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3,236,977

DOUBLE POLE THERMOSTAT SWITCH

Filed June 7, 1962

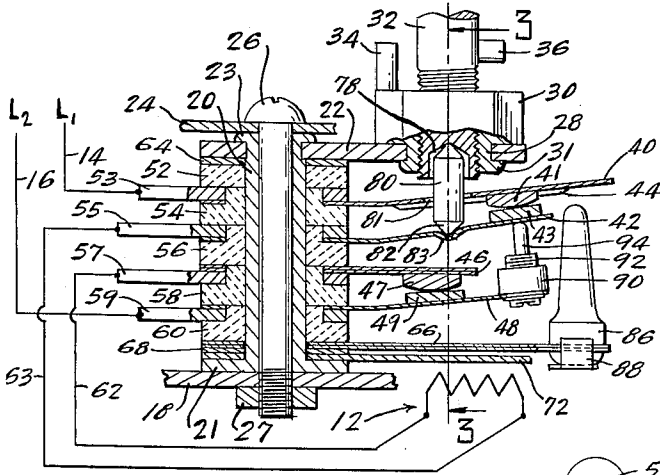


FIG-1-

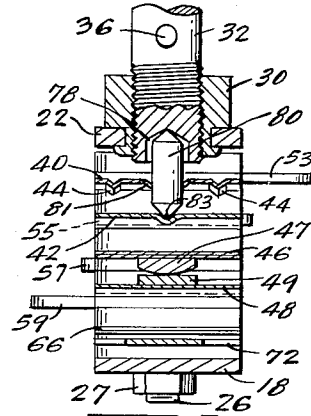


FIG-3-

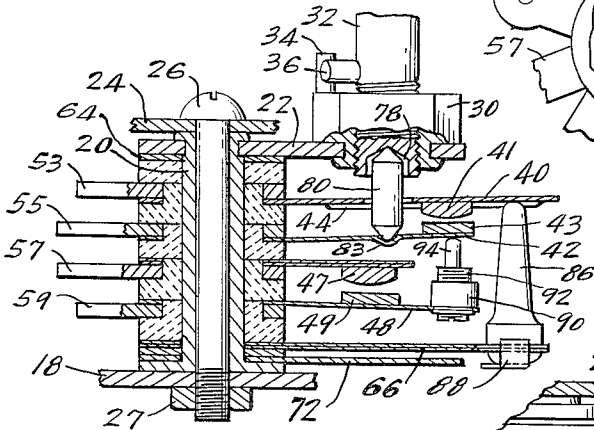


FIG-4-

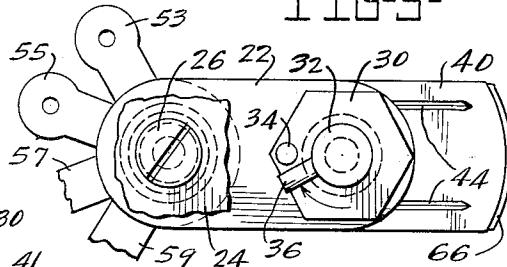


FIG-2-

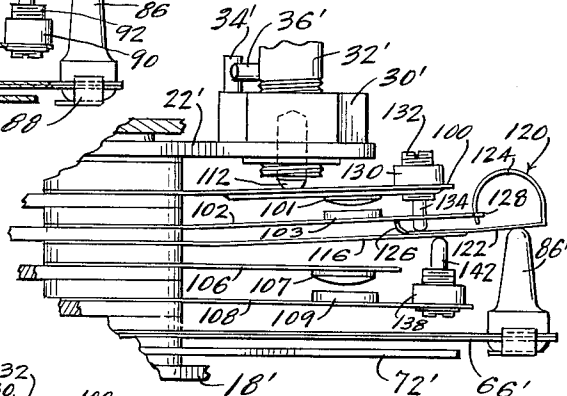


FIG-6-

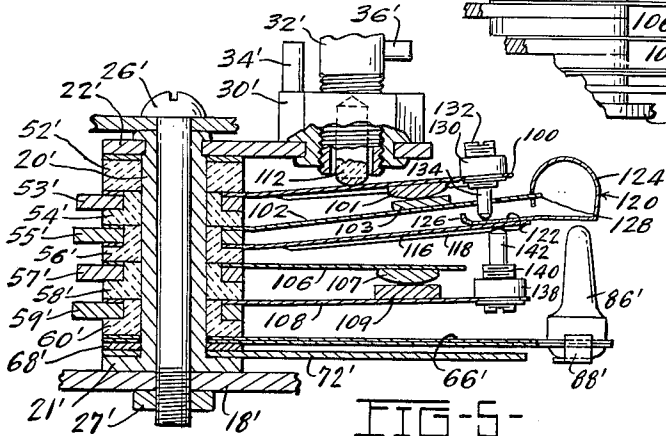


FIG-5-

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DOUBLE POLE THERMOSTAT SWITCH

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This invention relates to thermostat switches and more especially to a dual switch mechanism for controlling or interrupting both power supply conductors or lines, the switch mechanism embodying thermoresponsive means for automatically controlling the making and interrupting of a circuit for an electric energy consuming means or appliance.

Thermostat control switches have been extensively used wherein the switch means is arranged to interrupt or break the circuit of one current supply conductor or line. In the use of certain appliances, such as room or space heaters, it is desirable for purposes of safety to provide means for interrupting a circuit by interrupting both supply conductors or lines when the manual control for setting the range of operation of the switch is moved to an "off" position. Such arrangement is desirable for other types of appliances as it facilitates service and maintenance without the necessity of disconnecting the power supply by manipulation of a master switch or other supply circuit interrupting means.

The present invention embraces the provision of a simple and compact switch mechanism embodying dual means for interrupting both current supply leads or conductors of a circuit.

Another object of the invention resides in a switch mechanism of the "stacked-type" embodying dual means for interrupting both current supply leads or conductors and embodying thermoresponsive means for automatically controlling current supplied to an appliance with which the switch mechanism may be used.

Another object of the invention resides in a dual switch mechanism for controlling both current supply conductors or lines embodying a thermoresponsive means for controlling current supply to an appliance, the switch mechanism embodying a manually adjustable arrangement for interrupting both current supply conductors when the manual adjustment is moved to an "off" position.

Another object of the invention resides in the provision of switch means effective on both current supply leads, conductors or lines for interrupting both leads or conductors so that the appliance with which the switch may be used is completely isolated from current supply to enable maintenance of the appliance without liability of shock or electric hazard as well as avoiding possible damage to or destruction of the appliance.

Further objects and advantages are within the scope of this invention such as relate to the arrangement, operation and function of the related elements of the structure, to various details of construction and to combinations of parts, elements per se, and to economies of manufacture and numerous other features as will be apparent from a consideration of the specification and drawing of a form of the invention, which may be preferred, in which:

FIGURE 1 is an enlarged longitudinal sectional view of a form of thermostat switch mechanism of the invention;

FIGURE 2 is a top plan view of the switch mechanism illustrated in FIGURE 1;

FIGURE 3 is a transverse vertical sectional view taken substantially on the line 3—3 of FIGURE 1;

FIGURE 4 is a sectional view similar to FIGURE 1 illustrating the position of various components with the manual adjustment in an "off" position;

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FIGURE 5 is a longitudinal sectional view illustrating a modified form of thermostat switch mechanism embodying a snap action, and

FIGURE 6 is a view of the construction shown in FIGURE 5 illustrating the positions of the several components when the manual adjustment is in an "off" position.

The arrangement illustrated in the drawings is particularly adapted for controlling both supply lines or conductors of an appliance such as air conditioners, electrically energizable cooking appliances, space heaters, wall heaters or the like wherever it is desirable or imperative that both supply conductors or lines be controlled.

Referring to the form of the invention illustrated in FIGURES 1 through 4, the thermostat switch mechanism is illustrated in circuit with a current consuming unit 12 schematically shown, which may be a resistance heater or other appliance, the switch mechanism being arranged to control or interrupt both current supply conductors 14 and 16 for the current consuming unit 12. The switch mechanism of the invention for controlling both lines or sides of the circuit to the current consuming unit 12 may be mounted upon a frame portion 18 of the appliance.

In FIGURE 1, the switch mechanism illustrated is about twice actual size. The frame construction of the switch mechanism comprises a metal bushing or sleeve 20 and a horizontally disposed plate member 22. In the embodiment illustrated, one end of the sleeve 20 has a flange 21 and the other end is provided with a reduced portion which is received in an opening in the frame plate 22, a region 23 of the sleeve being swaged into overlapping engagement with the plate 22 after assembly of components on the sleeve.

The switch mechanism may be secured to the appliance frame structure 18 and a housing component 24 by means of a bolt 26 extending through the sleeve 20 and provided with a nut 27 which is drawn up to fixedly retain the switch mechanism in desired position. The sleeve 20 provides a support for several elements or components of the switch assembly to form a "stacked" switch.

The switch construction is inclusive of manually adjustable means operable within the operating temperature range of the switch for adjusting the position of one of the switch arms or members for current control at a desired temperature, a thermoresponsive means supplementing the manually adjustable means to maintain substantially constant the temperature for which the manual means is adjusted. The switch frame plate or frame component 22 is provided with an opening to accommodate a tenon portion 28 of a fitting or member 30, a portion 31 of the tenon being swaged or staked as at 31 to securely fasten the fitting 30 to the plate 22.

The fitting or sleeve 30 is interiorly threaded to accommodate a threaded member or shaft 32 arranged to be manually rotated relative to the fitting for adjusting the position of the switch arm for purposes hereinafter described. The shaft 32 may be provided with a suitable manipulating knob or grip member (not shown) of conventional construction for rotating the shaft.

The fitting 30 is provided with an abutment or pin 34 and the shaft 32 provided with a pin or transversely extending projection 36, the pins or stop means 34 and 36 cooperating to determine the maximum extent of rotation of the shaft 32 defining the limits of the temperature range within which the switch is adapted to operate.

The switch mechanism includes two pairs of switch arms, a thermoresponsive component or bimetallic element, terminal members or connectors, and a component for limiting the movement of the thermoresponsive means supported by insulating means mounted by or associated with the support sleeve 20. A first pair of switch arms

comprises a first switch arm 40 and a second switch arm 42, the arms respectively provided with cooperating contacts 41 and 43 as shown in FIGURE 1.

The second pair of switch arms includes a third switch arm 46 and a fourth switch arm 48, the third and fourth switch arms being respectively provided with contacts 47 and 49. The contacts 42 and 43 make or interrupt the circuit through one side of the current supply line and the contacts 47 and 49 make or interrupt the circuit through the other side or conductor of the current supply.

Nested upon the sleeve 20 are ceramic or high temperature resistant insulating members, discs or washers 52, 54, 56, 58 and 60. A metal washer 64 is disposed between the upper most insulating member 52 and the frame plate 22.

The first switch arm 40 is in direct contact with a first terminal member 53, a tenon portion on the insulating member 54 extending into openings formed in the switch member 40 and the terminal 53 whereby the first switch arm and the first terminal are supported by the insulating member 54 on the sleeve 20.

The terminal 53 is connected by a current conductor 14 with one side L1 of a current supply line. The second switch arm 42 and the second terminal 55 are in contact and are supported in the same manner by the insulating member 56. The third switch arm 46 and the third terminal member 57 are supported in a like manner by the insulating member 58. The fourth switch member 48 and the fourth terminal 59 are supported in a like manner by the insulating member 60.

The terminals 55 and 57 are connected by conductors 62 and 63 with the heating element 12 of the appliance schematically illustrated in FIGURE 1, and the fourth terminal 59 is connected by conductor 16 with the other side L2 of the current supply line. The switch mechanism includes a thermoresponsive means or bimetallic element 66 having an opening accommodating the sleeve 20 to support the bimetallic element from the sleeve.

The insulating member 60 is disposed above the bimetallic element 66 and a metal spacer 68 is disposed below the element 66. Also included in the assembly on the sleeve 20 is a plate or member 72 which is supported by a flange portion 21 formed on the lower end of sleeve 20.

The plate 72 forms a stop or abutment means for limiting the downward movement or flexure in one direction of the thermoresponsive element 66 to provide a positive "off" for the first switch means comprising switch arms 40 and 42 when the shaft 32 is rotated to an "off" position.

From the foregoing it will be seen that the pairs of switch arms, the thermoresponsive means 66, the stop plate 72 and the four terminals are supported by the sleeve 20 of the frame construction. After assembly of these components on the sleeve 20, the swaging 23 of the upper end of the sleeve securely holds the components in fixed relation with the frame plate 22. The switch arm 40 is provided throughout a substantial portion of its length with ridges or raised portions 44 shown in FIGURES 1 and 2 so that a hinging action of the switch member 40 occurs adjacent its support.

Means is provided between the manually operable shaft 32 and the second switch arm 42 for adjusting the position of the switch arm 42. The lower end region of the shaft 32 is provided with a bore 78 to receive one end of a strut 80 fashioned of high temperature resistant insulating material such as lava. The strut 80 extends through a clearance opening 81 in the switch member 40. The lower end of the lava strut 80 is cone-shaped, as shown at 82, and extends into a recess or depression 83 formed in the second switch member 42. The switch arm 42 is initially stressed in a forward direction so as to bear against the strut 80.

By rotation of the manipulating member or shaft 32, through the threaded connection of the shaft with the

fitting 30, the relative position of the switch member 42 may be manually varied to thereby control the making or breaking of the circuit through the contacts 41 and 43 at a desired temperature. The thermoresponsive means or bimetallic element 66 is provided with an upwardly extending strut or member 86 secured to the element 66 by means of a clip or retainer 88.

The strut 86 is disposed whereby the upper end of the strut is adapted for engagement and disengagement with the end region of the switch arm 40 upon variations in temperature affecting the bimetallic element 66. The bimetallic element is of a character such that when the ambient temperature is raised, the strut 86 moves upwardly and engages the switch arm 40 to elevate the contact 41 out of engagement with the contact 43 to interrupt flow of electric energy to the appliance 12.

When the ambient temperature is reduced, the bimetallic element 66 is flexed downwardly, moving the strut 86 away from the switch arm 40 which action engages contact 41 with contact 43 to re-establish current flow to the appliance 12. In the normal operation of the contacts 41 and 43, the circuit is made and interrupted through the movement of the strut 86 controlled by the thermoresponsive means or bimetallic element 66. During normal operation of the switch mechanism with the shaft 32 moved away from an "off" position, the contacts 47 and 49 remain in engagement or circuit closing position.

Secured to the distal end region of the fourth switch arm 48 is a threaded bushing 90 which is welded or otherwise secured to the switch arm. The bushing 90 supports a threaded member 92. The upper end region of the threaded member 92 is bored to accommodate a lava strut or insulating pin 94, the upper end of which engages the lower surface of the switch arm 42.

The purpose of the second pair of switch arms 46 and 48 their contacts 47 and 49 is to assure interrupting the other current supply line L2 when the manipulating member 32 is moved to an "off" position, that is, a position in which the abutment pins 36 and 34 are engaged and the strut 80 moved downwardly to its maximum lowermost position separating the contacts 41 and 43 breaking one side of the circuit. During such rotative movement of the manually operated shaft 32, the switch arm 42 is moved downwardly and, through the medium of the strut, 94, the threaded member 92 and the bushing 90, the fourth switch arm 48 is moved downwardly to disengage the contacts 47 and 49. Thus, in an "off" position of the shaft or member 32, both sets of contacts are open or disengaged as shown in FIGURE 4 so that both sides of the current supply line are interrupted.

The plate 72 is disposed so as to limit the downward flexure of the thermoresponsive element 66 and thereby limit the lowermost position of the strut 86. As shown in FIGURE 4, with the shaft 32 in a full "off" position, the strut 86 provides a stop means for the switch arm 40 to prevent engagement of the contact 41 with the contact 43. Thus, with shaft 32 in an "off" position, both sets of contacts are out of engagement as shown in FIGURE 4.

The range of operation of the switch mechanism may be adjusted by rotating the manually operable shaft 32 which determines the relative position of the switch arm 42 and its contact 43 so that the movement of the switch arm 40, under the influence of the bimetallic element 66, automatically controls the position of the movable contact 41 to make and interrupt the circuit through the appliance.

The threaded member 92 is initially adjusted relative to the switch arm 48 so that a slight amount of rotation of member 32 away from its "off" position re-engages contacts 47 and 49. Thus, through this arrangement, the circuit to both leads or lines of the current supply is broken through disengagement of both sets of contacts so that an operator is assured when the shaft 32 is in an "off" position that neither conductor to the appliance is connected with electric energy.

FIGURES 5 and 6 illustrate a modification of the switch construction of the invention embodying means providing a snap action for the switch arms and contacts controlled by the thermoresponsive means or bimetallic element. In the form shown in FIGURES 5 and 6, the components thereof, which are similar to components in the switch mechanism shown in FIGURES 1 through 4 are assembled in a similar manner. The switch mechanism of FIGURES 5 and 6 includes a frame construction comprising a plate 22' and a mounting sleeve 20'.

The frame plate 22' supports a fitting 30' threaded to accommodate a manually rotatable shaft 32', the fitting 30' being provided with an abutment or stop means 34' and the shaft 32' provided with a pin or projection 36' for cooperation with the abutment 34' for limiting rotation of the shaft 32'. The switch arrangement includes a first pair of switch arms, namely a first switch arm 100 and a second switch arm 102 provided respectively with contacts 101 and 103.

A second pair of switch arms namely a third switch arm 106 and a fourth switch arm 108 are equipped respectively with contacts 107 and 109. The switch arms 101 and 102 are respectively connected with terminals 53' and 55' and the switch arms 106 and 108 are connected respectively with terminals 57' and 59'. The terminals and the switch arms are supported and insulated from the sleeve 20' by means of ceramic insulators or insulating members 52', 54', 56', 58' and 60'. The assembly of sleeve 20' and the components carried thereby may be secured to a frame member 18' of an appliance by means of a bolt 26' and nut 27'.

The arrangement is inclusive of a thermoresponsive means or bimetallic element 66' provided with a ceramic member or lava strut 86', the strut being held to the element 66' by a clip 88'. The bimetallic element is secured on the sleeve 20' in the same manner that the element 66 is secured on the sleeve 20. Disposed beneath the bimetallic element 66' is a plate or stop member 72' which is assembled on the sleeve 20' in the same manner that the stop member 72 is assembled on the sleeve 20.

The member 72' provides an abutment means for limiting downward flexure of the bimetallic element 66' to attain a positive "off" position, viz. a separation of the contacts 101 and 103. The shaft 32' is provided at its lower region with a bore accommodating a strut or pin 112 of lava or other insulating material. The lower end of the strut engages the upper switch arm 100 whereby rotation of the shaft 32' changes the relative position of the switch arm 100 and the contact 101 carried thereby.

The arrangement shown in FIGURES 5 and 6 embodies means for attaining a snap action. Disposed lengthwise of and beneath the second switch arm 102 is an actuating member or arm 116 which is supported at one end region by the insulating member 56'. The member 116 is provided with lengthwise arranged raised portions 118 for resisting flexure. A resilient means 120 is associated with the arm or member 116 and the switch arm 102 for establishing a snap action effective to open or close the contacts 101 and 103.

The resilient means or spring 120 is fashioned with a uniplanar or flat portion 122 and a curved or arcuately-shaped portion 124. The planar portion 122 is spot welded or otherwise joined to the supporting arm 116. The arm 116 is formed with a struck-up projection 126 providing a stop means or abutment for limiting the downward movement or flexure of the switch arm 102 when the contacts 101 and 103 are disengaged.

The distal end region of the arcuate portion 124 is provided with a slot or opening into which extends a projection 128 formed on the end of the switch arm 102. The region adjacent the juncture of the arcuate portion 124 with the planar portion 122 is provided with an opening or otherwise fashioned of reduced cross-section

providing a weakened zone functioning as a hinge about which flexure of the arcuate portion of the spring takes place during movements of the switch arm or member 102. The construction of the spring 120 providing the snap action is disclosed in my patent 3,004,124 granted October 10, 1961.

It will be apparent that by flexing the planar portion 122 under the influence of the strut 86' actuated by the movement of the thermoresponsive means 66', the arcuate portion will be actuated about the hinge or weakened zone and moved upwardly or downwardly depending upon the direction of flexure to either side of the plane of the switch member 102. In this manner, a toggle action is provided imparting movement to the switch arm or member 102 through the arcuately-shaped portion 124 of the resilient means 120 to engage or disengage the contacts 101 and 103.

In the embodiment illustrated, the thermoresponsive means or bimetallic element 66' is arranged to be flexed upwardly by increased ambient temperature engaging the strut 86' with the portion 122, flexing the planar portion thereof upwardly to a position wherein the toggle action of the spring moves the switch member or arm 102 downwardly with a snap action to quickly disengage the contacts without appreciable arcing.

When the temperature is reduced, the strut 86' moves away from portion 122 and the inherent stress in the portion 122 flexes the arcuate portion 124 moving the switch member 102 upwardly with a snap action to engage the contacts 101 and 103 to complete a circuit.

The arrangement shown in FIGURES 5 and 6 embodies means for controlling the position of the switch arm 108 by the revoluble shaft 32' to disengage the contacts 107 and 109 when the projection or pin 36' engages the abutment 34' in an "off" position, as shown in FIGURE 6. The switch arm 100 is provided with a fitting or bushing 130 threaded to receive an adjusting screw 132, the screw having a bore accommodating an insulating pin or lava strut 134 which projects through an opening in the switch arm 102 and engages the upper surface of the planar portion 122 of the resilient means 120.

The distal end of the switch arm 108 is provided with a bushing 138 which is threaded to accommodate an adjusting screw 140, the screw being provided with a bore accommodating a lava strut or insulating member 142 which engages the lower surface of the arm 116. The screws 132 and 140 may be adjusted or regulated in order to secure the proper distances between the switch arms 100 and 108 and the member 116 so that when the shaft 32' is rotated to an "off" position, as shown in FIGURE 6, both sets of contacts 101, 103 and 107, 109 are disengaged so as to interrupt both conductors leading to the appliance, such as the appliance schematically illustrated at 12 in FIGURE 1.

It is apparent that, within the scope of the invention, modifications and different arrangements may be made other than as herein disclosed, and the present disclosure is illustrative merely, the invention comprehending all variations thereof.

I claim:

1. Switch mechanism for controlling both current conductors to a current consuming instrumentality including, in combination, a support means, first and second pairs of switch members mounted by the support means, co-operating contacts carried by the pairs of switch members, one pair of said switch members being in circuit with one current supply conductor and the other pair in circuit with the other supply conductor, manually actuable means mounted on the support means for adjusting the relative position of one switch member of the first pair, thermoresponsive means mounted by the support means arranged to influence the relative position of the other switch member of the first pair, and adjustable means carried by one of the switch members of the second pair and engageable with a switch member of the first pair

and actuable by movement of said manually actuable means to a predetermined position to separate the contacts carried by the second pair of switch members.

2. Switch mechanism for controlling both current conductors to a current consuming instrumentality including, in combination, a support means, first and second pairs of switch members mounted by the support means, cooperating contacts carried by the pairs of switch members, one pair of said switch members being in circuit with one current supply conductor and the other pair in circuit with the other supply conductor, manually actuable means mounted on the support means for adjusting the relative position of one switch member of the first pair, said manually actuable means being movable to an "off" position disengaging the contacts of the first pair of switch members, thermoresponsive means mounted by the support arranged to influence the relative position of the other switch member of the first pair, and strut means disposed between the manually actuable switch member and one of the switch members of the second pair influenced by movement of said manually actuable means to "off" position to separate the contacts carried by the second pair of switch members.

3. Switch mechanism comprising, in combination, support means, two pairs of switch members mounted by the support means, cooperating contacts carried by said pairs of switch members, manually actuable means mounted on the support means for adjusting the position of one switch member of the first pair, one pair of said switch members being in circuit with one current supply conductor and the other pair in circuit with the other supply conductor, thermoresponsive means mounted on the support means, resilient means having operable connection with the second switch member of said first pair, said thermoresponsive means being arranged for cooperation with said resilient means to effect a snap action engagement and disengagement of the contacts carried by said first pair of switch arms upon ambient temperature variations, strut means effective to move one of the switch members of the second pair by movement of said manually actuable means to a predetermined position to separate the contacts carried by said second pair of switch mem-

bers, and abutment means for limiting movement of said thermoresponsive means in one direction.

4. Switch mechanism comprising, in combination, support means, two pairs of switch members mounted by the support means wherein first and second members comprise one pair and third and fourth switch members comprise the second pair, cooperating contacts carried by said pairs of switch members, one of said pairs of switch members being in circuit with one current supply conductor and the other pair in circuit with the other supply conductor, manually actuable means mounted on the support means for adjusting the position of the first switch member, thermoresponsive means mounted on the support means, an arm mounted on the support means and disposed between the pairs of switch members, an element having a planar portion secured to said arm and an arcuate portion, said arcuate portion having pivotal connection with the second switch member of said first pair, said thermoresponsive means arranged for cooperation with said element to effect a snap action engagement and disengagement of the contacts carried by said first pair of switch arms upon ambient temperature variations, and strut means disposed between said first and fourth switch arms actuable by movement of said manually actuable means to a predetermined position to separate the contacts carried by said third and fourth switch members.

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