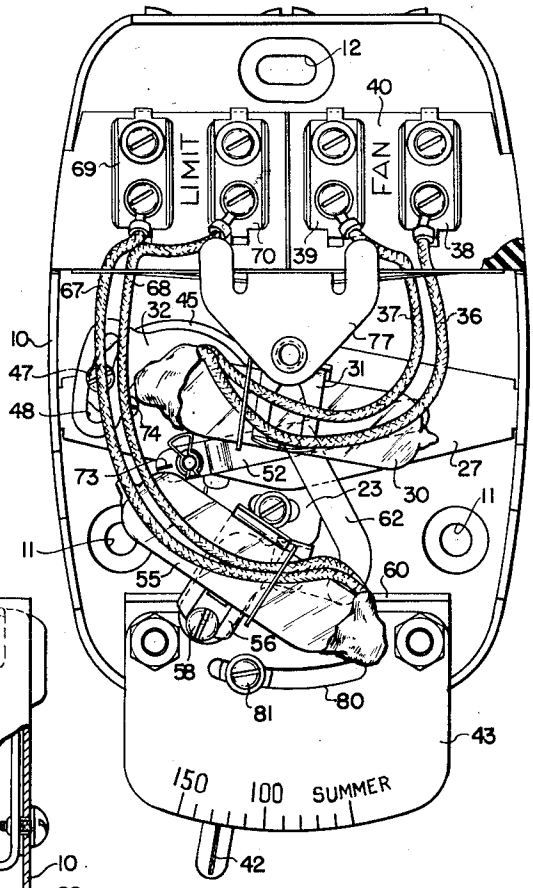
May 13, 1952 S. CRUM 2,596,657

CONTROL SWITCH

Filed Dec. 10, 1949 2 SHEETS--SHEET 1

FIG. 1



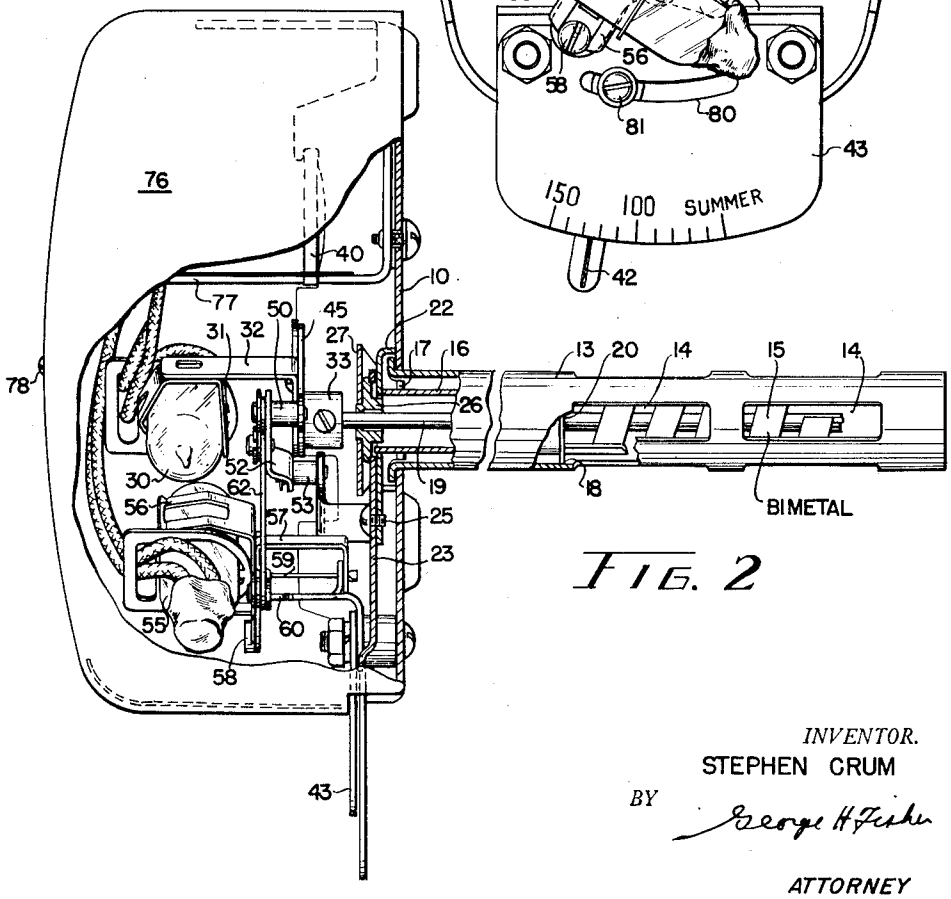


FIG. 2

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FIG. 3

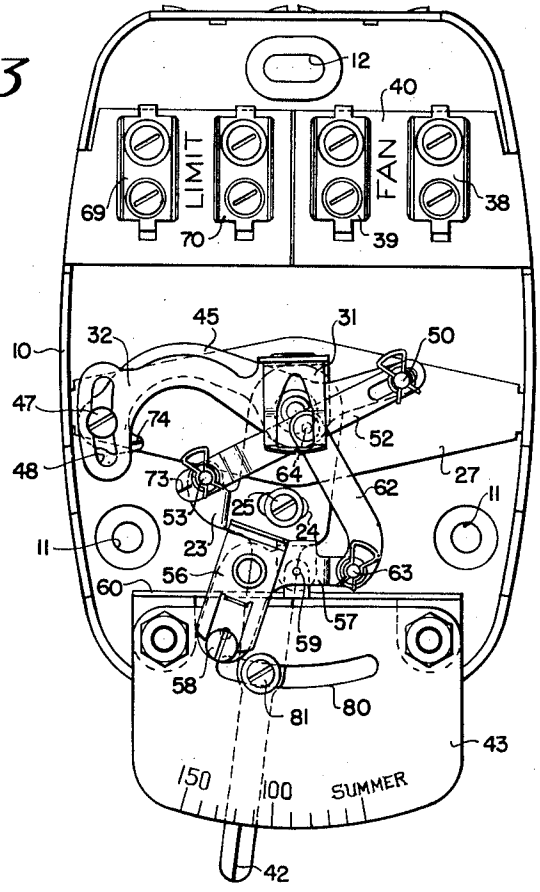
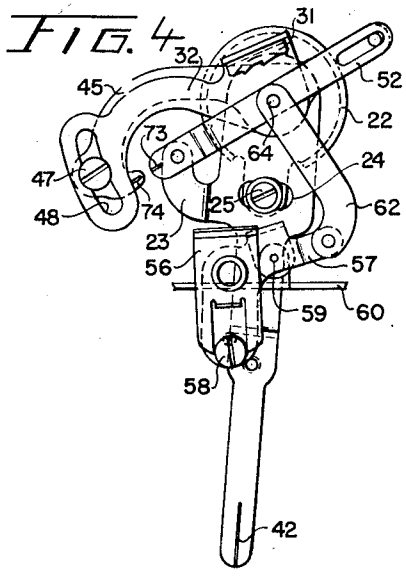


FIG. 4



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UNITED STATES PATENT OFFICE

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CONTROL SWITCH

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Application December 10, 1949, Serial No. 132,255

10 Claims. (Cl. 200—139)

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This invention relates to condition responsive control devices and more particularly to such devices in which a single condition responsive element actuates more than one control element.

An object of the invention is to provide a control device in which a condition responsive element actuates one control element at one condition value and another control element at a condition value that is adjustable.

Another object is to provide a control device in which a single thermostatic element actuates one switch at an adjustable temperature and another switch at a normally fixed temperature.

Another object is to provide a thermostat in which two switches are actuated at independently adjustable temperatures.

Other objects will be apparent from the following written description and claims, and from the drawing, in which

Figure 1 is a front elevation of a thermostat embodying the various features of the invention, the cover having been removed,

Figure 2 is a side elevation, partly in section, of the device shown in Figure 1 as seen from the right,

Figure 3 is a view similar to Figure 1 but with the mercury switches and their lead wires removed, and

Figure 4 is a fragmentary view showing the switch actuating linkage in the position it assumes to actuate the lower mercury switch.

The illustrative embodiment of the invention is a combination furnace fan and high limit control for use with forced warm air furnaces. A single bimetal element actuates both the fan switch and the limit switch. In what probably is the most common electrical wiring arrangement the fan switch causes operation of the blower only at bonnet temperatures sufficiently high so that the discharged air will not be uncomfortably cool. The fan switch is adjustable from outside the casing so that it may be set to make contact at the furnace bonnet temperature indicated on the scale. The limit switch is provided with a factory adjustment to determine the furnace temperature at which it will break contact to shut down the burner. The arrangement is such that the fan switch setting may be adjusted without affecting the limit switch setting. The fan switch control point is set by a conventional "back end" adjustment, and a novel linkage is provided whereby the limit switch control point is unaffected by such adjustment of the fan switch.

A base 10 is provided with a pair of lower

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mounting holes 11 and an upper mounting hole 12 in its back surface to facilitate mounting the device on the bonnet of a warm air furnace. A sleeve 13 secured to the back of the base 10 is adapted to extend within the bonnet of the furnace and is provided with a plurality of openings 14 to provide access of the air within the furnace to a helical bimetal element 15. A tube 16 which is journaled in the base 10 at 17 and in the tube 13 at 18 carries the inner end of the bimetal element 15. A rod 19 which is journaled in the tube at 20 carries the outer end of the bimetal element.

A generally cup-shaped member 22 is staked to the inner end of the tube 16 and is provided with a central aperture through which the rod 19 extends. The periphery of the member 22 engages the inner surface of base 10. An adjusting member 23 overlies cup-shaped member 22 and is provided with an aperture concentric with the aperture in member 22. The member 23 is provided with an arcuate slot 24 which receives a screw 25, the arrangement being such that a limited amount of pivotal adjustment is permitted between the members 22 and 23. A bushing 26 is located within the aperture in the member 23 and is provided with a central opening that serves as a bearing for the inner end of the rod 19. A spring plate 27 overlies the bushing 26 and has its end secured by the edges of the base 10. The plate 27 provides a bias on the bushing 26 which holds the members 22 and 23 and the tube 16 in place within the sleeve 13. The plate 27 also provides a frictional drag to maintain the tube 16 in its adjusted position. The arrangement is such that the tube 16 and the rod 19 are coaxially pivoted in the base 10.

A mercury switch 30 is mounted in a clip 31 which is carried by a bracket 32. The bracket 32 is staked to a collar 33 carried by the inner end of rod 19. The mercury switch 30 is connected by a pair of flexible lead wires 36 and 37 to terminals 38 and 39 secured to an insulating terminal strip 40 which is carried by the base 10. The lower end of the member 23 carries a pointer 42 which cooperates with suitable indicia of temperature on a scale plate 43. The relation between the tube 16 and the pointer 42 is adjusted by means of the screw 25 and slot 24 in the members 22 and 23 so that the mercury switch 30 will be actuated to "on" position when the bimetal element 15 reaches the temperature indicated on the scale plate 43.

An adjusting arm 45 is carried by the collar 33 and is pivotally adjustable about the collar

33 to various angular relations with respect to the switch bracket 32. The axis of adjustment of the arm 45 is, of course, the axis of the rod 19. The left-hand end of the arm 45 carries a screw 47 which extends through an arcuate slot 48 in an extension of the switch bracket 32. Tightening the screw 47 secures the arm 45 to the bracket 32 so they will move as a unit on changes in temperature of the bimetal element 15.

A pivot post 50 is carried by a right-hand extension of the arm 45. A lever 52 has its right-hand end pivoted, by means of a slot therein, on the post 50. The left-hand end of the lever 52 is pivoted on a post 53 that is carried by an extension of the member 23. A second mercury switch 55 is carried in a clip 56 which is pivotally adjustable with respect to a bracket 57 by means of an eccentric 58. Bracket 57 is pivotally mounted in the base 10 on a pin 59 which is carried by a bracket 60 secured to the base 10. A link 62 interconnects a right-hand extension of the bracket 57 and an intermediate portion of the lever 52. A pin 63 carried by the bracket 57 serves as the pivotal connection between the bracket 57 and the link 62, while a pin 64 pivotally connects the link 62 and lever 52. The distance along the lever 52 between the pin 64 and the post 53 is the same as the distance between the post 53 and the axis of the rod 19 and tube 16. Hence, under certain conditions the pivotal axis of the link 62 in the lever 64 will be coincident with the axis of the rod 19.

A pair of flexible conductors 67 and 68 connect the mercury switch 55 to a pair of terminals 69 and 70 on the terminal strip 40.

The mercury switch 55 is adjusted by means of the eccentric 58 so that it will break contact when the axis of the pin 64 interconnecting the link 62 and the lever 52 is coincident with the axis of the rod 19. This will occur when the temperature of the bimetal element 15 is at a value such that the post 50 is diametrically opposite the post 53 with respect to the pivotal axis of the rod 19. This temperature may be varied, however, since the relation between the rod 19 and the post 50 is adjustable by means of the screw 47 and the slot 48.

It will be seen that when the axis of the pin 64 interconnecting lever 52 and link 62 is coincident with the axis of the rod 19 that adjustment of the member 23 to adjust the control point of the mercury switch 30 will have no effect on the position of the mercury switch 55. Movement of the member 23 will move the post 53 but it will also move the tube 16 a like amount and, through the bimetal element 15, will move the rod 19 a like amount to shift the position of the post 50 the proper amount to maintain the position of the pin 64. At other temperature values adjustment of the member 23 will cause some movement of the pin 64 and some movement of the mercury switch 55, but all such positions of the mercury switch 55 are "on" positions and therefore have no effect on its circuit controlling operation.

Adjustment of the temperature at which the mercury switch 55 will be operated to open circuit position is accomplished during manufacture of the device by placing the bimetal element 15 in an oven adjusted to the temperature at which it is desired to have the switch operate. In order to facilitate such adjustment and to determine the point at which the axis of the pin 64 is coincident with the axis of the rod 19, the left-hand end of the lever 52 is provided with a pointer 73 which cooperates with a pointer 74 on the adjusting arm 45. When these pointers are in alignment, as shown in Figure 4, the screw 47 may be tightened to secure the arm 45 in a position that will actuate the mercury switch 55 when that temperature is reached. It may be convenient to make this adjustment so that the switch 55 is actuated to open circuit position at some temperature in the neighborhood of 200° F.

No adjustment is provided in this device for the temperatures at which the two mercury switches will be actuated to their opposite circuit controlling positions. Such temperature values may be determined by selecting mercury switches having the desired operating angles.

A suitable cover 76 is provided to enclose the switching mechanism. This may be secured in place on the base 10 by a bracket 77 and a screw 78. The scale plate 43 is provided with an arcuate slot 80 to receive a screw 81 carried by the member 23. This screw may be tightened to secure the member 23 against unauthorized tampering.

Various other embodiments of the invention will be apparent to those skilled in the art. The scope of the invention is to be determined, therefore, only by the appended claims.

I claim:

1. In a control device, a frame, first and second members coaxially pivoted in said frame, a condition responsive element operatively connected to each member for relatively positioning said members about said axis in accordance with condition value, cooperating indicia of condition value on said first member and said frame, a first control element actuated by said second member at the condition value indicated by said indicia, a lever pivotally connected to said first and second members on opposite sides of said axis, and a second control element actuated by an intermediate portion of said lever at a condition value such that the pivotal connections of said link to said members are diametrically opposed with respect to said axis.

2. In a control device, a frame, first and second members coaxially pivoted in said frame on a first axis, a helical bimetal element operatively connected to each member for relatively positioning said members about said axis in accordance with temperature, means for adjustably positioning said first member in said frame, a first switch actuated by said second member at a temperature depending on the adjusted position of said first member in said frame, a lever pivotally connected at opposite ends to said first and second members on axes parallel to said first axis but disposed on opposite sides thereof, and a second switch actuated by an intermediate portion of said lever.

3. In a control device, a frame, first and second members coaxially pivoted in said frame on a first axis, a helical bimetal element operatively connected to each member for relatively positioning said members about said axis in accordance with temperature, means for adjustably positioning said first member in said frame, a first switch actuated by said second member at a temperature depending on the adjusted position of said first member in said frame, a lever pivotally connected at opposite ends to said first and second members on axes parallel to said first axis but disposed on opposite sides thereof, a second switch, means operatively connecting said second switch and a point on said lever in line with said first axis at

the temperature at which the pivotal axes of said lever in said members are diametrically opposed with respect to said first axis.

4. In a control device, a frame, a sleeve pivoted in said frame, a rod pivoted in said sleeve, a helical bimetal element interconnecting said rod and said sleeve for rotating said rod relative to said sleeve on changes in temperature, a mercury switch carried by said rod, a first member rotatable with said sleeve, a second member rotatable with said rod, cooperating indicia of temperature on said frame and said first member for indicating the temperature at which said mercury switch is actuated, a second mercury switch pivoted in said frame, a lever pivotally connected to said first and second members, and a link pivotally connected at one end to said lever at a point intermediate its connections to said members and at the other end to said second mercury switch, the arrangement being such that said second switch is actuated when the connection between said lever and said link is substantially in line with the pivotal axis of said rod and hence at a temperature independent of the adjusted position of said member in said frame.

5. In a control device, a frame, first and second members coaxially pivoted in said frame, a thermostatic element interconnecting said members and adapted to relatively position said members about said axis, means for pivotally adjusting said first member in said frame, a first switch actuated by said second member at a temperature determined by the adjusted position of said first member in said frame, a lever pivotally connected at opposite ends to said first and second members at points on opposite sides of the pivotal axis of said members in said frame, a second switch and means interconnecting said second switch and a point on said lever which, at a predetermined temperature of said element, lies on the axis of said members, said interconnecting means being adapted to actuate said second switch at said predetermined temperature.

6. In a control device, a frame, first and second members coaxially pivoted in said frame on a first axis, a thermostatic element interconnecting said members adapted to relatively position said members about said axis, a first switch actuated by said second member at a temperature depending on the position of said first member in said frame, a second switch, and a lever pivotally connected at one point to said first member on an axis displaced from said first axis, pivotally connected at a second point to said second member on an axis displaced from said first axis and at a third point to said second switch on an axis that is in line with said first axis at a predetermined temperature, at which temperature said second switch is actuated.

7. In a control device, a frame, first and second members coaxially pivoted in said frame, a condition responsive element interconnecting said members adapted to position said second member with respect to said first member in accordance with condition value, a first switch actuated by said second member at a condition value depending on the position of said first member in said frame, a lever, connections between spaced points on said lever and said members, a second switch, and

a connection between said second switch and a point on said lever that is stationary for all adjusted positions of said first member in said frame at a predetermined condition value, said second switch being actuated at said predetermined condition value.

8. In a control device, a frame, a tube and a rod coaxially pivoted in said frame, a thermostatic element interconnecting said rod and said tube adapted to angularly position said rod with respect to said tube in accordance with temperature, a first switch actuated by said rod at a temperature depending on the position of said tube in said frame, a first member attached to said tube and rotatable therewith, a second member carried by said rod, means for adjusting the angular relation between said second member and said rod, a lever pivotally connected at opposite ends to said first and second members at points on opposite sides of the pivotal axis of said tube and rod in said frame, a second switch, and an actuator for said second switch pivotally connected to said lever on an axis that lies on the pivotal axis of said tube and rod at a temperature determined by the adjusted angular relation between said second member and said rod.

9. In a control device, a frame, a tube and a rod coaxially pivoted in said frame, a thermostatic element interconnecting said rod and said tube adapted to angularly position said rod with respect to said tube in accordance with temperature, a first member attached to said tube and rotatable therewith, a second member attached to said rod and rotatable therewith, a first switch actuated by said second member at a temperature depending on the position of said tube in said frame, a third member positioned by said second member, means for adjusting said third member with respect to said second member about the axis of said rod, a lever pivotally connected at opposite ends to said first and third members on pivots on opposite sides of the axes of said tube and said rod, a second switch, and an actuator for said switch pivotally connected to said lever on an axis that lies on the axis of said tube and said rod at a predetermined relative position of said first and third members.

10. In a control device, a frame, first and second members coaxially pivoted in said frame, a condition responsive element operatively connected to each member for relatively positioning said members about said axis in accordance with condition value, means for pivotally adjusting said first member in said frame, a first control element actuated by said second member, a lever pivotally connected at opposite ends to said first and second members on axes parallel to the first axis but disposed on opposite sides thereof, and a second control element actuated by an intermediate portion of said lever.

STEPHEN CRUM.

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