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CONTROL FOR RANGE HEAT
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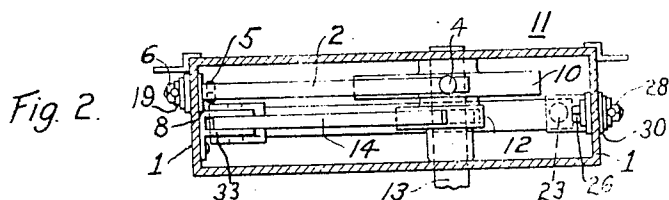


Fig. 1.

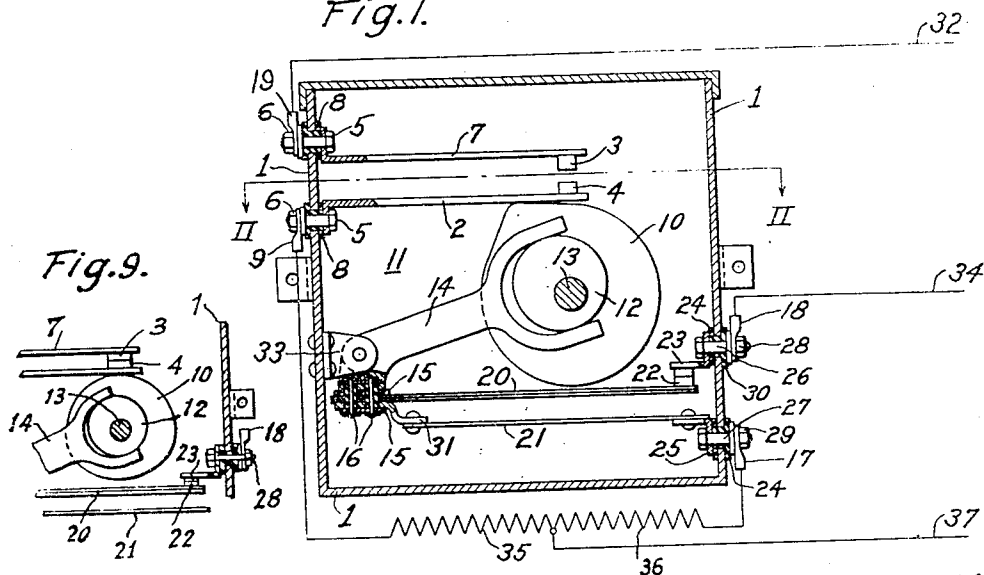
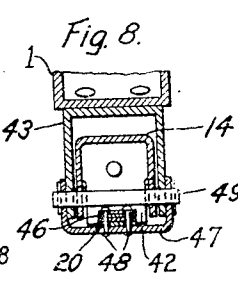
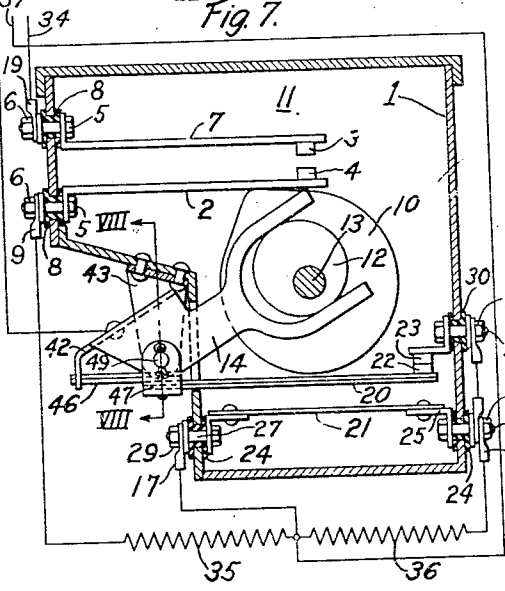
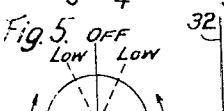
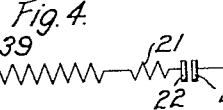
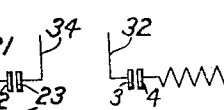
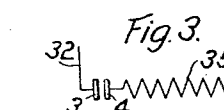
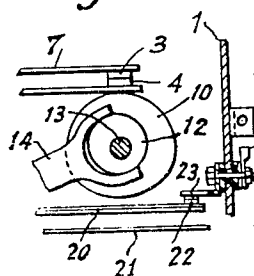


Fig. 9.



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CONTROL FOR RANGE HEAT

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18 Claims. (Cl. 200—122)

My invention relates to range surface heaters and more particularly to current control for such surface heaters.

In ranges now known to the art, the operations of the surface heaters have been limited to the conventional low, medium and high heat positions. This limitation has seriously restricted the proper advancement of the electric range in view of the large number of heat positions available on gas ranges. It is, therefore, an object of my invention to remove this limitation by providing means whereby the surface heaters of an electric range may be adjusted to a large number of heat positions.

A further object of my invention is to provide a common means for varying the operation of a thermally responsive circuit-controlling device and for operating a manually operated circuit-controlling device.

A further object of my invention is to provide a combined circuit-controlling device which may be used in conjunction with either a two- or a three-wire power source.

A further object of my invention is to provide a rugged, simple, compact, inexpensive circuit-controlling device which will be small enough to enable it to be placed upon the present electric ranges without increasing the size thereof.

Other objects of my invention will either be pointed out specifically in the following description of a preferred form of my invention, or will be apparent from such description.

In the accompanying single sheet of drawings:

Figure 1 is a side elevation and partial sectional view of a device embodying my invention;

Fig. 2 is a sectional view taken along line II—II of Fig. 1;

Fig. 3 is a wiring diagram of a three-wire surface heater in conjunction with my device;

Fig. 4 is a wiring diagram of a two-wire surface heater in conjunction with my device;

Fig. 5 is a diagram illustrating the relative positions of the control shaft to the power output of the three-wire surface heater;

Fig. 6 is a diagram illustrating the relative positions of the control shaft to the power output of the two-wire surface heater;

Fig. 7 is a side elevational and partial sectional view of a device similar to that shown in Fig. 1 with an ambient temperature compensator incorporated therewith;

Fig. 8 is a sectional view taken along line VIII—VIII of Fig. 7; and

Fig. 9 is a fractional view of a modification of the structure shown in Fig. 1.

Referring to Figure 1, I show a range surface heater or circuit-controlling mechanism 11 comprising a casing 1, a manually operable circuit-controlling device 2—7, a thermally responsive circuit-controlling device 20—21, a range heater unit 35—36, and a manually rotatable control shaft 13 having a plurality of cams 10 and 12 operatively associated therewith for operating the said manually operated circuit-controlling device 2—7 and adjusting the thermally responsive circuit-controlling device 20—21, whereby the output of the range surface heater, or the like, may be controlled and regulated.

The casing 1 may be made in any shape and of any material desired; however, it is preferred that it be composed of sheet steel and of a fabricated construction.

The manually operable circuit-controlling device 2—7 may comprise a flexible finger 2 and a semi-flexible finger 7. The semi-flexible finger 7 may be insulatedly attached to housing 1 by means of an insulating tube 8, a bolt 5 and a nut 6. Located on the free end of finger 7 is a contact 3 which may be composed of any suitable material. Flexible finger 2 is insulatedly mounted on casing 1 in a manner similar to finger 7 by means of the insulating tube 8, bolt 5 and nut 6. This finger 2 has a contact 4, similar in material to contact 3, located on the free end thereof. The contacts 3 and 4 thus become operatively associated, functioning as a circuit-maker and breaker.

The thermally responsive circuit-controlling device 20—21 comprises a bimetallic finger 20 and a radiant heater 21. Located on the free end of bimetallic finger 20 is a contact 22 which may be operatively associated with stationary contact 23. Contact 23 may be rigidly and insulatedly mounted to the casing 1 by means of an insulating tube 30, a bolt 26 and a nut 28. Operatively associated at the rigid end of the bimetallic finger 20 is a suitable irregularly shaped connecting device 31 which has attached to its free end the radiant heater 21. This radiant heater is permanently attached at its other end to a suitable bracket 25 which may be insulatedly attached to casing 1 by means of an insulating tube 24, a bolt 27 and a nut 29.

The bimetallic finger 20 and radiant-heater supporting device 31 are rigidly attached to a bell-crank lever 14 by means of rivets 16. Suitable insulating material 15 may be inserted between the bell crank lever 14 and the rivets 16, and the bimetallic finger 20 and the radiant-heater supporting device 31 to insulate the bimetallic finger and radiant heater from bell-crank lever 14.

Bell-crank lever 14 may be swingably mounted on casing 1 by means of any suitable hinging device 33 which may be rigidly attached to said casing, permitting the bimetallic finger 20, which is insulatedly mounted thereto, to be bodily moved therewith.

Operatively associated with the free end of bell-crank lever 14 and with flexible finger 2 are a plurality of cams 10 and 12, respectively. The cams 10 and 12 may be attached to a control shaft 13 in any suitable manner. Cam 10 contacts the flexible finger 2 intermittently, while cam 12, which is circular, is permanently in contact with the U-shaped end of bell-crank lever 14. Accordingly, due to the rotation of control shaft 13 and operatively associated eccentrically mounted cam 12, the bell-crank lever will be swung through a small arc, the effect of which is to bodily move the bimetallic finger and change the effective angular position of the bimetallic finger 20. This changing of the effective angular position of bimetallic finger 20 regulates the operating temperature thereof; namely, the greater the effective angle from a horizontal position the higher the operating temperature of said thermal responsive circuit-controlling device, and the smaller the effective angle from a horizontal position, the lower the operating temperature of said device.

Accordingly, by the rotation of the control shaft 13 and the operatively associated bell-crank lever 14, the inherent operating characteristics of the bimetallic finger 20 may be adjusted to cause the bimetallic finger 20 and the operatively associated circuit-controlling device 22-23 to operate at any desired temperature. Likewise, as the control shaft 13 is rotated, cam 10 is rotated and as the high point of said cam approaches the flexible finger 2, the said finger is forced upwardly, so that contact 4 engages contact 3. With a slightly greater rotation of the shaft 13 in either direction, the contact 4 will disengage itself from contact 3 due to the spring action of the flexible finger 2. It is, therefore, obvious that the rotation of control shaft 13 operates both the manually operated circuit-controlling device 2-7 and the thermal responsive device 20, enabling the surface heater to be controlled in a manner to be described hereinafter.

In operating the surface-heater-controlling device 11 in conjunction with a range or the like, while using a three-wire supply circuit therefor, one of the outside supply lines 32 may be connected to the semi-flexible finger 7 by means of a terminal 19. The other outside wire 34 may be connected to the stationary contact 23 of the thermally responsive circuit-controlling device 20-21 by means of a terminal 18. The neutral or middle wire 37 of the three-wire supply will then be connected to the mid-point of the surface heater, as shown in Figs. 1 and 3. The radiant heater 21 is then connected to one end of the surface heater or the like by means of terminals 17 and bracket 25, the other terminal of the surface heater being likewise connected to the flexible finger 2 by means of a terminal 9.

If a power supply switch (not shown) be closed, so that suitable current flows through section 36 of the surface heater, and the surface-heater-controlling device 11 be in the position shown in Fig. 1, the radiant heater 21 after a predetermined increment of time will cause the bimetallic finger 20 to move to an open position, disengaging the contact 22 from the stationary contact 23, which will disconnect the surface

heater from the power supply. Then as the radiant heater 21 cools, the bimetallic finger 20 will flex to its original position causing the contact 22 to re-engage the contact 23 and permit a flow of current through section 36 of the surface heater as in its original position. The operating temperature of the bimetallic finger 20 may be regulated by the rotation of the control shaft 13 and operatively associated bell-crank lever 14 to any desired value. Accordingly, the bimetallic finger 20 and operatively associated radiant heater 21 due to the intermittent operation thereof will maintain the average power output of the surface heater at the value desired by the operator.

Should the control shaft 13 be rotated in a slightly clockwise direction from that shown in Fig. 1, the contact 4 will engage contact 3 causing section 35 of the surface heater to be connected to the power supply. In such a position the bimetallic finger 20 is adjusted to remain closed a maximum length of time so that the surface heater is then in a high-heat position.

Should the control shaft 13 then be rotated in either direction, the operatively associated cam 10 will cause the contact 4 to become disengaged from contact 3, disconnecting section 35 from the power supply. The radiated heat of the surface heater will then be reduced from the high position to the medium position. Then upon continuing the rotation of the control shaft 13 in the same direction, the cam 12 will cause bell-crank lever 14 to reduce the flexure angle of the bimetallic finger 20 so that the bimetallic finger will continue to remain in the closed position a shorter length of time for every degree of rotation of said shaft 13. Should the shaft 13 be rotated approximately 180° from the position shown in Fig. 1, the bimetallic finger 20 would then remain in a closed position a minimum length of time, which would correspond to the simmering or lowest heat output of the surface heater.

It is, therefore, obvious that the rotation of control shaft 13 regulates the operation of bimetallic finger 20 in such a manner that the power output of the surface heater may be of any value desired between its low or simmer position and its medium position, whereas, after a continued rotation of the control shaft toward the high setting thereof, the flexible finger 2 is swung upwardly causing contact 4 to become engaged with contact 3 resulting in the surface heater being in its high position. The direction of rotation of control shaft 13 at any position in the operation thereof is an arbitrary factor, since the cams may be so designed that the controlling device may be operated in either direction.

In using the surface-heater-controlling mechanism 11 with a two-wire power supply source shown in Fig. 4, the wires 32 and 34 may be connected to the controlling device in a manner described hereinbefore. The sections 35 and 36 are then in series relation with each other forming section 39, the thermally operated circuit-controlling mechanism 11 and the power supply. The only difference in operation with this type of connection over that of the three-wire is that the surface heater controlling mechanism is variably controlled by the control shaft 13 throughout its complete cycle of operation.

Since the manually operated circuit-controlling device 2-7 is connected in series with the thermally responsive circuit-controlling device 20-21, the cam 10 must be built in reverse re-

lation to its previous configuration and rotated substantially 180° on shaft 13, as shown in Fig. 9, so that, as the heat responsive device 20—21 arrives at its lowest operation position, the cam 10 with a slight continued rotation will permit contact 4 to disengage itself from contact 3, the contacts being closed at all other times. The high point of cam 10, as illustrated in Fig. 1, will be reduced to a radius equivalent to that of the previous normal or low portion of the cam and the previous low portion will be increased to a radius equivalent to the high point of cam 10 in Fig. 1, all as illustrated in Fig. 9. This construction will permit the controlling mechanism 11 to operate with the previous location of the manually operated circuit-controlling device 2—7 by merely changing the shape of cam 10. Consequently, as the heat responsive device 20—21 arrives at its lowest operating temperature, the cam will open the manually operated circuit-controlling device 2—7, interrupting the circuit.

It is, therefore, obvious that the circuit-controlling mechanism may or may not be used in combination with a power switch and that the mechanism may be used with either a two or a three-wire supply to adjust the power output of a surface heater of an electric range, or the like, to an infinite number of heat positions.

It is to be understood that radiant heater 21 need not be connected in series with the surface heater, but may be connected in parallel therewith substantially as shown in Fig. 7, or in any manner desired. By using a shunt or potential radiant heater, it would be permissible to use the control device in conjunction with any wattage surface heater desired, whereas, with a series heater, as shown in Fig. 1, a different radiant heater element 21 is needed for every different size of surface heater.

If the manually operated circuit-controlling device 2—7 be eliminated, the control mechanism 11 will then become a manually adjustable thermostat in which the bimetallic finger's operating temperature will be adjusted by changing the effective angular position of such finger. As hereinbefore stated, the greater this effective angle from the normally closed position of said bimetallic finger the greater will be the operating temperature of such thermostat. Conversely, with a smaller effective angle the thermostat will operate at a correspondingly lower temperature.

Referring to Figs. 7 and 8, I show a device, similar to that shown in Fig. 1, with an ambient temperature compensator operatively associated therewith. The bell-crank lever 14 may be swingably attached to casing 1 by means of a fulcrum pin 49 which may be rigidly attached to the casing by means of a bracket 43 or in any other suitable manner. The bell-crank lever 14 may have an extension 42 associated with the free end thereof. This extension 42 may extend outside the casing 1 and may have a bimetallic compensating member 46 rigidly attached to the free end thereof. A floating bracket 47 may be swingably mounted upon the fulcrum pin 49 and may have rigidly attached thereto the free-end of bimetallic compensator 42 and the rigid end of bimetallic finger 20. The swinging movements of bell-crank lever 14 will then be transmitted to the bimetallic finger 20 through the extension 42, bimetallic compensator 46, and floating bracket 47. The radiant heater 21 may be rigidly attached to the casing 1 at both ends by bracket 25, bolt 27, nut 29 and insulating tube 24, and

may be operatively associated with the heating units 35 and 36 by means of terminals 17, substantially as shown in Fig. 7.

The bimetallic compensator 46 is operatively mounted in reverse position to the bimetallic finger 20 and in a position such that the radiated heat from the radiant heater will not affect the operation thereof. Therefore, since the bimetallic compensator, which may be outside casing 1, does not receive heat from the radiant heater 21, the curvature thereof will change only with changes in the ambient temperature, whereas the curvature of the bimetallic finger 20, which is inside casing 1, will change with the variations of heat from the radiant heater 21. In such a manner, the output of the range surface unit, regulated by the surface heater control, will be maintained at a substantially constant value regardless of the ambient temperature fluctuations.

In operating my device having an ambient temperature compensator thereon, the bell-crank lever 14 is swung through a small arc by means of eccentrically mounted cam 12 as hereinabove described. As the bell-crank lever 14 swings through a small arc, the ambient temperature compensator is likewise swung through a small arc, which in turn changes the effective angle of the bimetallic finger 20. It is, therefore, obvious that with a constant ambient temperature, the combination of bimetallic finger 20 and ambient temperature compensator 46 functions as a single member, the operation of which is controlled by means of radiant heater 21. However, with a change in ambient temperature, the ambient temperature compensator will assume a reverse curvature to that of the bimetallic finger 20 with an increase or decrease in temperature and will cause the effective angle of the bimetallic finger 20 to be correspondingly changed to compensate for the change in the ambient temperature. Therefore, the effective position of the contacts at that free end of the bimetallic finger 20 will operate with a different frequency for every different ambient temperature which, in turn, will maintain a constant heat output of the range surface heater for every particular setting of the control device.

It is to be understood that various other applications and modifications may be made in the device embodying my invention without departing from the spirit and scope thereof, and I desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art and the appended claims.

I claim as my invention:

1. In combination, a thermal responsive circuit-controlling device, a manually operable circuit-controlling device, means for adjusting said thermal device and means for actuating said manual device, said means having a common operating means.

2. In combination, a thermal responsive circuit-controlling device, a manually operable circuit-controlling device, rotatable means for adjusting said thermal device and rotatable means for actuating said manual device, said means having a common operating shaft.

3. In combination, a thermal responsive circuit-controlling device, a manually operable circuit-controlling device, cam means for adjusting said thermal device and cam means for actuating said manual device, said means having a common cam shaft.

4. In combination, a thermal responsive circuit-controlling device, a manually operable circuit-controlling device, and means comprising a plurality of cams respectively operatively associated with the thermal responsive circuit-controlling device for adjusting the same and operatively associated with the manually operable circuit-controlling device for operating the same.

5. In combination, a thermal responsive circuit-controlling device, a manually operable circuit-controlling device, a base therefor, a bell-crank lever swingably mounted on said base, means comprising the bell-crank lever for varying the operation of said thermal responsive circuit-controlling device, and means operatively associated with the manually operable circuit-controlling device for operating said device.

6. In combination, a thermal responsive circuit-controlling device, a manually operable circuit-controlling device, a base therefor, a control shaft rotatably mounted upon said base, a bell-crank lever swingably mounted on said base and operatively associated with the control shaft, means comprising the bell-crank lever and operatively associated control shaft for varying the operation of said thermal responsive circuit-controlling device, and means operatively associated with the control shaft for operating said manually operable circuit-controlling device.

7. In combination, a thermal responsive circuit-controlling device, a manually operable circuit-controlling device, a base therefor, a control shaft rotatably mounted upon said base, a plurality of cams attached to the control shaft, a bell-crank lever swingably mounted on said base and operatively associated with one of said cams, means comprising the bell-crank lever, the operatively associated cam and the control shaft for varying the operation of said thermal responsive circuit-controlling device, and means operatively associated with the control shaft for operating said manually operable circuit-controlling device.

8. In combination, a thermal responsive circuit-controlling device, a manually operable circuit-controlling device, a base therefor, a control shaft rotatably mounted upon said base, a plurality of cams attached to the control shaft, a bell-crank lever swingably mounted on said base, said bell-crank lever being mounted intermediate the ends thereof and operatively associated at one end with one of said cams and rigidly attached to the other end to said thermal responsive circuit-controlling device, means comprising the bell-crank lever, the operatively associated cam and the control shaft for varying the operation of said thermal responsive circuit-controlling device, and means operatively associated with the control shaft for operating said manually operable circuit-controlling device.

9. In combination, a thermal responsive circuit-controlling device, a manually operable circuit-controlling device, a base therefor, a control shaft rotatably mounted upon said base, means operatively associated with the control shaft for operating said manually operable circuit-controlling device, and means operatively associated with the thermal responsive circuit-controlling device for varying the operation of said device.

10. In combination, a thermal responsive circuit-controlling device, a manually operable circuit-controlling device, a base therefor, a control shaft rotatably mounted upon said base, a plu-

rality of cams rigidly attached to the control shaft; means comprising one of the cams for operating said manually operable circuit-controlling device, and means operatively associated with the thermal responsive circuit-controlling device for varying the operation of said device.

11. In combination, a thermal responsive circuit-controlling device, a manually operable circuit-controlling device, a base therefor, a control shaft rotatably mounted upon said base and means operatively associated with the control shaft for operating said manually operable circuit-controlling device and for varying the operation of said thermal responsive circuit-controlling device.

12. In combination, a thermal responsive circuit-controlling device, a manually operable circuit-controlling device, a base therefor, a control shaft rotatably mounted upon said base, a plurality of cams rigidly attached to the control shaft, means comprising one of the cams for operating said manually operable circuit-controlling device, and means comprising another of said cams for varying the operation of said thermal responsive circuit-controlling device.

13. In combination, a thermal responsive circuit-controlling device, a manually operable circuit-controlling device, a base therefor, a control shaft rotatably mounted upon said base, a plurality of cams rigidly attached to the control shaft, a bell-crank lever swingably mounted on said base and operatively associated with one of said cams, means comprising the bell-crank lever, the operatively associated cam and the control shaft for varying the operation of said thermal responsive circuit controlling device, means operatively associated with the bell-crank lever and thermal responsive circuit-controlling device for compensating for the ambient temperature, and means comprising another of said cams for operating the manually operable circuit-controlling device.

14. In combination, a thermal responsive circuit-controlling device, a radiant heater operatively associated therewith, a manually operable circuit-controlling device, a base therefor, a control shaft rotatably mounted upon said base, a plurality of cams rigidly attached to the control shaft, a bell-crank lever swingably mounted on said base, said bell-crank lever being mounted intermediate the ends thereof and operatively associated at one end with one of said cams and rigidly attached at the other end to said thermal responsive circuit-controlling device, means comprising the bell-crank lever, the operatively associated cam and the control shaft for varying the operation of said thermal responsive circuit-controlling device, and means comprising another of said cams for operating the manually operable circuit-controlling device.

15. In combination, a bimetallic thermal responsive device, a base therefor, a circuit-controlling device operatively associated with said bimetallic responsive device, a bell-crank lever swingably mounted on said base and having one portion secured to said thermal responsive device, and means comprising the bell-crank lever for mechanically varying the effective angle of said bimetallic thermal responsive device.

16. In combination, a bimetallic thermal responsive device, a base therefor, a circuit-controlling device operatively associated with said bimetallic responsive device, a control shaft, a bell-crank lever swingably mounted on said base and operatively associated with the control shaft and

having one portion secured to said thermal responsive device, and means comprising the bell-crank lever and operatively associated control shaft for mechanically varying the effective angle of said bimetallic thermal responsive device.

- 5 17. In combination, a bimetallic thermal responsive device, a base therefor, a circuit-controlling device operatively associated with said bimetallic thermal responsive device, a control
10 shaft, a cam attached to the control shaft, a bell crank lever swingably mounted on said base and operatively associated with said cam and having one portion secured to said thermal responsive
15 device, means operatively associated with the bell-crank lever and the bimetallic thermal responsive device for compensating for the ambient temperature, and means comprising the bell-crank lever, the operatively associated cam and the control shaft for mechanically varying the

effective angle of said bimetallic thermal responsive device.

18. In combination, a bimetallic thermal responsive device, a base therefor, a radiant heater operatively associated with said thermal responsive device, a circuit-controlling device operatively associated with said bimetallic thermal responsive device, a control shaft, a cam attached to the control shaft, a bell-crank lever swingably
5 mounted on said base, said bell crank lever being mounted intermediate the ends thereof, and operatively associated at one end with said cam and
10 rigidly attached at the other end to said bimetallic thermal responsive device, and means comprising the bell-crank lever, the operatively associated cam and the control shaft for varying
15 the effective angle of said bimetallic thermal responsive device.

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