Aug. 9, 1966 J. B. RAMSEY ETAL 3,265,831

THERMALLY RESPONSIVE ELECTRICAL CONTROL DEVICE

Filed May 24, 1963

2 Sheets-Sheet 1

Fig. 1.

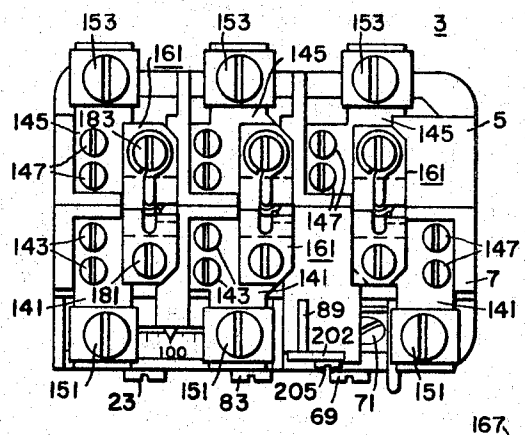


Fig. 3.

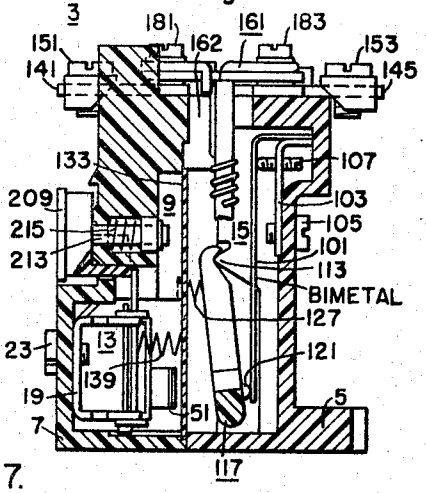


Fig. 7.

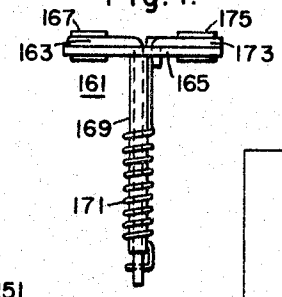


Fig. 2.

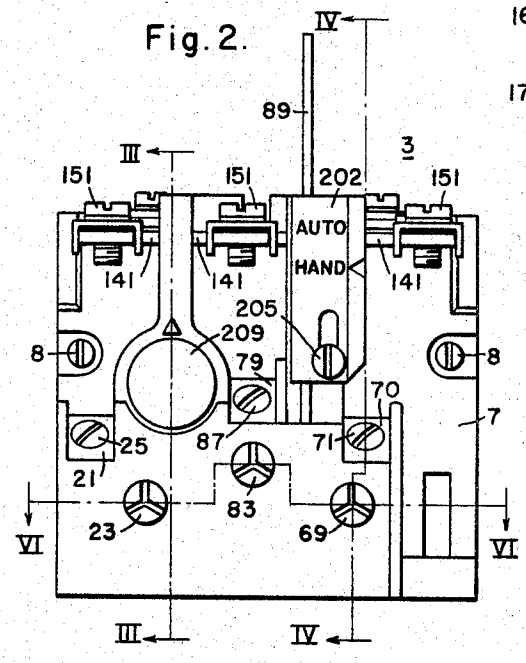


Fig. 4.

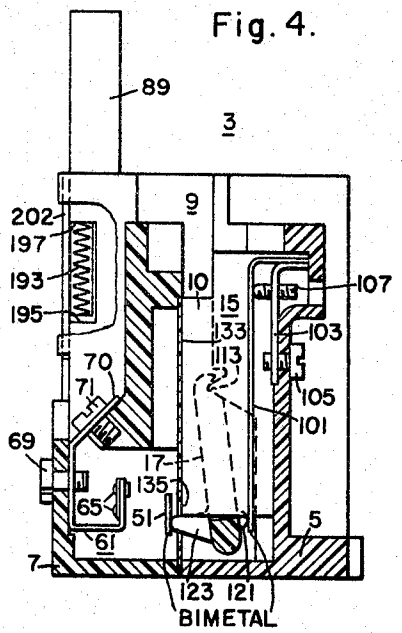
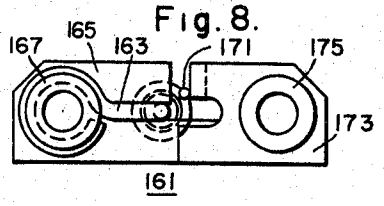


Fig. 8.



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THERMALLY RESPONSIVE ELECTRICAL CONTROL DEVICE

Filed May 24, 1963

2 Sheets-Sheet 2

Fig. 6.

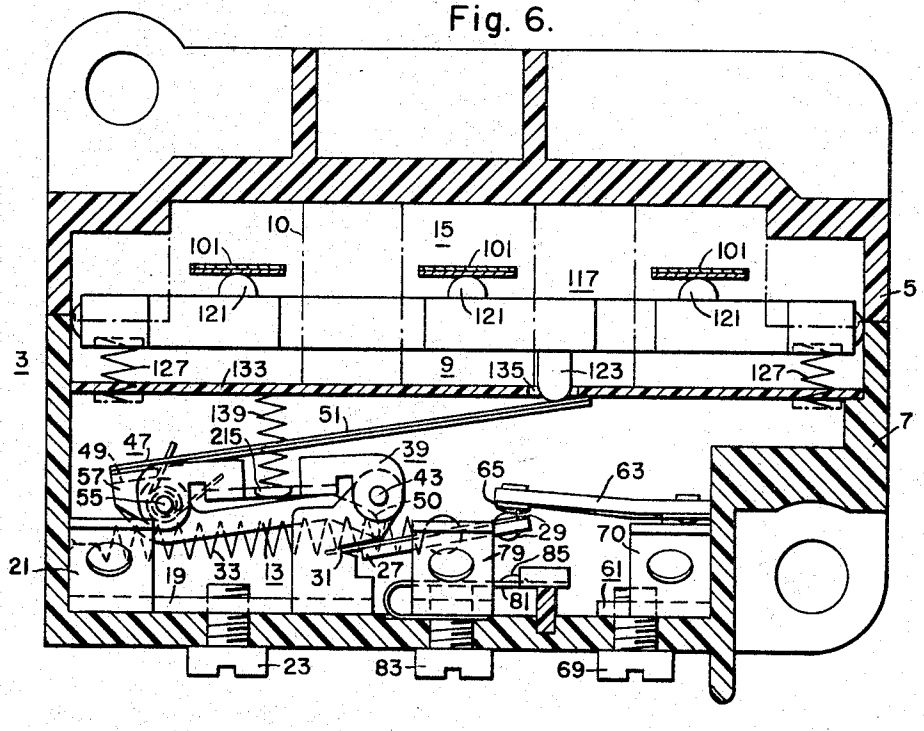
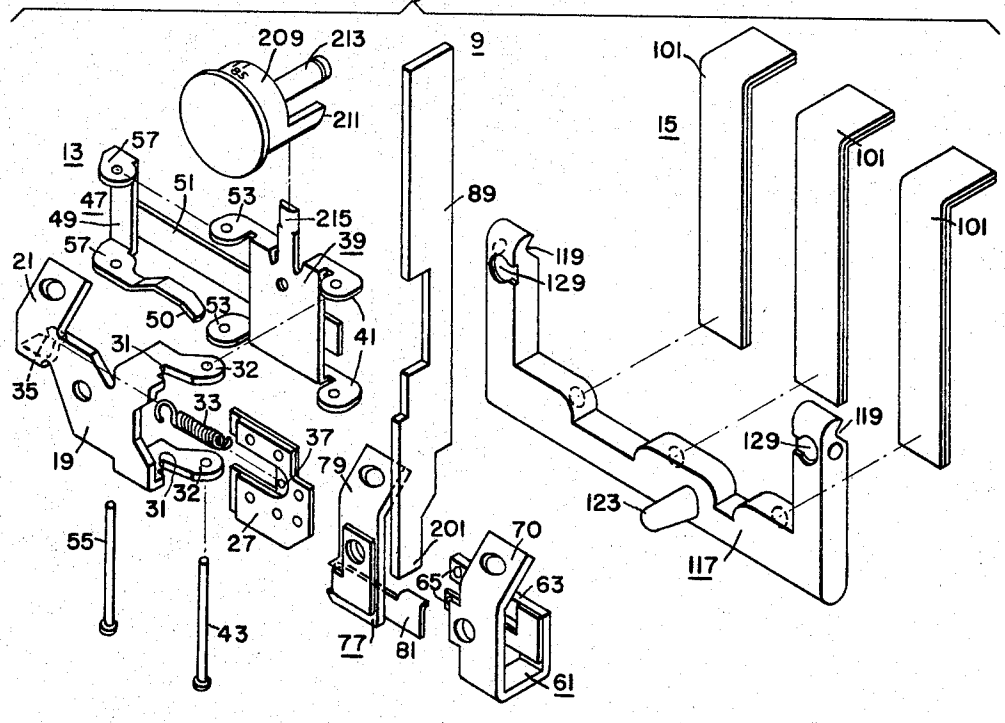


Fig. 5.



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3,265,831

THERMALLY RESPONSIVE ELECTRICAL CONTROL DEVICE

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Filed May 24, 1963, Ser. No. 283,000
13 Claims. (Cl. 200—116)

This invention relates generally to electric control devices and more particularly to thermally actuated relays.

An object of this invention is to provide an improved relay that is constructed to enable relatively easy assembly thereof.

Another object of this invention is to provide an improved multi-pole thermally actuated overload relay.

A further object of this invention is to provide an improved thermal overload relay of the type embodying ambient temperature compensating means.

A further object of this invention is to provide an improved thermal overload relay of the type comprising removable heater means for actuating the relay.

Another object of this invention is to provide an improved thermally actuated multi-pole overload relay embodying ambient temperature compensating means and removable heater means.

Another object of this invention is to provide an improved replaceable-type heater device.

The invention both as to structure and operation, together with additional objects and advantages, will be best understood from a study of the following detailed description when read in conjunction with the accompanying drawings.

In said drawings:

FIGURE 1 is a top plan view of an overload relay embodying the principles of this invention;

FIG. 2 is a side elevational view of the relay seen in FIG. 1;

FIG. 3 is a sectional view taken generally along the line III—III of FIG. 2;

FIG. 4 is a sectional view taken generally along the line IV—IV of FIG. 2;

FIG. 5 is an exploded perspective view of parts of the relay mechanism;

FIG. 6 is a sectional view taken generally along the line VI—VI of FIG. 2;

FIG. 7 is a side elevational view of the plug-in heater member seen in FIGS. 1 and 3; and

FIG. 8 is a plan view of the plug-in heater member seen in FIG. 7.

This invention is an improvement in the art of thermal overload relays of the general type disclosed in our Patent No. 2,942,081, issued June 21, 1960 and in our copending application Serial No. 204,282, filed June 21, 1962.

Referring to the drawings, there is shown in FIGS. 1–4 and 6, a relay 3 comprising a molded insulating housing part 5 and a molded insulating housing part 7 which housing parts 5 and 7 are secured together by means of two bolts 8 (FIG. 2). As can be seen in FIGS. 3, 4 and 6, each of the housing parts 5 and 7 comprises a backwall with four sidewalls extending therefrom to form an open cavity for receiving parts of a relay mechanism 9. The cavity of the housing part 5 comprises three spaces with the adjacent spaces being separated by insulating barriers 10 that are molded integrally with the housing part 5. The barriers are shown in dot-and-dash lines in FIG. 6 and one of the barriers is shown in full lines in FIG. 4. The cavities of the housing parts 5 and 7 form an internal compartment when the parts 5 and 7 are secured together. The relay mechanism 9 (FIGS. 3–6)

comprises an operating mechanism 13 and an actuating mechanism 15 which structures are suitably supported within the internal compartment of the insulating housing 5, 7.

The operating mechanism 13 comprises a conducting supporting frame 19 having a terminal 21 formed integral therewith, which frame 19 is supported on the housing part 7 by means of a screw 23 (FIG. 6). A screw 25 (FIG. 2) is provided to connect the terminal 21 and, therefore, the conducting frame 19 in an electric circuit. A generally U-shaped movable contact arm 27 having two contacts 29 (only one being shown in FIG. 6) at the outer end thereof, is pivotally supported in pivots 31 (FIG. 5) in two leg portions 32 of the frame 19. An overcenter spring 33 is supported under tension at one end in a V-shaped notch 35 (FIG. 5) in the frame 19, and at the other end in a suitable opening 37 in the bight portion of the U-shaped contact arm 27. An adjusting member 39 having two legs 41 is pivotally supported on the frame 19 by means of a supporting pin 43 that passes through openings in the legs 32 of the frame 19 and through openings in the legs 41 of the adjusting member 39. An operating structure 47 comprising a member 49 having an extension 50 and a compensating bimetal member 51 suitably supported on the member 49, is pivotally supported on two legs 53 of the adjusting member 39 by means of a pin 55 that passes through suitable openings in legs 57 of the member 49 and also through suitable openings in the legs 53 of the adjusting member 39.

A conducting stationary contact structure 61 comprising two stationary contact arms 63, each having a stationary contact 65 disposed at the free end thereof, is secured to the housing part 7 by means of a screw 69 (FIG. 6). A conducting terminal 70 is provided on the stationary contact structure 61. A screw 71 (FIG. 2) is provided to enable connection of the stationary contact structure 61 in an electric circuit. As can be seen in FIG. 6, the contacts 29 on the movable contact arm 27 cooperate with the stationary contact 65.

Another conducting stationary contact structure 77 (FIG. 5) comprising a generally rigid conductor having a conducting terminal part 79 at one end thereof and a resilient conducting member 81 supported thereon is secured to the housing part 7 by means of a screw 83 (FIGS. 2 and 6). Two contacts 85 (only one being seen in FIG. 6) are secured to the resilient conductor 81. A screw 87 (FIG. 2) is provided to enable connection of the stationary contact structure 77 in an electric circuit. The operating mechanism 13 also comprises a resetting bar 89 that is provided for resetting the actuated movable contact structure in a manner to be hereinafter more specifically set forth.

The actuating structure 15 comprises three pole units each of which pole units comprises an actuating bimetal 101. As can be seen in FIGS. 4 and 6, the adjacent actuating bimetals 101 are separated by the insulating barriers 10. Each of the actuating bimetals 101 is supported on a supporting member 103 (FIGS. 3 and 4) each of which supporting members 103 is connected to the housing part 5 by means of a screw 105. A calibrating screw 107 is provided in each pole unit to permit positioning of the initial position of the associated actuating bimetal 101 in order to permit calibration of the overload relay 3. A separate V-shaped pivot 113 (FIGS. 3 and 4) is molded integral with the housing part 5 at each of two opposite sides of the housing part 5. A generally U-shaped insulating common actuating bar 117, having a generally V-shaped notch 119 (FIG. 5) at the free end of each of the two opposite legs thereof, is pivotally supported on the pivots 113 on the housing part 5. As can be seen in FIG. 4, the bight part of the U-shaped actuating bar 117 can move freely below the insulating barriers

10. A separate button 121 (FIGS. 3 and 4), molded integral with the insulating actuating bar 117, is provided adjacent each of the actuating bimetals 101. A single projection 123 (FIGS. 4–6) is provided on the other side of the actuating bar 117 and is disposed to engage the compensating bimetal 51 (FIGS. 4 and 6). Two springs 127, each of which is disposed at one end in a depression 129 (FIG. 5) in the insulating actuating bar 117, and at the other end against stop means molded integral with the housing part 7, are provided to bias the actuating bar 117 against the pivots 113 and also against the actuating bimetals 101. The insulating barrier 133 fits between the insulating barriers 10 (FIG. 4) of the housing part 5 and suitable ledges formed on the housing part 7. An opening 135 (FIGS. 4 and 6) is provided in the barrier 133 to permit passage therethrough of the extension 123 of the insulating actuating bar 117. A compression spring 139 (FIGS. 3 and 6) is supported between the insulating barrier 133 and the adjusting member 39 to bias the adjusting member 39 and operating structure 47 in a counterclockwise (FIG. 6) direction about the pivot 43.

Each of the pole units of the relay 3 comprises a controlling circuit comprising a conducting terminal strip 141 (FIGS. 1–3) that is secured to the housing part 7 by means of screws 143, and a conducting terminal strip 145 that is secured to the housing part 5 by means of screws 147. Connecting means 151 is supported at the free end of each of the terminal strips 141, and connecting means 153 is supported at the free end of each of the conducting strips 145, both of which connecting means 151 and 153 are provided in order to enable connection of the relay 3 in an electric circuit.

In each pole unit, the terminal strips 141 and 145 are bridged by means of a removable heater member indicated generally at 161 in FIGS. 1 and 3, and shown in detail in FIGS. 7 and 8. As can be seen in FIG. 3, when the housing parts 5 and 7 are secured together, a separate opening 162 for each pole unit is formed in proximity to the terminal conductors 141 and 145, with the adjacent openings being separated by cooperating insulating barriers of the housing parts 5 and 7. The openings 162 provide access to enable the heater members 161 to extend into the internal compartment. As can be seen in FIGS. 7 and 8, each of the heater members 161 comprises a generally L-shaped and rigid conducting support wire 163 and an insulating spacing member 165 which members 163 and 165 are held together by means of a conducting rivet type eyelet 167. A generally cylindrical insulating tube 169 is disposed over the lower end of the wire 163 and held in position by means of engagement of the lower end thereof with another wire 171 that is brazed to the lower end of the support wire 163. The wire 171 is a helical type heater wire that is disposed over the insulating tube 169 and is brazed at the other end thereof to a conductor 173 that is supported on the insulating spacer 165. The conductor 173 is secured to the spacer 165 by means of a rivet-type conducting eyelet member 175. The insulating tube 169 is preferably a ceramic member to better withstand heat. The heater member comprises the rigid supporting wire 163 that also serves as part of the electric circuit through the heater member 161.

As is best seen in FIGS. 1 and 3, each of the replaceable heater members 161 is secured to a pair of the terminals 141 and 145 by means of screws 181 and 183, respectively. When the heater members 161 are in place, the controlling circuit through each pole unit of the relay 3 extends from a conductor that would be connected to the terminal conducting strip 141 by means of the connecting structure 151, through the terminal 141, the supporting conductor 163 (FIG. 7), the heating conductor 171, the conductor 173, the terminal strip 145, to a conductor that would be connected to the terminal strip 145 by means of the connecting means 153.

When the current through any of the pole units of the relay 3 reaches a certain value, the heat generated in the associated heater member 161 will cause the associated actuating bimetal member 101 to flex to the left (FIGS. 3 and 4) to thereby rotate the common actuating bar 117 clockwise (FIGS. 3 and 4) about the pivots 113. During this movement, the projection 123 (FIG. 4) on the common actuating bar 117 moves to move the compensating bimetal member 51 clockwise (FIG. 6) about the pivot 55. This clockwise (FIG. 6) movement of the bimetal 51 effects a clockwise movement of the operating structure 47 (FIG. 6) about the pivot 55 during which movement the projection 50 (FIGS. 5 and 6) on the operating structure 47 engages the contact arm 27 to move the contact arm 27 clockwise about the pivots 31, during which movement the spring 33 passes to an overcenter position to snap the movable contact arm 27 clockwise to a position wherein the contacts 29 engage the stationary contacts 85 (FIG. 6). As can be seen in FIG. 6, the contacts 29 are disposed on each of two opposite sides of the contact arm 27. Thereafter, if the relay is set for a hand-resetting operation, the resetting bar 89 can be manually depressed against the bias of a compression spring 193 (FIG. 4), which spring is disposed between a lower ledge 195 on the insulating housing part 7 and an upper ledge 197 on the reset bar 89, during which movement the lower end 201 (FIG. 5) of the reset bar 89 operates to flex the resilient conducting arm 81 upward (FIG. 6), which movement, because of the engagement of the contacts 85 on the resilient contact arm 81 with the contacts 29 on the movable contact arm 27, rotates the movable contact arm 27 in a counterclockwise direction about the pivots 31 whereupon the overcenter spring 33 moves over center to snap the contact arm 27 in a clockwise direction back to the position in which it is seen in FIG. 6. If the predetermined current persists in the pole unit to keep the actuating bimetal 101 flexed to an actuating position, upon release of the bar 89, the contact arm 27 will again be snapped to the actuated position into engagement with the contacts 85. If, however, the current in the actuating pole unit has subsided and the bimetal has cooled and unflexed, the parts will remain in the position seen in FIG. 6. The relay can be set for automatic resetting by moving an adjusting plate 202 downward, which plate 202 engages a ledge on the reset bar 89 to move the bar 89 downward to a lower position. The plate 202 and bar 89 are retained in the lower automatic position by means of a screw 205 (FIG. 2). Thereafter, after the operating structure has been operated to move the contacts 29 into engagement with the contacts 85, the position of the flexed contact arm 81 (FIGS. 5 and 6) is a position that holds the movable contact arm and the spring 33 from going over center so that the spring 33 will automatically move the contact arm 27 back into engagement with the stationary contact 75 when the actuating bimetal 101 has cooled and flexed back to the position wherein the projection 50 (FIGS. 5 and 6) on the operating structure 47 no longer biases the contact arm 27 into the actuated position.

When the parts of the relay are in the position seen in FIG. 6, and conductors are connected to the terminals 21 and 70 (FIGS. 2 and 6) by means of the screws 25 and 71, the relay is in a normally closed position. When the relay is in this normally closed position, a circuit extends from the terminal 21 (FIG. 6), through the conducting bracket 19, the movable contact arm 27, the movable contacts 29, the stationary contacts 65, the stationary contact arm 63, the stationary contact structure 61, to the terminal strip 67. When the relay is actuated to the actuated position previously described, in which position the movable contacts 29 engage the stationary contacts 85, the relay is moved to an open position, and, thereafter, the relay is reset either manually or automatically back to the closed position in the manner previously described.

The relay could also be wired to be a normally open relay by merely connecting the conducting lines to the termi-

nals **21** and **79** (FIG. 6) by means of the screws **25** and **87** (FIG. 2). When the relay is so wired, and the parts are in the position seen in FIG. 6, the controlled circuit is normally open, and, when the structure is actuated to move the contacts **29** into engagement with the contacts **85**, a circuit is closed from the terminal **21**, through the conducting bracket **19**, the movable contact arm **27**, the movable contacts **29**, the stationary contacts **85**, the resilient stationary contact arm **81**, to the terminal strip **79**. Thus, when the parts of the relay are in the position seen in FIG. 6, the controlled circuit is normally open and is actuated to the closed position from which it is reset back to the open position seen in FIG. 6.

The relay **3** is adjustable to be actuated by different values of current, within a certain range, by rotation of an adjusting cam knob **209** (FIG. 6) having a cam surface **211** at the inner end thereof. As can be seen in FIG. 3, the knob **209** has a shaft **213** at the center thereof which shaft is rotatably supported on the housing part **7**. A compression spring **215** is provided to bias the knob **209** to the right as seen in FIG. 3, to hold the knob in position on the housing part **7**. When the parts are assembled, the cam surface **211** of the adjusting knob **209** engages an extension **215** (FIG. 5) on the support member **39**. Upon rotation of the knob **209**, the cam surface **211** operates against the extension **215** (FIG. 6) to move the member **39** about the pivot **43**, against the bias of the spring **139**, to thereby move the pivot **55** and, therefore, the operating structure **47** and compensating bimetal **51** about the pivot **43** during which movement the bimetal arm **51** of the operating structure **47** is moved to vary the initial position of the bimetal arm **51** relative to the extension **123** on the actuating bar **117**. Thus, the adjustment provides that varying degrees of movement of the actuating bimetal **101** will move the spring **33** and movable contact arm **27** to the actuated position.

The adjustment provided by the adjusting knob **209** is an adjustment within a limited range. The relay can be adjusted within a larger range by providing different rated replaceable heater members **161** in the relay. As was previously described, each of the heater members **161** is readily removable from the assembled relay so that these members can be replaced by other heater members that are constructed with either higher or lower heat generating characteristics. Thus, the amount of heat generated in the controlling circuit can be varied by replacing the heater members **161**. The differently rated heater members can be provided to provide differently rated relays and the adjusting knob **209** can be operated to provide an additional plus or minus adjustment of any particular rated relay.

The relay is also provided with means to compensate for changes in ambient temperature. As can be seen in FIG. 6, the operating structure **13** is actuated by deflection of any of the actuating bimetals **101**, which deflection pivots the actuating bar **117** to operate against the compensating bimetal **51**. The high-expansion sides of the actuating bimetals **101** and also of the compensating bimetal **51** are the upper sides as viewed in FIG. 6. Thus, upon a rise in ambient temperature, if one of the actuating bimetals **101** is flexed downward (FIG. 6) the compensating bimetal member **51** will also be flexed downward to provide that there will be no effective variance of the operating characteristics of the relay. Thereafter, if the ambient temperature drops, both of the bimetals **101** and **51** will be flexed upward to provide that this variance of the ambient temperature will not substantially affect the operating characteristics of the relay.

The relay **3** is relatively easy to assemble. During the assembly operation, the operating mechanism **13** is mounted on the housing part **7**. The terminals **141** (FIG. 1) and the adjusting knob **209**, and the resetting bar **89** are all also mounted on the housing part **7**. With the cavity of the housing part **7** relatively open, the operating structure **13** can be easily mounted therein. The actuating bimetals **101** are mounted on the housing part **5** in the manner previously set forth. The terminals **145** are also suitably mounted on the housing part **5**. The barrier **133** is placed in position against the spring **139**. Thereafter, the springs **127** and the insulating actuating bar **117** are placed in position and the parts are bolted together by means of the bolts **8** (FIG. 2). Thereafter, the heater members **161** are dropped in place through the openings **162** (FIG. 3) and they are secured in place, to bridge the condutcors **141** and **145**, by means of the screws **181** and **183**.

From the foregoing description, it can be understood that there is provided by this invention an improved multi-pole thermally actuated and ambient compensated overload relay having readily replaceable heater members to permit adjustment of the rating of the relay and also adjusting means to provide for a limited plus and minus adjustment of the rated relay. The relay can be set for either an automatic resetting operation or a hand-resetting operation. The relay housing comprises a two-part housing each of which parts comprises an open cavity to enable easy assembly of the relay. The operating mechanism is supported on one of the housing parts and the actuating bimetal members are supported on the other housing part. Each pole unit comprises a pair of terminals, one of which terminals is supported on one part of the housing and the other of which terminals is supported on the other part of the housing, which pair of terminals is bridged by means of a replaceable plug-in heater member, so that the only electrical connection between the two parts of the assembled relay comprises the replaceable plug-in heater members. Thus, the relays can be assembled and, thereafter, the heater members are merely dropped into position and secured in place. As can be seen in FIGS. 3 and 6, the structure is so disposed that a relatively small space is taken up by the compactly constructed relay. The operating mechanism **13** (FIG. 6) is disposed near the bottom of the relay and is provided with an axis **55** for the operating structure **47**; an axis **31** for the movable contact arm **27** and an axis **43** for adjustment of the relay, all of which axes extend in a direction generally normal to the direction of the axis of the pivot **13** of the common insulating actuating member **117**. The relay is ambient temperature compensated by means of a compensating bimetal member **51** (FIG. 6) that is actuated to operate the movable contact arm **27**. The improved heater member comprises a generally rigid conducting wire **163** (FIG. 7) that serves as a conductor in the circuit of the heater member and also as a support means for supporting a generally tubular ceramic structure member **169**. The plug-in heater member is easy to assemble since the tube **169** and conductor **171** are easily placed over the support and conducting wire **163** and the conductor **171** is brazed to the end of the support wire **163** to hold the tube **169** in position. The spacer **165** and conductor **173** are held in position by means of eyelets or rivet members that also provide openings to enable the heater member to be connected in position on the relay **3**. The compact multi-pole overload relay is readily adaptable to provide for a normally open or normally closed controlled circuit by merely wiring the external terminals **21**, **79** and **70** for the operation desired.

While the invention has been disclosed in accordance with the provisions of the patent statutes, it is to be understood that various changes and modifications may be made in the structure thereof without departing from the spirit of the invention.

We claim as our invention:

1. An electrical control device comprising a stationary contact, a movable contact supported for pivotal movement about a first axis, means comprising an overcenter spring operable to pivotally move said movable contact between an open position out of engagement with said stationary contact and a closed position in engagement with

said stationary contact, a compensating bimetal disposed to operate said overcenter spring, a plurality of pole units, each pole unit comprising an actuating bimetal and means responsive to current flow to effect heating of said actuating bimetal, an actuating bar common to all of said pole units, means supporting said common actuating bar for pivotal movement about a second axis different from said first axis, and upon the occurrence of a predetermined amount of current in any of said pole units the associated current-flow responsive means operating to heat the associated actuating bimetal such that the associated actuating bimetal flexes to pivotally move said common actuating bar whereupon said common actuating bar operates said compensating bimetal to effect operation of said overcenter spring to pivotally move said movable contact from one of said positions to the other of said positions.

2. An electric control device comprising a first relatively stationary contact, a movable contact structure in an initial position engaging said first relatively stationary contact, a second relatively stationary contact, overcenter spring means, a compensating bimetal disposed to operate said overcenter spring means, a plurality of pole units, each pole unit comprising an actuating bimetal, a pivotally supported actuating bar common to all of said pole units, upon the occurrence of a predetermined amount of current in any of said pole units the associated actuating bimetal flexing to pivotally move the common actuating bar whereupon the common actuating bar operates said compensating bimetal to move said overcenter spring means to effect movement of said movable contact structure to an actuated position out of engagement with said first relatively stationary contact and in engagement with said second relatively stationary contact, and reset means engageable with said second relatively stationary contact and manually operable to move said second relatively stationary contact to operate said overcenter spring means to thereby effect movement of said movable contact structure back to said initial position.

3. A multi-pole relay comprising a stationary contact structure, a movable contact structure movable about a first axis, said movable contact structure moving from a first position to a second position out of engagement with said stationary contact structure and from said second position to said first position into engagement with said stationary contact structure, a compensating bimetal member, each of said pole units comprising an actuating bimetal member and current responsive means operable to effect actuation of said actuating bimetal member, an actuating member common to all of said poles and movable about a second axis that extends generally transverse to the direction of said first axis, upon the occurrence of an overload in any of said pole units the associated current responsive means operating to effect flexing of the associated actuating bimetal whereupon the associated actuating bimetal operates to pivotally move the common actuating member whereupon the common actuating member moves the compensating bimetal member to effect movement of the movable contact structure from one of said positions to the other of said positions.

4. A multi-pole relay comprising a stationary contact structure, a movable contact structure pivotally movable about a first axis between two positions into and out of engagement with said stationary contact structure, overcenter spring means operable upon movement of said movable contact structure to provide a snap action of said movable contact structure, an operating structure, means supporting said operating structure for pivotal movement about a second axis different from said first axis, said operating structure being pivotally movable to operatively pivotally move said movable contact structure, said operating structure comprising a compensating bimetal arm, a plurality of pole units, each pole unit comprising an actuating bimetal member, a common actuating bar common to all of said pole units, means supporting said common actuating bar for pivotal movement about a third axis different from said first and second axes, and upon the occurrence of an overload in any pole unit the bimetal in that pole unit reacting thermally to pivotally move the common actuating bar whereupon the common actuating member moves to actuate said bimetal member to pivotally move said operating structure to thereby pivotally move said movable contact structure from one to the other of said positions.

5. A multi-pole relay comprising a stationary contact structure, a movable contact structure pivotally movable about a first axis between two positions into and out of engagement with said stationary contact structure, an operating structure pivotally movable about a second axis generally parallel to said first axis to effect operative movement of said movable contact structure, said operating structure comprising a compensating bimetal arm, a plurality of pole units, each of said pole units comprising an actuating bimetal member, a common actuating member common to all of said pole units and supported for pivotal movement about a third axis which third axis extends generally transverse to the direction of said first and second axes, and upon the occurrence of an overload in any pole unit the associated actuating bimetal in that pole unit reacting thermally to move the common actuating member whereupon the common actuating member moves against the compensating bimetal arm to pivot said operating structure whereupon said operating structure operates to effect operative movement of said movable contact structure from one to the other of said positions.

6. A relay comprising an insulating housing, a relay mechanism supported within said housing and comprising a pair of contacts and a movable contact arm movable back and forth between two positions to open and close said contacts, an actuating bimetal when heated sufficiently flexing to effect movement of said movable contact arm from one to the other of said positions, a unitary heating structure comprising two terminals and means generating heat upon the flow of current between said terminals, said housing comprising a first part and a second part, means securing said first and second parts together, a first terminal means supported on said first part, a second terminal means supported on said second part, said heating structure being disposed in proximity to said actuating bimetal member with each of said two terminals being removably connected to a different one of said first and second terminal means.

7. A multi-pole relay comprising an insulating housing, a relay mechanism disposed within said housing and comprising a pair of contacts and a movable contact arm movable back and forth between two positions to open and close said contacts, each pole unit comprising an actuating bimetal, said housing comprising a first part and a second part, means securing said first and second parts together, each pole unit comprising a first terminal means supported on said first part and a second terminal means supported on said second part, each pole unit comprising a removable heater member electrically bridging the first and second terminal means of the associated pole unit and operable upon the occurrence of a predetermined amount of current flow through the associated pole unit to heat the associated actuating bimetal member to thereby effect movement of said contact arm from one to the other of said positions.

8. A relay comprising an insulating housing, said insulating housing comprising a first part and a second part, means securing said first and second parts together, an operating mechanism mounted on said first part and comprising a stationary contact and a movable contact cooperable with said stationary contact to open and close a controlled circuit, a first terminal mounted on said first part, a second terminal mounted on said second part, an actuating bimetal member mounted on said second part,

a heater structure electrically bridging said first and second terminals and removably supported in proximity to said actuating bimetal, and upon the occurrence of a predetermined amount of current through said heater structure said actuating bimetal being heated sufficiently to effect operation of said operating mechanism to thereby effect movement of said movable contact from one to the other of said positions.

9. A relay comprising an insulating housing, said insulating housing comprising two parts each of which parts forms a cavity, means securing said two parts together with said cavities being adjacent to form internal compartment means, an operating mechanism mounted on said first part in the associated cavity, said operating mechanism comprising a stationary contact and a movable contact movable between two positions to open and close said contacts, a first externally accessible terminal mounted on said first part, a second externally accessible terminal mounted on said second part, an actuating bimetal member mounted on said second part within the associated cavity, a removable heater member removably supported generally within said internal compartment means and electrically bridging said first and second terminals, said removable heater member being disposed to heat said actuating bimetal member, and upon the occurrence of a predetermined current through said first and second terminals said heater member heating said actuating bimetal member such that said actuating bimetal member flexes to effect operation of said operating mechanism to thereby effect movement of said movable contact from one to the other of said positions.

10. A relay comprising an insulating housing, said housing comprising a first part and a second part which parts cooperate to substantially enclose internal compartment means, means securing said first and second parts together, an operating mechanism mounted on said first part and disposed within said internal compartment means, said operating mechanism comprising a stationary contact and a movable contact movable between two positions into and out of engagement with said stationary contact, a first externally accessible terminal mounted on said first part, a second externally accessible terminal mounted on said second part, an actuating bimetal member mounted on said second part and disposed within said internal compartment means, said housing comprising opening means in proximity to said first and second terminals providing access to said internal compartment means, a removable heater structure externally connected to said first and second terminal means and extending through said opening to be disposed substantially within said internal compartment means in proximity to said actuating bimetal member, and upon the occurrence of a predetermined amount of current through said heater structure said heater structure generating sufficient heat to actuate said actuating bimetal member such that said actuating bimetal member flexes to operate said operating mechanism to thereby effect movement of said movable contact from one to the other of said positions.

11. A multi-pole relay comprising an insulating housing, said insulating housing comprising a first part and a second part, means securing said first and second parts together to form internal compartment means, an operating mechanism mounted on said first part and comprising a pair of contacts and a movable contact arm movable back and forth between two positions to open and close said contacts, an operating structure comprising a compensating bimetal arm supported to effect movement of said movable contact arm, a plurality of pole units, each of said pole units comprising an actuating bimetal member mounted on said second part, each of said pole units comprising a first externally accessible terminal means mounted on said first part and a secondary externally accessible terminal means mounted on said second part, said housing having opening means for each pole unit in proximity to the associated first and second externally accessible terminal means, each of said pole units comprising a removable heater member removably connected to said first and second terminal means and extending through the associated opening means into said internal compartment means in proximity to the associated actuating bimetal member, a common actuating bar pivotally supported in said internal compartment means and common to all of said pole units, and upon the occurrence of a predetermined amount of current in any of said pole units the associated heater member operating to heat the associated actuating bimetal member causing said actuating bimetal member to flex to thereby move said actuating bar to move said compensating bimetal member to effect actuation of said movable contact arm from one to the other of said positions.

12. A multi-pole relay comprising an insulating housing, said insulating housing comprising a first part and a second part, means connecting said first and second parts together to form internal compartment means, an operating mechanism disposed within said internal compartment means and supported on said first part, said operating mechanism comprising a stationary contact structure and a movable contact structure pivotal about a first axis between two positions into and out of engagement with said stationary contact structure, said relay comprising a plurality of pole units, each of said pole units comprising an externally accessible first terminal means supported on said first part and an externally accessible second terminal means supported on said second part, said housing comprising opening means for each pole unit in proximity to the associated first and second externally accessible terminal means, a removable heater structure for each pole unit removably connected to the associated first and second externally accessible terminal means and extending through the associated opening means into said internal compartment means, each pole unit comprising an actuating bimetal member supported on said second part and being disposed in said internal compartment means, a common actuating member common to all of said pole units and being pivotally supported within said internal compartment means, said common actuating member being pivotal about a second axis that extends generally transverse to the direction of said first axis, upon the occurrence of a predetermined amount of current through any of said pole units the associated removable heater structure operating to heat the associated actuating bimetal member causing said actuating bimetal member to flex to move said common actuating member to thereby effect movement of said movable contact structure from one to the other of said positions.

13. A multi-pole relay comprising an insulating housing, said insulating housing comprising a first part and a second part, means connecting said first and second parts together to form internal compartment means, an operating mechanism disposed within said internal compartment means and supported on said first part, said operating mechanism comprising a stationary contact structure and a movable contact structure pivotally movable about a first axis between two positions into and out of engagement with said stationary contact structure, a compensating bimetal arm movable to operate said movable contact structure, said relay comprising a plurality of pole units, each of said pole units comprising an externally accessible first terminal means supported on said first part and an externally accessible second terminal means supported on said second part, said housing comprising opening means for each pole unit in proximity to the associated first and second externally accessible terminal means, each pole unit comprising a removable heater structure removably connected to the associated first and second externally accessible terminal means and extending through the associated opening means into said internal compartment means, each pole unit comprising an actuating bimetal member supported on said second part and being disposed in said internal compartment means,

a common actuating member within said internal compartment means and being common to all of said pole units, said common actuating member being supported to pivotally move about a second axis that extends generally transverse to the direction of said first axis, upon the occurrence of a predetermined amount of current through any of said pole units the associated removable heater structure operating to heat the associated actuating bimetal member causing said actuating bimetal member to flex to pivotally move said common actuating member whereupon said common actuating member moves said compensating bimetal arm to thereby operate said movable contact structure from one to the other of said positions.

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