Dec. 10, 1957 R. C. INGWERSEN 2,816,192

ELECTRIC SWITCH INCORPORATING AN AUTOMATIC CIRCUIT BREAKER

Filed Sept. 5, 1956 3 Sheets-Sheet 1

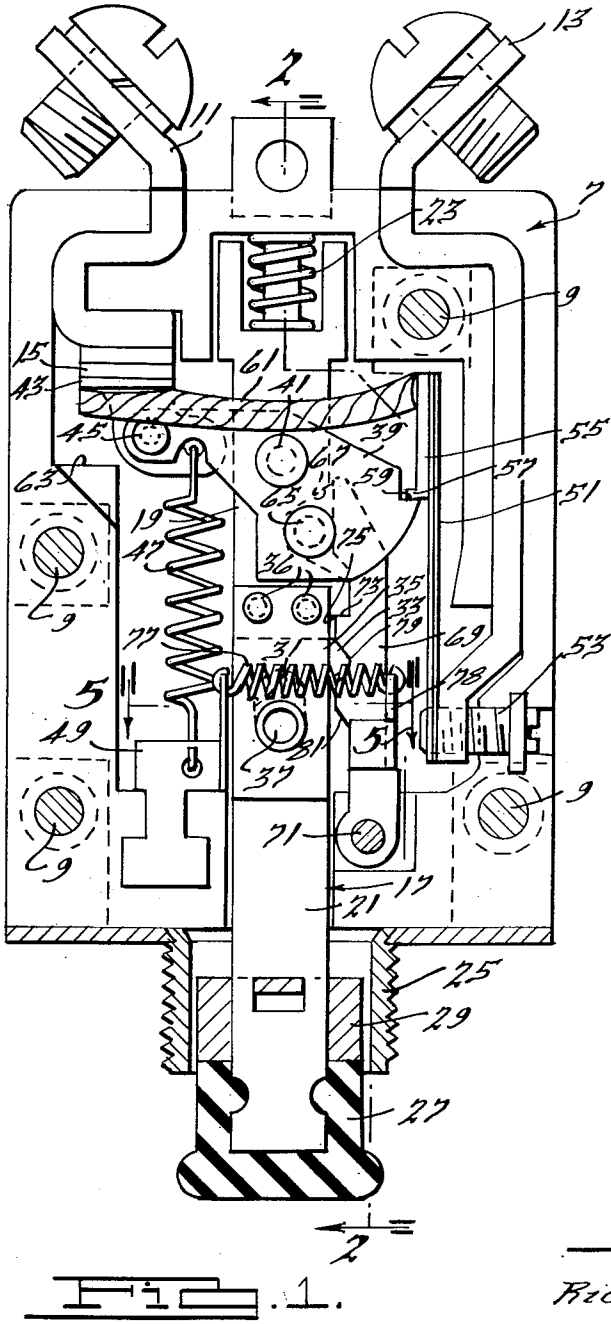


Fig. 1.

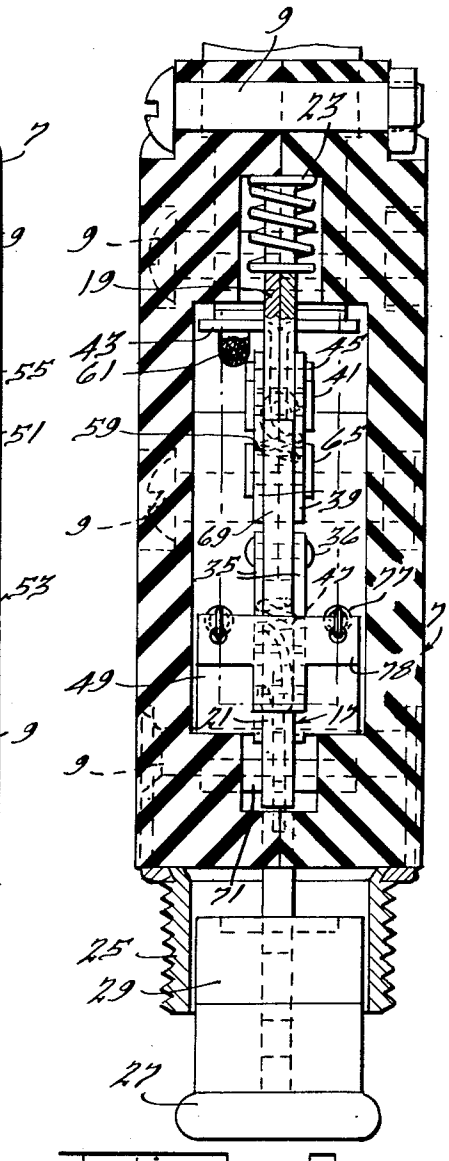


Fig. 2.

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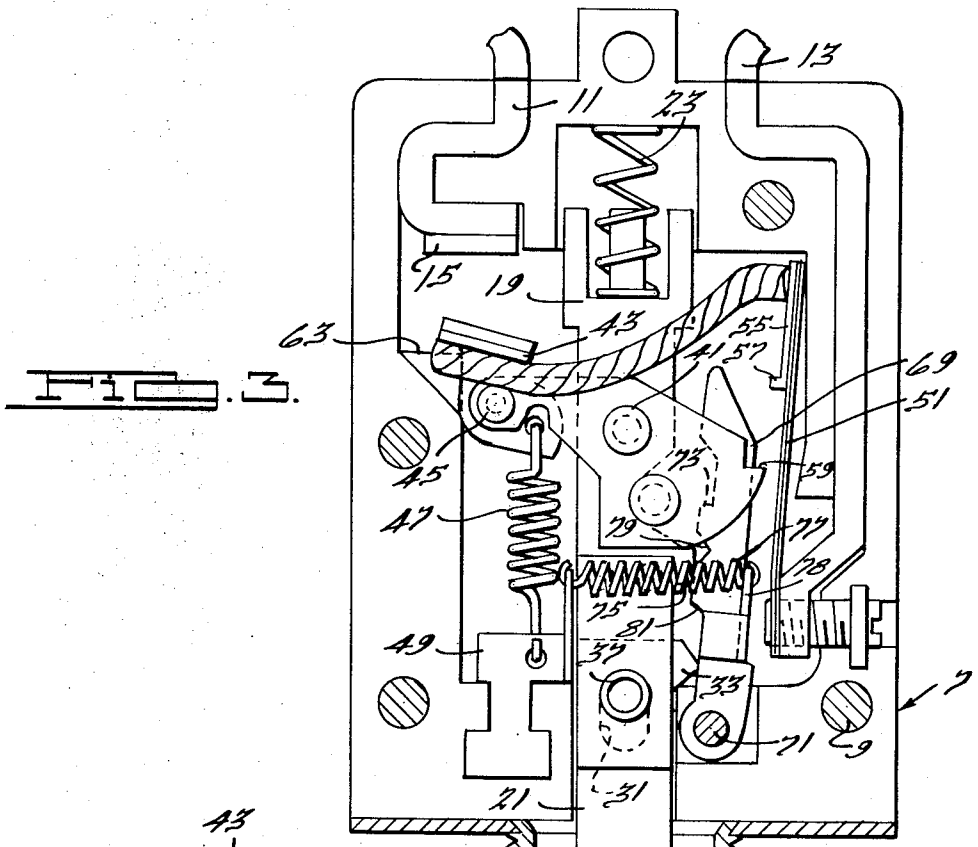


FIG. 3.

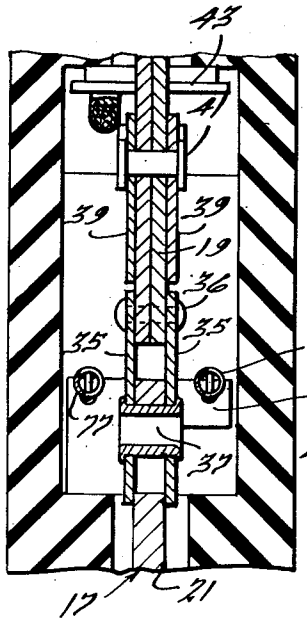


FIG. 8.

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Filed Sept. 5, 1956 3 Sheets-Sheet 3

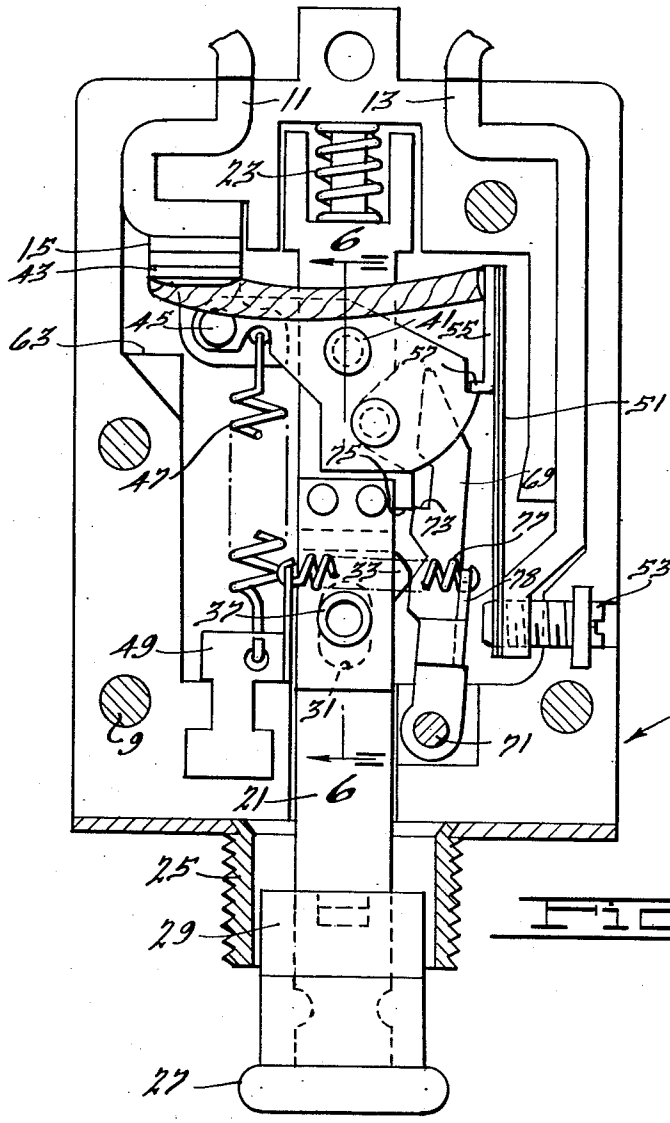


FIG. 4.

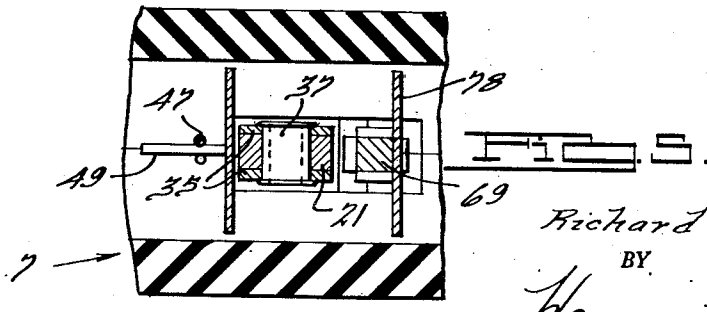


FIG. 5.

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2,816,192

ELECTRIC SWITCH INCORPORATING AN AUTOMATIC CIRCUIT BREAKER

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Application September 5, 1956, Serial No. 608,009

3 Claims. (Cl. 200—116)

This invention relates generally to electric switches, and more particularly to electric switches incorporating automatic current overload protection so that in the event of current overload in a circuit, the switch will automatically open to break the circuit.

It is an object of this invention to provide an electric switch of the aforementioned type which is automatically actuatable upon the occurrence of a predetermined overload current, and which is manually actuatable to an open or closed position.

It is a still further object of this invention to provide a switch of the aforementioned type which includes a thermostatic element which is actuatable upon the occurrence of a current overload to permit the switch contacts to move to open position.

It is a still further object of this invention to provide an electric switch of the aforementioned type in which the thermostatic element will not be actuated, moved, or deflected when the switch is manually actuated to open or close the contacts.

It is a still further object of this invention to provide an electric switch of the aforementioned type which may be easily calibrated, which is efficient and durable in operation, relatively inexpensive to manufacture, and compact in size.

These and other objects of this invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a longitudinal view, partially in section and partially in elevation, of an electric switch of this invention with the parts illustrated in contact-closed position;

Fig. 2 is a sectional view of the structure illustrated in Fig. 1, taken along the line 2—2 thereof;

Fig. 3 is a view, similar to Fig. 1, illustrating the position of the parts with the switch in its contact-open position, due to the occurrence of a current overload;

Fig. 4 is a view, similar to Figs. 1 and 3, illustrating the position of the parts of the switch as the switch is being manually opened and just prior to opening of the contacts;

Fig. 5 is an enlarged, sectional view of the structure illustrated in Fig. 1, taken along the line 5—5 thereof; and

Fig. 6 is an enlarged, sectional view of the structure illustrated in Fig. 4, taken along the line 6—6 thereof.

Referring now to the drawings, it will be seen that the electric switch includes a hollow casing 7, which may be formed of two plastic parts secured together by a suitable fastener, such as screws 9. A pair of terminal elements 11 and 13 are supported in the casing and project outwardly therefrom and are adapted to be connected in an electrical circuit. Terminal element 11, at its inner end, carries a stationary contact 15. Plunger means 17 is supported in the casing 7 for movement between an "in" position, illustrated in Fig. 1, and an "out" position, illustrated in Fig. 3. Plunger means 17 includes an inner plunger portion 19 and an outer plunger portion 21. The extreme inner end of the plunger portion 19 is forked and a coil spring 23 is sleeved over one of the forks and engages a wall of the casing so as to urge the plunger portion 19 outwardly. The outer end of the plunger portion 21 projects through a collar 25 connected in one wall of the casing 7 and carries a button 27 and a sleeve 29. The button 27 and sleeve 29 are preferably of different colors so that when the plunger means is in its "in" position, only the button 27 will be visible, while the sleeve 29 is confined within the collar 25. However, when the plunger means is in its "out" position, as illustrated in Fig. 3, both the button 27 and the sleeve 29 are visible, thus indicating to the user that the switch is in its open position.

The inner end of the plunger portion 21 is provided with an elongated slot 31 and with a laterally projecting cam 33. A pair of depending plates 35 is connected to the outer end of the plunger portion 19 on opposite sides thereof, by means of rivets 36, and a tubular rivet member 37 is carried by the plates 35 and extends through the elongated slot 31 in the plunger portion 21 so that a lost-motion connection is provided between the plunger portions 19 and 21, whereby when the plunger is in the "in" position, illustrated in Fig. 1, the outer plunger portion 21 can move relative to the inner portion 19 until the inner end of the slot 31 engages the tubular member 37, and thereafter the inner and outer portions will move together as a unit.

A pair of aligned, spaced-apart arms 39 are pivotally supported on the plunger inner portion 19 by a rivet 41. A contact 43 is pivotally supported between the arms 39, on one side of the plunger, by means of a rivet 45. A coil spring 47 has one end connected to the contact 43 and the opposite end connected to an anchor plate 49 supported in the casing adjacent the outer end thereof so that the spring 47 tends to rotate the contact 43 in a clockwise direction and swing the arm 39 in a counterclockwise direction around the rivet 41. An elongated bimetal element 51 is fixed to the lower end of the terminal element 13, which extends into the casing. An adjusting screw 53 is supported in the casing and threadably engages the terminal 13 and the bimetal element 51, and is adapted to adjust the position of the bimetal element and thus properly calibrate the switch. The opposite end of the bimetal element 51 carries a stainless steel plate 55 having a latching shoulder 57 thereon which engages complemental latching shoulders 59 on the opposite sides of the arms 39 from the contact 43. The bimetal element 51 is electrically connected with the contact 43 through a pigtail 61 so that upon the occurrence of a predetermined overload, the bimetal element will warp or move away from the arms 39 and move the latching shoulders 57 and 59 out of engagement with each other, thus releasing the arms so that the tension of the spring 47 will cause the contact 43 and arms 39 to pivot away from the terminal contact 15 and into engagement with a ledge 63 on the casing. A rivet 65 extends between and is carried by the arms 39 in a position to engage one end of a latch 69. The plunger portion 19 is recessed or cut out at 67 to permit the rivet 65 to move toward and away from the plunger when the arms 39 move. Upon movement of the arms 39, due to current overload, rivet 65 engages the inner end of the latch member 69 and swings it away from the plunger about a pivot pin 71, which pivotally supports the opposite end of the latch in the casing 7. The latch 69 is provided with a latching shoulder 73, which normally abuts the underside of a complemental latching shoulder 75, adjacent the outer end of the plunger means inner portion 19. The latch 69 is urged toward the plunger by means of coil springs 77, one end of each of which is connected to a

bracket 78 on the latch, and the opposite end of which is connected to the anchor plate 49 so that when the plunger is pushed to its "in" position, springs 77 will pull the latch shoulder 73 beneath the plunger latching shoulder 75 to releasably lock the plunger portion 19 in its "in" position against the urging action of the coil spring 23. However, when the latch 69 has been swung away from the plunger, due to the movement of the arms 39, the latch shoulder 73 will move out from beneath the plunger shoulder 75, thus freeing the entire plunger means for outward movement under the impetus of the spring 23. It should, at this time, be noted that the latch 69 has a cam-like recess 79 in which the outer plunger portion cam 33 is positioned when the plunger is in its "in" position. An additional cam surface 81 is provided on the latch 69, between the cam recess 79 and pivot 71, for reasons which will hereafter appear.

It will thus be appreciated that upon the occurrence of a predetermined current overload, the plunger means 17, the arms 39, and the arm contact means 43 will move outwardly so that the contacts 43 and 15 are separated, thus interrupting the flow of current through the switch. The parts of the switch, after such movement, will be in the position illustrated in Fig. 3. When it is desired to reset the switch and close the contacts, the button 27 on the outer end of the plunger means 17 is pushed inwardly and the plunger cam 33 will engage the latch cam 81 to swing the latch away from the plunger to permit the plunger to move inwardly to its "in" position wherein the spring 77 will swing the latch shoulder 73 underneath and into engagement with the plunger shoulder 75, so as to lock the plunger in its "in" position. The inward movement of the plunger means will cause the arms 39 to move upwardly therewith until the shoulders 59 on the arms 39 engage the thermostat element shoulder 57, and continued inward movement of the plunger will cause the arms to move the contact 43 again into engagement with terminal contact 15. This occurs if the thermostat element has cooled sufficiently so as to return to its normal position, and in such event, the contacts are again closed and the switch is in its contact-closed position.

If it is desired to manually open the switch or cause the contacts 43 and 15 to disengage, the button 27 on the end of the plunger means is grasped by a user and manually pulled outwardly. Because of the lost-motion connection between the plunger inner and outer portions 19 and 21, the outer portion will move outwardly relative to the inner portion so that the cam 33 on the outer portion will engage the walls of the cam recess 79 of the latch 69 to cam the latch 69 away from the plunger against the action of the springs 77 (Fig. 4). After the latch has been cammed sufficiently to move the latch shoulder 73 out from beneath the plunger inner portion shoulder 75, continued outward pulling of the plunger means will cause the inner and outer plunger portions 19 and 21 to move outwardly together as a unit, thus moving the arms 39 downwardly therewith, which will cause the arm contact means 43 to move outwardly or away from the terminal contact 15, thus opening the switch and interrupting current flow therethrough. When it is desired to again close the contacts or reset the switch, the plunger is pushed inwardly and the plunger will be locked in its "in" position with the contacts 43 and 15 in engagement, as previously described.

It will be appreciated that the manual actuation of the plunger will not cause any deflection or actuation of the thermostat or bimetal element 51, and as the switch may be manually actuated many thousands of times, the thermostat or bimetal element will not be fatigued or affected and the life of the switch will be materially increased over previously known constructions wherein each time the switch was mechanically actuated, the thermostat element likewise was actuated.

What is claimed is:

1. An electric switch having automatic current overload protection, including a hollow casing, stationary contact means supported in said casing and connectible in an electric circuit, plunger means in said casing movable between an "in" position and an "out" position, said plunger means including an inner portion and an outer portion and lost-motion means interconnecting said portions so that said outer portion can move inwardly and outwardly relative to said inner portion a predetermined distance and thereafter said portions will move together as a unit, contact means pivotally supported on said inner plunger portion and normally engageable with said stationary contact means when said plunger means is in said "in" position to complete a circuit through said switch, means urging said pivotal contact means out of engagement with said stationary contact means, a thermostat element movably supported in said casing and normally retaining said pivotal contact means in engagement with said stationary contact means when said plunger means is in said "in" position, said thermostat element being electrically connected with said pivotal contact means so that upon occurrence of a predetermined current overload said thermostat element will be actuated to release said pivotal contact means so that the latter will move out of engagement with said stationary contact means, a resilient member normally urging said plunger means to said "out" position, latch means movably supported in said casing and normally engaging said plunger means to retain the same in its "in" position, means on said pivotal contact means engageable with said latch means when said pivotal contact means moves away from said stationary contact means to move said latch means out of engagement with said plunger means, whereby said resilient member will move said plunger means to said "out" position, and complemental cam means on said latch means and on said plunger means outer portion engageable to move said latch means out of interfering relationship with said plunger means upon manual "in" and "out" movement of said plunger means in order to permit said electric switch to be manually opened or closed.

2. An electric switch having automatic current overload protection, including a hollow casing, stationary contact means supported in said casing and connectible in an electric circuit, plunger means in said casing movable between an "in" position and an "out" position, said plunger means including an inner portion and an outer portion and lost-motion means interconnecting said portions so that said outer portion can move inwardly and outwardly relative to said inner portion a predetermined distance and thereafter said portions will move together as a unit, contact means pivotally supported on said inner plunger portion and normally engageable with said stationary contact means when said plunger means is in said "in" position to complete a circuit through said switch, means urging said pivotal contact means out of engagement with said stationary contact means, a thermostat element movably supported in said casing and normally retaining said pivotal contact means in engagement with said stationary contact means when said plunger means is in said "in" position, said thermostat element being electrically connected with said pivotal contact means so that upon occurrence of a predetermined current overload said thermostat element will be actuated to release said pivotal contact means so that the latter will move out of engagement with said stationary contact means, a resilient member normally urging said plunger means to said "out" position, an elongated latch member pivotally supported adjacent one end in said casing and having the opposite end urged into engagement with said plunger means, said latch member and said plunger means inner portion having complemental latching surfaces engageable when said plunger means is in its "in" position so that said latch member will retain said plunger means in said "in" posi-

tion, complemental cam means on said latch member and on said plunger means outer portion engageable upon movement of said outer portion relative to said latch means and said inner plunger means portion to cam said latch member away from said plunger means to permit said plunger means to be manually moved between its "in" and "out" position, means on said pivotal contact means engageable with said latch member upon the occurrence of a predetermined current overload to move said latch member out of engagement with said plunger means, whereby said resilient member will move said plunger means to said "out" position.

3. An electric switch having automatic current overload protection, including a hollow casing, terminal means supported by said casing and connectible in an electric circuit, contact means connected with said terminal means, plunger means supported in said casing for movement between an "in" position an "out" position, said plunger including an inner portion and an outer portion and lost-motion means interconnecting said portions so that said outer portion can move inwardly and outwardly relative to said inner portion a predetermined distance and thereafter said portions will move together as a unit, arm means pivotally supported on said plunger means inner portion, contact means carried by said arm means on one side of said plunger means and normally engageable with said terminal contact means when said plunger means is in its "in" position, spring means connected with said arm contact means and with said casing urging said arm means and its contact means away from said terminal contact means, an elongated bimetal element supported adjacent one end thereof on said casing and disposed on the opposite side of said plunger means from said arm contact means, complementary latching surfaces adjacent the opposite end of said bimetal element and on said arm means normally in engagement to retain said arm contact means in engagement with said terminal contact means when said plunger is in its "in" position, a latch member pivotally supported adjacent one end thereof on

said casing and disposed adjacent to said plunger means, a resilient member normally urging said plunger means inner portion outwardly, complementary latching surfaces on said plunger means inner portion and on said latch member normally in engagement to retain said inner portion in its "in" position, means resiliently urging said latch member toward said plunger means so that said latch member and plunger means latching surfaces are normally in engagement, means on said arm means engageable with said latch member when said arm contact means moves out of engagement with said terminal contact means to swing said latch member away from said plunger means and disengage the latching surfaces of said latch member and plunger means inner portion to permit said resilient member to move said plunger means to its "out" position, said bimetal element being electrically connected with said arm contact means and being adapted upon occurrence of a predetermined overload to move out of engagement with said arm means and permit said arm means and its contact means to move out of engagement with said terminal contact means, and complementary cam surfaces on said plunger means outer portion and on said latch member engageable to move said latch member away from said plunger means upon movement of said outer plunger means portion relative to said inner plunger means portion so as to disengage the complemental latching surfaces on said latch member and said plunger means inner portion to permit said plunger means to be moved manually outwardly to said "out" position and so as to move said latch member out of interfering relation with said plunger means to permit said plunger means to be moved from its "out" to its "in" position.

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