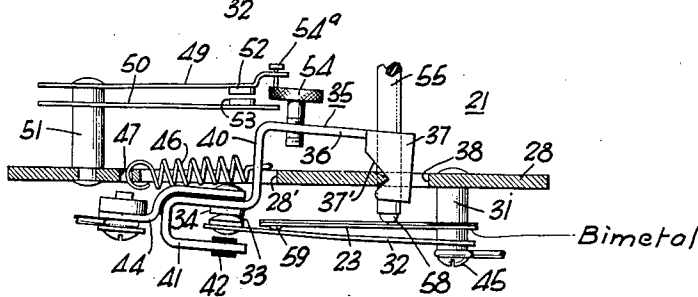
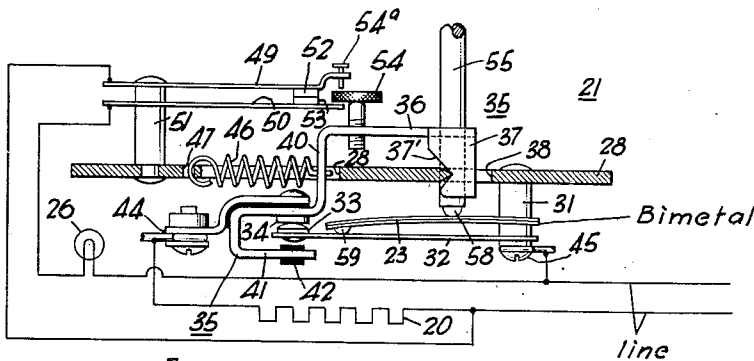


FIG. 3.



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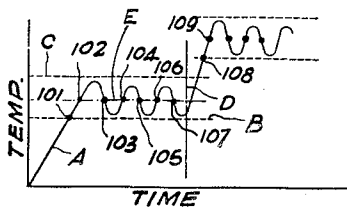


FIG. 4.

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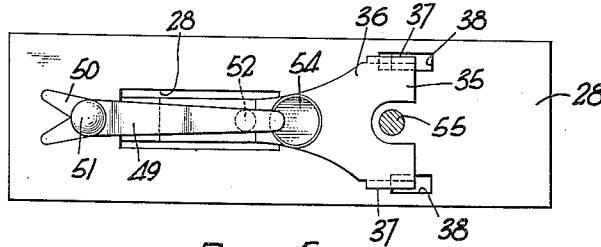


FIG. 5.

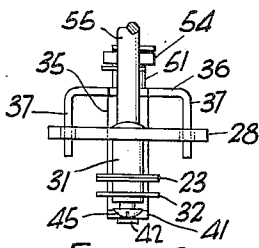


FIG. 6.

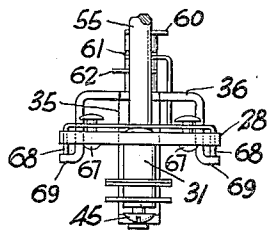


FIG. 9.

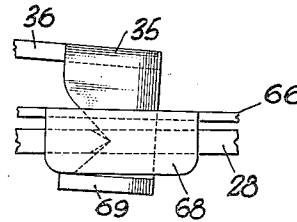


FIG. 10.

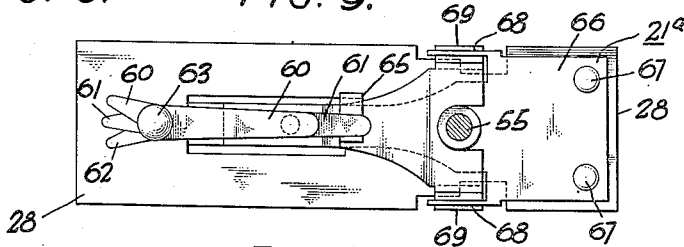


FIG. 7.

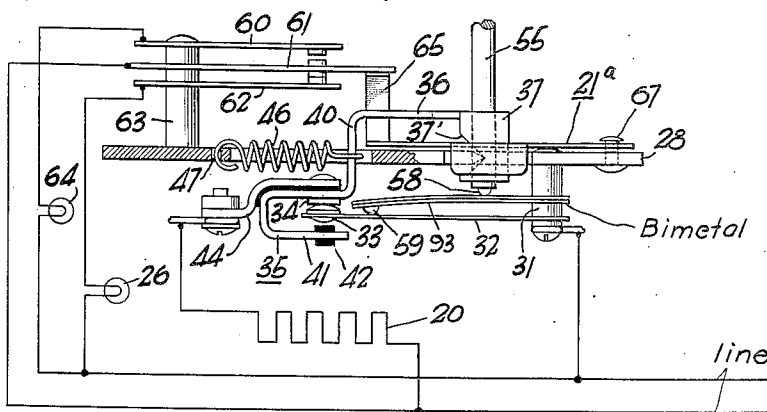


FIG. 8.

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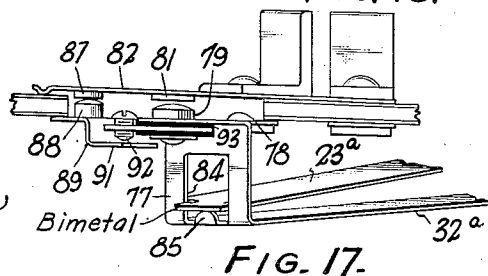
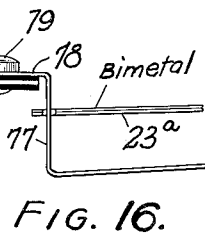
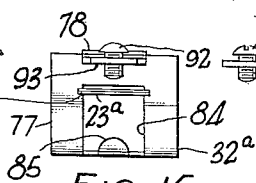
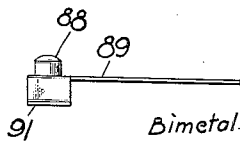
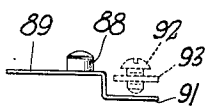
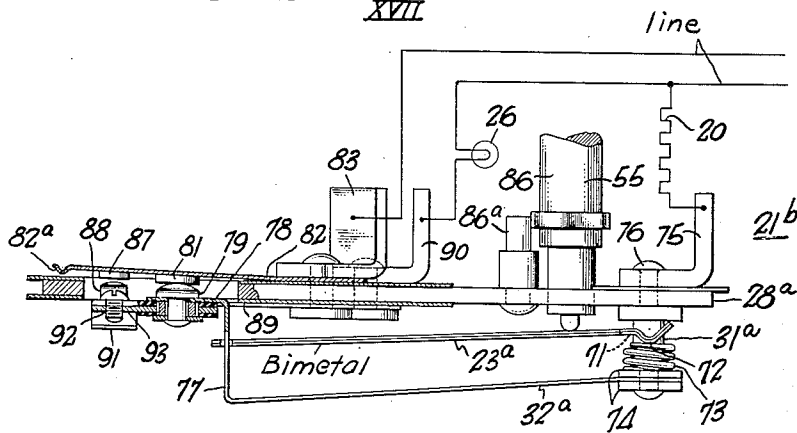
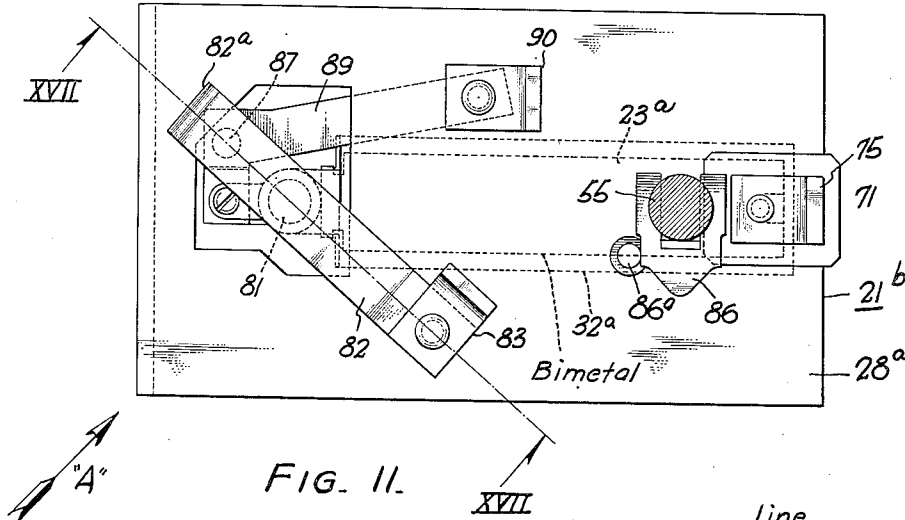
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## UNITED STATES PATENT OFFICE

2,439,795

## THERMOSTAT

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Application January 9, 1942, Serial No. 426,209

3 Claims. (Cl. 177-311)

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This invention relates to an electrically-heated appliance and particularly to a temperature control and indicating device for such an appliance, and it has for an object to provide an improved device of the character set forth.

While the invention is particularly adapted for use with and has been illustrated and described as applied to an electrically-heated flatiron, it will be apparent to those skilled in the art that its use is not limited to such application.

Flatirons and other electrically-heated appliances have been provided with a thermostatically-controlled switch for turning the heating element on and off to maintain the appliance substantially at a desired temperature. Actually, the temperature rises and falls repeatedly within a limited range as the heating element is turned on and off. Such a thermostatically-controlled switch usually has provision for adjusting it to different temperature settings.

Some flatirons have also been provided with an indicator light which is controlled by the same switch and, therefore, goes on and off simultaneously with the heating element. The purpose of the light is to indicate to the user when the iron is at a temperature suitable for use. For example, in the initial heating up of the iron from room temperature to the desired operating temperature, the light is on continuously along with the heating element. When the light goes out, the user knows that the iron has reached the desired temperature.

Such an indicating light, however, has certain limitations. The light goes on again repeatedly as the heating element is energized intermittently to maintain the desired temperature range, and during such times the user has no indication that the iron is within the desired temperature range. Also, during the initial heating period, the light does not go out until the iron reaches the set temperature at which the thermostatically-controlled switch opens its contacts, whereas the iron is ready for use when the temperature reaches the lower limit of the range maintained by the thermostat; in fact, it is usually suitable for use before then, since, for a given material to be ironed, a range of temperature greater than that maintained by the thermostat is suitable. Similarly, when the iron has been used at a relatively high temperature and the thermostat is adjusted for a lower temperature, the user has no indication that the temperature has decreased to the lower desired temperature until the switch closes its contacts, which occurs at a temperature below the upper limit of the temperature range at which the iron is suitable for use.

It is an object of this invention to provide an indicator which tells the user when the iron is at a temperature suitable for use, regardless of whether the heating element is on or off.

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A further object is to provide an indicator which gives an indication as soon as the iron reaches the range of temperature suitable for use without waiting for the temperature at which the thermostatically-controlled switch turns the heating element on or off.

A further object is to provide an improved temperature control and indicating device for use with an electrically-heated appliance or the like which will automatically maintain the appliance within a predetermined temperature range and which also indicates when the temperature of the appliance is within that range or within a somewhat greater range of temperature which may be suitable for use; a more particular object being to provide such a device which may be adjusted to vary the predetermined temperature range as desired.

A further object is to provide an improved control and indicating device for use with an electrically-heated device or the like which will maintain the temperature of the appliance within a predetermined range and which gives a positive indication when the appliance is above or below said range, or at a slightly greater range which may be suitable for use, and which gives a different positive indication when the appliance is within such range of temperature.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a side elevation of an electrically-heated flat iron embodying the present invention, a portion of the iron being broken away to show certain details of construction;

Fig. 2 is a side elevation of the temperature control and indicating device visible in Fig. 1, the supporting plate thereof being shown in longitudinal section, and the parts carried thereby being shown in the position they assume when the iron is below the desired or set temperature range;

Fig. 3 is a view similar to Fig. 2 and including a wiring diagram of the electrical circuit employed in the iron illustrated in Fig. 1, the parts of the temperature control and indicating device being shown in the position they assume just prior to the time when the thermostat reaches its set temperature;

Fig. 4 is a graph showing the variation in temperature of the temperature-responsive element of the present thermostat and also showing the temperature range in which the indicator light is on;

Fig. 5 is a plan view of the device illustrated in Figs. 2 and 3;

Fig. 6 is an end elevation looking from the right of Fig. 3;

Figs. 7 and 8 are plan and side elevation views,

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respectively, of a modified temperature control and indicating device which may be employed in the iron illustrated in Fig. 1, a schematic wiring diagram of the circuit employed with this form of the invention being shown in Fig. 8;

Fig. 9 is an end elevation of the device shown in Figs. 7 and 8, as viewed from the right of Fig. 8;

Fig. 10 is an enlarged detailed view of a portion of the device of Figs. 7 and 8, showing the relation of certain parts when the iron is below its set temperature;

Figs. 11 and 12 are plan and side elevation views, respectively, of another form of the invention, and which may be employed in the iron illustrated in Fig. 1, a schematic wiring diagram of the circuit employed with this device being shown in Fig. 12;

Figs. 13 and 14 are end and side elevation views, respectively, of one of the spring contact arms used in the device illustrated in Figs. 11 and 12, as viewed from the left and from the front, respectively of Fig. 12;

Figs. 15 and 16 are left end and front elevation views, respectively, of a spring, contact-carrying, arm and cooperating bimetal element used in the device illustrated in Figs. 11 and 12; and

Fig. 17 is a view of the device illustrated in Fig. 11, looking in the direction of the arrow A, the supporting plate being broken away along the line XVII—XVII of Fig. 11.

Referring to the drawings and particularly to Figs. 1 to 6, inclusive, there is illustrated an electrically-heated flatiron generally indicated 16, which comprises an electrically-heated soleplate 17, a cover 18, and a handle 19. The soleplate may be heated in any conventional manner, as by a resistance element clamped thereto or preferably by means of an armored resistance element cast or embedded therein. The resistance element for heating the soleplate is schematically indicated at 20 in Figs. 3, 8, and 12.

The resistance element 20, controlled by means of an adjustable thermostat, generally indicated 21, supplies heat to the soleplate to maintain the same within a desired or set temperature range determined by the setting of the thermostat. The thermostat 21 is preferably supported within a recess in the soleplate 17, as shown in Fig. 1, with its heat-responsive bimetal element 23 mounted closely adjacent the soleplate so that the bimetal element will be responsive to the temperature of the soleplate. The thermostat 21 controls a circuit for the heating element 20 of the iron and also controls a second circuit in such a manner that an incandescent lamp 26 or other electrically-operated visual or audible signal in the second circuit will indicate to the operator of the iron when the iron is within its set temperature range and therefore ready for use. The lamp or signal 26 may be mounted in any desired position on the iron, as for example, within the cover 18 below a window 27 (Fig. 1).

Referring particularly to Figs. 2 and 3, where thermostat 21 is shown apart from the iron, it will be noted that the thermostat structure is mounted on a supporting plate or base 28 which may be secured to posts 29 formed on or carried by the soleplate 17. The plate 28 is provided with a depending post 31, adjacent its rear end, to which the bimetal strip 23 is secured. This post also carries a spring, contact-carrying, arm 32 which is normally self-biased or sprung

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upwardly as shown in Fig. 2. The bimetal strip 23 and the arm 32 are preferably insulatedly mounted on the post 31 with the bimetal strip arranged to bow toward the arm when heated.

A contact 33 carried on the free end of the spring arm 32 is adapted to engage a cooperating contact 34 carried by a pivoted contact frame 35. These contacts, when closed, complete an energizing circuit (Fig. 3) for the heating element 20.

The contact frame 35 comprises an irregularly-shaped rigid member which includes a horizontal portion 36 disposed above the base 28 and provided with depending flanges 37 having aligned V-shaped notches 37' therein. These flanges 37 are receivable in spaced apertures 38 (Fig. 5) formed in the base 28. The edges of the plate 28, at these apertures, which face the notches 37' in the flanges 37, are preferably bevelled to provide fulcrum or pivot points receivable in the notches 37' so that the frame 35 is free to rock on the plate 28.

A vertical portion 40 of the frame 35 extending downwardly from the forward or left end of the horizontal portion 36 terminates in a U-shaped portion 41 which carries the mentioned contact 34 in the upper arm thereof. The lower arm of this U-shaped portion carries an insulating button or stop 42. The spacing between the upper surface of this button 42 and the contact 34 is preferably such as to provide a clearance for the movable contact 33 carried by the arm 32 of the order of between .005 and .010 inch. The contact 34 may be provided with a terminal arm 44, insulated from the frame 35, while a terminal 45 may be connected to the fixed end of the spring arm 32, for connecting the contacts 33 and 34 in the circuit for the heating element 20 (Fig. 3).

The vertical portion 40 of the contact frame 35 extends through an opening 28' formed in the base 28 and has connected thereto one end of a tension spring 46, the other end of this spring being anchored to the base as indicated at 47. The spring 46 normally maintains the contact frame 35 in the position shown in Fig. 3.

A pair of spring, contact-carrying, arms 49 and 50 are insulatedly fixed to the base 28 as by means of a supporting post 51. Contacts 52 and 53 carried by the arms 49 and 50, respectively, control a circuit (Fig. 3) for the signal lamp 26. A screw 54 adjustably threaded into the horizontal portion 36 of the contact frame 35 is positioned with the head thereof, which is made of non-conducting material, between the projecting free ends of the spring arms 49 and 50 so that when the contact frame is materially above (Fig. 2) or below its normal position (Fig. 3), the screw head will engage one or the other of the arms 49 and 50 and separate the contacts 52 and 53 to interrupt the lamp circuit. From the construction just described it will be seen that the signal lamp circuit will be closed only when the contact frame is in or near its normal position.

The thermostat 21 is adjusted by means of a rod 55 which is threaded through the base 28 in alinement with the bimetal strip 23. The upper end of this rod has fixed thereto an operating knob 56 (Fig. 1) which may be provided with a suitable scale adapted to be read in conjunction with an index such as 57 and which may comprise a projection formed on the front support of the handle 19. This scale may be graduated in any desired manner to indicate the

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temperature of the soleplate either in degrees or types of material adapted to be ironed when the iron is at its set temperature. The lower end of this rod carries a button 58, of insulating material, which is adapted to engage the bimetal strip 23 adjacent its fixed end so that on turning the knob 56 in one direction or the other, the bimetal strip will be moved closer to or further away from the spring arm 32.

The bimetal strip 23 is mounted on the post 31 so that an increase in temperature of the bimetal strip will cause it to bow downwardly. It will be understood that the rod 55 may be turned down sufficiently to maintain the contacts 33 and 34 open and thereby provide an "off" position for the iron without the need of a separate line switch. When the iron is at room temperature and the thermostat adjusting knob 56 is turned from its "off" position to a position to maintain the iron at a particular temperature, the rod 55 is thereby raised, allowing the bimetal strip 23 to spring upwardly in a direction away from the spring arm 32. Since the spring arm 32 is self-biased upwardly, under the condition just mentioned this spring arm will also move upwardly and cause its contact 33 to engage the contact 34 carried by the contact frame 35 and raise the contact frame to substantially the position shown in Fig. 2. With the contact frame in this position, the head of the adjusting screw 54 has raised the upper spring arm 49 and separated contacts 52 and 53 to interrupt the circuit for the indicating lamp 26 while the contacts 33 and 34 are closed and complete the circuit for energizing the heating element 20.

As the temperature of the soleplate increases, the temperature of the bimetal strip 23 also increases and it begins to bow downwardly and eventually its free end, which may be provided with a spherical knob 59, of insulating material, will engage the spring arm 32. Continued bowing of the bimetal strip forces the spring arm 32 downwardly until it reaches the position shown in Fig. 3. The spring 46 causes the contact frame to follow the spring 32 to maintain contacts 33 and 34 closed until this frame reaches its normal position (Fig. 3). When in this position, the contacts 52 and 53, which control the lamp circuit, have closed and further movement of the bimetal strip causes the contact 33 to move clear of the contact 34 and open the circuit for the heating element 20. From the above description, it will be seen that the signal lamp 26 will be energized prior to the interruption of the circuit for the heating element 20, and that this last-mentioned circuit is interrupted when the thermostat reaches its set temperature.

After the heater circuit has been interrupted by opening of contacts 33 and 34, the soleplate and the bimetal strip begin to cool, allowing the bimetal strip to move upwardly so that the contacts 33 and 34 will again close to energize the heating element 20 to maintain the soleplate within its set temperature range. It will be appreciated that when the soleplate is within its set temperature range the thermostat cycles between "off" and "on" to open and close contacts 33 and 34 and intermittently energize the heater to maintain the temperature of soleplate within that range.

The movement of the bimetal strip 23 during this cycling operation of the thermostat is sufficient to open and close contacts 33 and 34 but the clearance between the head of screw 54 and

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the projecting ends of the spring arms 49 and 50 is preferably such as to allow the contacts 52 and 53 to remain closed during such cycling of the thermostat so that the lamp 26 remains lit as long as the soleplate is within the set temperature range. The clearance between the head of screw 54 and the projecting ends of the spring arms may be adjusted by means of a screw 54a which is adjustable in an offset portion of the upper spring arm 49 and engageable by the screw head.

To change the set temperature of the iron from a previously high temperature to a lower temperature, as for example, when it is desired to iron with the soleplate at 250° F. and the iron is already at 350° F., the adjusting rod 55 is turned down causing the free end of the bimetal strip 23, which is already adjacent to the spring arm 32, to be flexed downwardly and move this arm so that its free end engages the insulating button 42 of the contact frame 35 and thereby swing the contact frame below its normal position (Fig. 3).

This movement of the contact frame 35 causes the head of the adjusting screw 54 to engage the free end of the lower spring arm 50 to pull it downwardly and open the contacts 52 and 53 and extinguish the lamp 26. With the lamp out the operator knows that the iron is no longer at the temperature indicated by the scale on the thermostat adjusting knob 56. The mentioned movement of the spring arm 32 also opens the contacts 33 and 34 so that the circuit for the heating element 20 is interrupted and will remain open until the soleplate and the bimetal strip heated thereby have cooled sufficiently to allow the parts to move to the position shown in Fig. 3. As in the case where the iron is being brought up to heat, on allowing the iron to cool from a previous higher temperature to a new low temperature, the contacts 52 and 53 will close shortly prior to the time when the contact frame reaches its normal position.

The operation of the thermostat 21 and of the signal light 26 will be better understood by reference to the graph of Fig. 4, wherein the temperature of the bimetal element 23, which may also be considered as a measure of the soleplate temperature, has been plotted against time to show approximately the action of the switches 33—34 and 52—53. It will be understood that the shape of the temperature curve will vary depending on the various characteristics of the iron, particularly the thermostat and its thermal relation to the soleplate and also depending on the conditions of use.

In this graph, time is plotted on the abscissa, and temperature of the bimetal, on the ordinate. The curve A represents the temperature of the bimetal element which, starting at room temperature, rises until it reaches the set temperature range, after which it follows a sinuous path throughout this range to approximately the vertical line D. In the particular curve plotted, the curve A has been extended beyond the line D to illustrate the temperature condition of the bimetal element when the thermostat is adjusted from a low temperature to a new higher set temperature range.

The horizontal lines B and C represent respectively, the lower and upper limits of the light switch 52—53. As long as the temperature of the bimetal element lies between these lines, with the thermostat set to maintain the iron within

the range represented by the sinuous part of the curve and to the left of the line D, the light switch will remain closed. The actual set temperature of the thermostat is indicated by the line E, this line representing the temperature at which the bimetal element opens and closes the switch 33—34 to control the energization of the iron heating element 20.

As mentioned, in plotting this graph, it is assumed that the iron has been at room temperature and then turned on to operate at a predetermined set temperature, indicated by the line E. It is, of course, not possible to maintain the iron at one particular temperature; in practice the set temperature of the iron and of the bimetal 23 actually is a temperature range or zone lying between the tops of the peaks and the bottoms of the valleys of the sinuous part of the graph.

As the iron heats up, the temperature of the bimetal increases, as represented by the curve A, until the parts of the thermostat reach the position shown in Fig. 3 where the light-controlling switch 52—53 has closed to light lamp 26, the closing of this switch being represented by the point 101 in Fig. 4. However, the switch 33—34 does not open until the point 102 (Fig. 4) is reached, the condition of the thermostat just after this switch has opened being shown in Fig. 1.

Due to the thermal lag between the soleplate and the thermostat, the temperature of the thermostat may increase somewhat even after switch 33—34 has opened, providing a peak in the curve A extending above the point 102. The soleplate and bimetal then cool until the point 103 (Fig. 4) is reached, at which time the switch 33—34 again closes, but since the temperature of the thermostat does not drop below the line B, which represents the lower limit at which the light switch 52—53 closed, the light switch does not open. The thermostat continues to cycle to open switch 33—34 at points 104 and 106 and close it at points 105 and 107, the light 26 remaining lit for the particular setting of the thermostat as long as the temperature of the thermostat remains between the lines B and C. If the temperature of the thermostat were to rise above the line C, the light would be extinguished, for under this condition the bimetal element would engage the spring 32 and move the contact frame below its normal position (Fig. 3) and open the signal switch 52—53. It will be understood that the greater temperature differential or range of the light switch 52—53, represented by the zone between the lines B and C, as compared to the actual temperature of the bimetal strip, is due to the clearance between the head of screw 54 and the contact springs 49 and 50.

On heating up the iron from a lower temperature, such as room temperature, the first peak of the curve A may go above the upper line C due to the thermal lag between the bimetal element and the heated soleplate, with the result that the signal light will go out until the temperature of the bimetal element drops below the line C. However, on subsequent cycles of the thermostat switch, as the iron becomes saturated with heat, the peaks and valleys of the sinuous curve will lie within the lines B and C. In my copending application, Serial No. 436,299, filed March 26, 1942, now matured as Patent No. 2,409,420, dated October 15, 1946, and assigned to the assignee of the present application, there is disclosed a thermostat structure which prevents overheating

of the soleplate and of the bimetal element on the initial heating-up period.

If the thermostat be adjusted to maintain the soleplate at a higher temperature, the switch 33—34 will close and the light 26 will go out, since the bimetal strip will be raised clear of spring 32 causing the parts to assume substantially the position shown in Fig. 2. The temperature of the soleplate and of the thermostat increases and at the point 108 (Fig. 4) the light switch 52—53 closes to illuminate the lamp 26 and indicate to the operator that the iron has reached the new temperature range. The thermostat switch 33—34 opens when the temperature thereof reaches approximately the point 109. The thermostat continues to cycle in the same manner as that described for the lower temperature setting to maintain the soleplate at the new temperature level.

The bimetal element shown in Figs. 1 to 4 and in the modified forms of the invention, is of the creep type, in which the contacts open and close at substantially the same temperature. Accordingly, the points 102 to 107 of the graph in Fig. 4 lie on the same horizontal line. The invention is equally applicable to a thermostat employing a bimetal element of the snap-acting type, in which the contacts close at a temperature lower than that at which they open. In such case, the points 102, 104, and 106 would lie on one horizontal line and the points 103, 105, and 107 would lie on a second and lower horizontal line. Both lines, however, would be between the tops of the peaks and the bottoms of the valleys of the sinuous part of the graph and within the zone bounded by the lines B and C.

In Figs. 7 to 10, inclusive, there is illustrated a slightly modified form of the invention in which two signal lamps are provided, one of which may give a red signal and the other a green signal. In this form of the invention, the red signal will be illuminated whenever the iron is plugged into the line but is not within its set temperature range and indicates to the operator of the iron that it is not ready for use. The green lamp will be lit only when the soleplate is within its set or operating temperature range as determined by the setting of the thermostat adjusted knob 56.

In this form of the invention, many of the parts of thermostat 21a are identical with corresponding parts of the thermostat 21 and similar reference characters have, therefore, been used to identify such parts. The modified thermostat 21a, comprises base 28 which carries bimetal strip 93, spring contact arm 32 in cooperative relation therewith and a pivoted, spring biased contact frame 35. The contacts 33 and 34 carried respectively by the spring arm 32 and the contact frame 35 control the circuit for the heating element 20 in exactly the same manner as the thermostat 21.

The thermostat 21a differs from the thermostat 21 in that three spring, contact-carrying arms 60, 61, and 62, the lower two of which correspond to the spring arms 49 and 50 of the thermostat 21, are insulatedly carried by a post 63 fixed to the base 28. The contacts carried by lower and middle arms 62 and 61, control a circuit for green lamp 26 to energize this lamp when the iron is within its set temperature range. The contact carried by the middle or motor arm 61 also cooperates with a contact carried by the upper arm 60 to control a circuit for red lamp 26 for energizing the same when the iron is either above or below the ironing or set temperature range.

The middle spring arm 61 is normally self-biased downwardly into contact with the contact carried by the lower arm, as shown in Fig. 8, so that whenever the contact frame 35 is in or near its normal position (Fig. 8), the green lamp will be lit and the red lamp will be out.

The middle arm 61 extends beyond the ends of the upper and lower arms 60 and 62 and is adapted to be engaged by an upstanding bracket 65 attached to the free end of a strip 66 loosely pivoted at 67 on the upper face of the base 28. As shown particularly in Figs. 8, 9, and 10, the strip 66 is provided with opposed downwardly-extending lugs 68. The depending flanges 37 on contact frame 35 of the thermostat 21a are provided with outwardly-extending shoulders 69 which are adapted to engage the lower edge of the lugs 68. It will be understood that whenever the contact frame 35 is rocked above or below its normal position (Fig. 8) the shoulders 69 will engage the lugs 68 to raise the member 66. In Fig. 10, the base 28, the contact frame 35, and the member 66 have been shown in the relative positions they assume with the contact frame 35 raised by the spring member 32 to a point above its normal position. Whenever the contact frame 35 is above or below its normal position, that is, when the iron is not within its set or operating temperature range, the member 66 acting through its upstanding bracket 65 raises the middle or motor spring arm 61 to open the contacts of arms 61 and 62 and thus extinguish the green lamp and close the contacts of arms 60 and 61 to light the red light.

In Figs. 11 to 16, inclusive, there is shown another and preferred form of the invention. The modified thermostat, generally indicated 21b, comprises a base plate 28a on which is supported a bimetal strip 23a. The bimetal strip 23a is rockably mounted at one end on a depending insulating post 31a fixed to the underside of the base plate. As shown in Figs. 11 and 12, the bimetal strip 23a is provided with an open-ended slot 71 of a size to loosely receive the depending post 31a and this slotted end is also provided with a rocker or humped portion 72 disposed between a flange of the depending post and a helical compression spring 73 encircling the post above washers 74. The washers 74 clamp a spring, contact-carrying, arm 32a to the lower end of the post. The arm 32a is electrically connected to the terminal 75 as by means of rivet 76 which secures the post and terminal to the base plate 28a. A sheet of mica interposed between the terminal 75 and the base plate 28a insulates these parts. It is to be understood that the bimetal strips 23 and spring arms 32 of thermostats 21 and 21a may be mounted in the manner just described.

The free end of the spring arm 32a is bent upwardly, as shown particularly in Figs. 12, 16, and 17, providing a vertical portion 77 which terminates in a substantially horizontal portion 78. This horizontal portion carries a contact button 79 (Fig. 16) which is adapted to cooperate with a contact button 81 to control an energizing circuit (Fig. 12) for the heater element 20 of the iron. The contact 81 is carried on the underside of a spring arm 82 which is fixed at one end to the upper surface of the base plate 28a as by means of a rivet which also secures terminal 83.

The vertical portion 77 of the spring arm is provided with substantially rectangular opening 84 (Figs. 15 and 17) to receive the T-shaped end

of the bimetal strip 23a so that as the bimetal strip flexes it will be guided along this opening. By reference to Figs. 15 and 17, it will be noted that the spring arm 32a is provided with a stop 85 which projects into the opening 84 whereby the bimetal strip 23a may have substantially point contact with the spring arm when heated sufficiently to bow the same downwardly into engagement with the spring arm.

The position of the bimetal strip 23a relative to the spring arm is manually adjusted by means of thermostat adjusting screw 55 which is threaded through the base 28a. It will be understood that this screw will be manipulated by means of a knob like that shown at 56 in Fig. 1. The screw 55 is provided with a stop 86 (Fig. 11) which is adapted to engage a pin 86a carried by the base plate 28a when the thermostat is turned to its "off" position or to its extreme "high" position.

From the foregoing description, it will be understood that by raising or lowering the thermostat adjusting screw 55 to increase or decrease, respectively, the set temperature of the iron, the bimetal strip 23a will pivot in a vertical plane on its rocker portion 72. As in the case of the previously described thermostats 21 and 21a, the bimetal strip 23a bows downwardly as its temperature increases and eventually engages the stop 85 carried by the spring arm. When the bimetal strip engages this stop, it moves the spring arm 32a downwardly allowing the spring arm 82 to be lowered until its free end 82a rests on the upper surface of the base 28a. Continued movement of the bimetal strip 23a causes the contact 79 carried by the spring arm 32a to be moved clear of the contact 81 to open the circuit for the heater 20. It will be understood that the thermostat 21b is calibrated to open these contacts when the temperature of the bimetal strip reaches the set temperature range of the iron as indicated by the scale carried by its adjusting knob.

The spring arm 82 carries a second contact 87 adjacent its free end which cooperates with a contact 88 carried by a third spring arm 89 (Figs. 11, 13, and 14) mounted on the under surface of the base 28a. The contacts 87 and 88 control a circuit for signal lamp 26 and are closed only when the iron is near its set temperature range.

By reference to Fig. 12 wherein the parts are shown in the relation they assume when the iron is below its set temperature range, it will be noted that the spring arm 32a holds the contact 87 up and away from the lower contact 88. As the spring arm 32a moves downwardly under the influence of the bimetal strip 23a these contacts will close, just prior to the time the contacts 79 and 81 open, to energize the lamp 26.

The lower spring arm 89 is fixed at one end to the base 28a by means of a rivet which also secures terminal 90. As shown in Figs. 13 and 14, this arm is provided with an offset horizontal portion 91 which is adapted to be engaged by the lower end of a screw 92 adjustably secured in a bracket 93 (Fig. 16) insulatedly attached to the horizontal portion 78 of the spring arm 32a. In the event the iron becomes too hot, that is, its temperature exceeds the set temperature of the thermostat or if the setting of the thermostat is decreased from a previous higher value, the bimetal strip 23a will move the spring arm 32a downwardly and cause the screw 92 to engage the horizontal offset portion 91 (Fig. 13) and thereby move the lower contact 88 away from the upper contact 87 to open

the lamp circuit. This movement of the spring arm 32a also opens the contacts 79 and 81 which control the heating element circuit.

The mentioned heating element circuit may be traced from one side of the line through the heating element 20, terminal 75, rivet 76, and arm 32a to the closed contacts 79 and 81, spring arm 82, terminal 83 to the other side of the line. The mentioned lamp circuit may be traced from one side of the line through lamp 26, terminal 90, lower spring arm 89, closed contacts 88 and 87, spring arm 82 and terminal 83 to the other side of the line.

As in the case of the previously described thermostats 21 and 21a, while the thermostat 21b is cycling to intermittently energize the heating element to maintain the iron or other appliance, controlled by the thermostat, within a predetermined temperature range, the lamp circuit, controlled by contacts 87 and 88, may remain closed in order to illuminate the lamp 26.

The operation of the thermostats 21a and 21b is similar to the thermostat 21 and is represented by a graph similar to that shown in Fig. 4. However, in the case of the thermostat 21a, the red light 64 will be lit whenever the green light 26 is out to give a positive indication that the iron is not at its set temperature.

While I have shown my invention in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. An electrically-heated appliance comprising electrical heating means, a switch controlling energization of said heating means, means responsive to a temperature in said appliance and operating said switch to deenergize said heating means upon rise above a predetermined temperature and to energize said heating means upon fall below substantially the same predetermined temperature, adjusting means for varying the predetermined temperature or temperatures at which said temperature-responsive means operates said switch, a pilot light, a second switch comprising abutting contacts for controlling said pilot light, and a lost motion connection between said temperature-responsive means and said second switch, said lost motion connection comprising a first arm which carries one of the contacts of the first-mentioned switch and which is actuated by said temperature-responsive means and a second arm which carries one of the contacts of the second switch and which is biased in switch closing direction, said first arm being operable to move said second arm to open said second switch after a predetermined movement of said first arm in opening direction after opening said first switch, there being a lost motion between said first and second arms which is taken up during such predetermined movement, said lost motion connection being constructed and arranged so that movement of said temperature-responsive means occasioned by variation in said temperature when normally cycling at any adjustment is within the lost motion provided by such connection and said second switch is closed and so that when said temperature-responsive means moves beyond the extent of said lost motion, said second switch is opened.

2. An electrically-heated appliance comprising electric heating means, a first switch for controlling energization of said heating means, a signal device, a second switch for controlling said signal device, said second switch comprising a pair of cooperating contacts and a pair of contact carrying members on which said contacts are mounted and which are biased to closed position, means responsive to a temperature in said appliance, a part movable by said temperature-responsive means to actuate said first and second switches, said part actuating said first switch to deenergize said heating element when said part is moved past a predetermined point upon rise in temperature and to energize the same when moved past substantially the same point upon fall in said temperature, said part also actuating said second switch to closed position to give one signal when said part is within a predetermined range of movement and to open position to give a different signal when said part is outside of said range, one of said contact carrying members being actuated to open said second switch upon movement of said part beyond said range in one direction and the other contact carrying member being actuated to open said second switch upon movement of said part beyond said range in the opposite direction, and means for adjusting the relation of said temperature-responsive means to said movable part to vary the relation of temperature to position of said movable part, said range of movement being constant for all adjustments of said adjusting means and of sufficient extent to give said one signal throughout the entire range through which said temperature varies during normal cycling operation at any temperature adjustment.

3. An electrically heated appliance comprising heating means, a switch for controlling said heating means, means responsive to a temperature affected by said heating means and operating said switch to maintain said temperature substantially constant, adjusting means for varying the temperature to be maintained by said temperature-responsive means, a pilot light, switch contacts for controlling said pilot light including first and second contacts connected in series, said temperature-responsive means, at each adjustment of said adjusting means, operating to close said contacts to energize said pilot light throughout a temperature range including the highest and the lowest value of said temperature encountered in normal operation at such adjustment, to move said first contact to open position in response to temperatures below said range and to move said second contact to said open position in response to temperatures above said range.

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#### REFERENCES CITED

The following references are of record in the file of this patent:

#### UNITED STATES PATENTS

| Number    | Name          | Date          |
|-----------|---------------|---------------|
| 2,195,002 | Clark .....   | Mar. 26, 1940 |
| 2,198,924 | Smith .....   | Apr. 30, 1940 |
| 2,208,432 | Samuels ..... | July 16, 1940 |
| 1,080,493 | Smith .....   | Dec. 2, 1913  |
| 1,113,955 | Carey .....   | Oct. 20, 1914 |