Jan. 21, 1947. D. ELLIS ET AL 2,414,513

OVERLOAD RELAY

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Fig. 1.

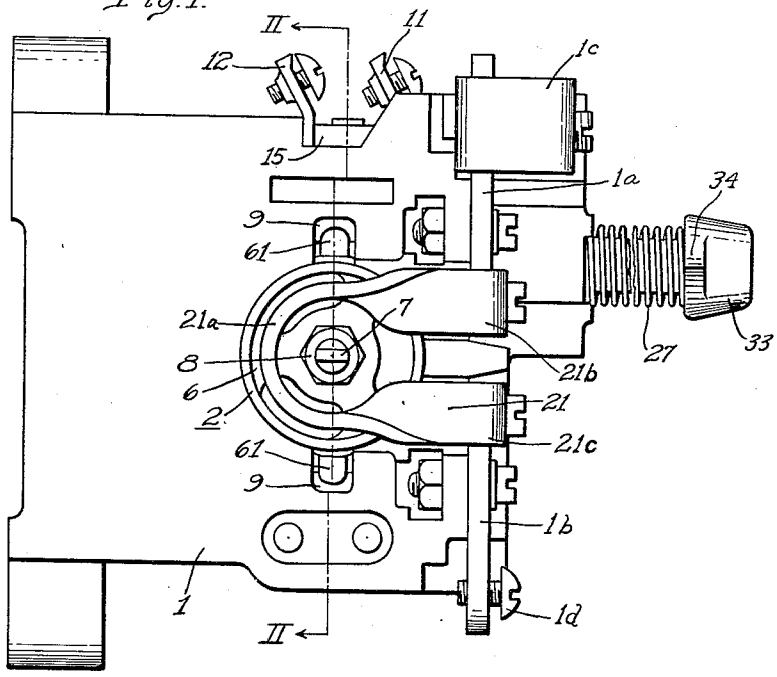
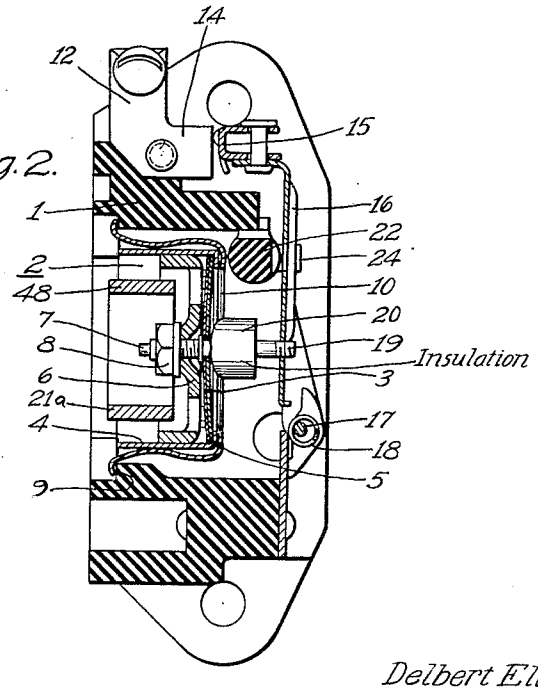


Fig. 2.



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Fig. 3.

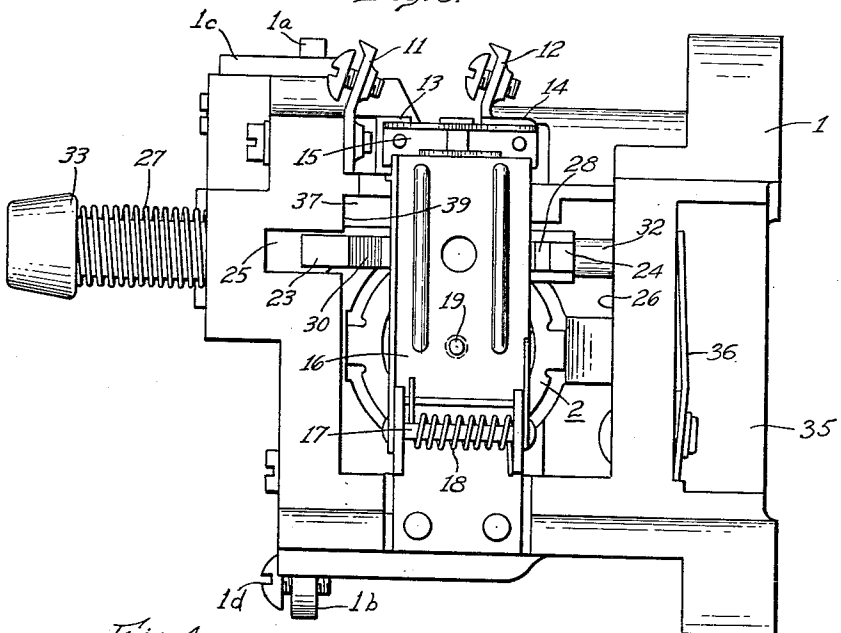
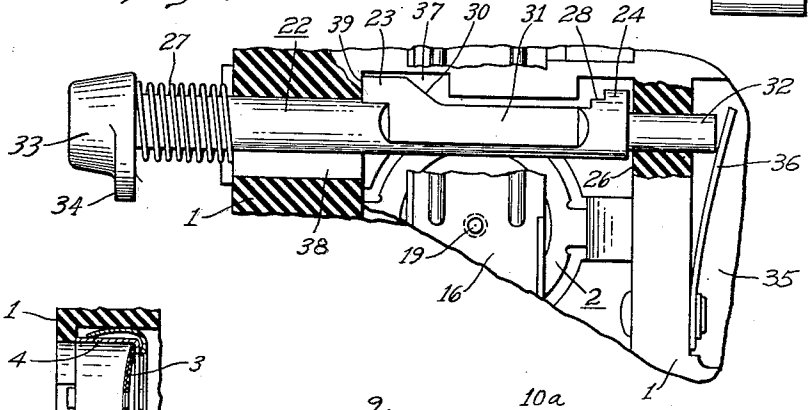


Fig. 4.



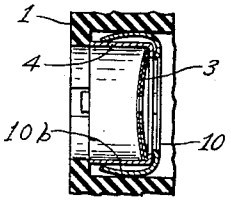


Fig. 6.

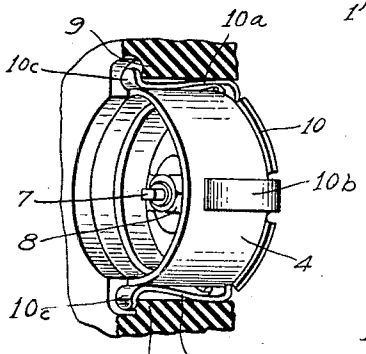


Fig. 5.

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Filed Nov. 6, 1943 3 Sheets-Sheet 3

Fig. 7.

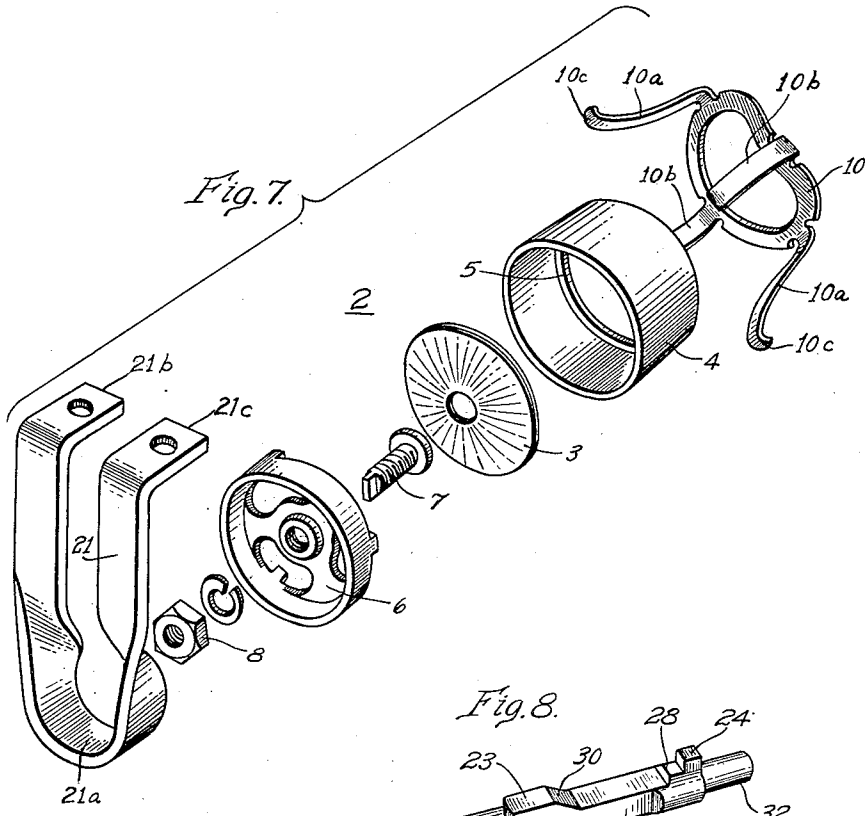
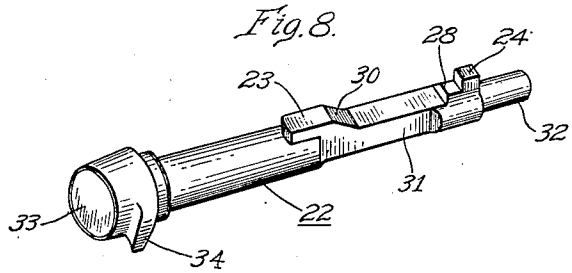


Fig. 8.



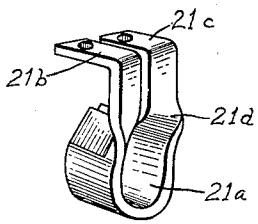


Fig. 9.

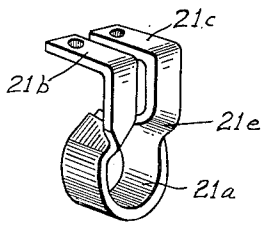


Fig. 10.

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Patented Jan. 21, 1947

2,414,513

UNITED STATES PATENT OFFICE

2,414,513

OVERLOAD RELAY

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Application November 6, 1943, Serial No. 509,259

13 Claims. (Cl. 200—122)

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Our invention relates to thermostatic overload relays for the protection of electric circuits and devices and involves improvements over the thermostatic relay disclosed in United States Patent No. 2,195,012 issued March 26, 1940, to Lawrence Pierce.

An object of the invention is to facilitate and improve the manufacture and assembly of a thermostatic relay of the type just mentioned so as to calibrate it with high accuracy for a definite value of thermo responsive operation. Another object, related to the foregoing, is to provide such a relay whose calibration remains constant during an increased period of operation and is insensitive to shocks or vibrations. Still another object along similar lines is to permit a correct operation and calibration of the thermostatic relay means irrespective of appreciable inaccuracies in dimensions of the pressed or molded insulating body usually forming the support and holder of the individual parts of such a device.

It is also an object of our invention to increase the resistance of the thermostatic means to high temperatures as occurring at extensive overloads or short circuits in the circuit or apparatus to be protected by the relay. In conjunction therewith, it is aimed at rendering the heating effect and rated calibration of the heating element of the thermostatic control means insensitive to such extensive load conditions so that the overload relay maintains its original calibration even after a repeated occurrence of heavy short-circuit currents.

In still another aspect, our invention is intended to improve and facilitate the manipulation of such an overload relay required for the selective adjustment of the thermostatic device for automatic or manual resetting operation. A more specific object is to provide a thermostatic device of the type here concerned with a single manual operated control member which permits a manual resetting of the relay after the occurrence of an overload-responsive operation as well as an adjustment of the device for automatic resetting of the thermostatic control means, depending merely on the selected positioning of the same control member. It is further aimed at providing a relay with a manual control member, functioning as just-mentioned, which is prevented from separating itself from the main relay structure if the thermostatic contactor serving to lock the manual member in its proper seat, is tampered with and releases its hold on the manual member, while on the other hand an intentional removal of the member from its seat, as well as a reinsertion, is

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readily afforded without requiring the use of tools.

The means provided by our invention for achieving these objects will be understood from the embodiment shown in the drawings in which all figures relate to the same thermostatic overload relay.

Figure 1 is a side view of the complete overload relay.

Fig. 2 is a cross section in a plane extending along the line II—II indicated in Fig. 1.

Fig. 3 is another view taken from the side opposite the view point of Fig. 1, the three Figures 1, 2 and 3 showing a manual push-button member in the same position.

Fig. 4 is a partial and partly sectional view showing the relay in the same position as represented in Fig. 3 but with the push-button member moved towards the right-hand side and turned 90 degrees.

Fig. 5 shows a perspective and part-sectional view of some of the thermoresponsive elements of the relay.

Fig. 6 illustrates some of these elements by an axial cross section perpendicular to the plane of illustration of Fig. 5.

Fig. 7 is an exploded perspective view of the thermoresponsive elements including the appertaining overload-responsive heater.

Fig. 8 shows in perspective the manual push-button type control member, while

Figs. 9 and 10 are perspective views of two modifications of the heater, both different from the one shown in Fig. 7.

The relay illustrated in these figures serves to protect an electric circuit or apparatus from damage due to overload by actuating an electric switch in response to the heat developed by an overload-responsive heater. The switch, in turn, controls a separable cutout contactor or the like device for disconnecting the circuit or apparatus to be protected. Only the relay unit proper is concerned by this invention while the separate circuits or apparatus controlled and protected thereby may be of any customary type and hence are not illustrated in the drawings.

Referring to the figures in general, and in special instances to those mentioned hereinafter in parentheses, the numeral 1 denotes a support or base consisting of molded insulating material. Firmly attached to base 1 are two contact bars 1*a* and 1*b* which are provided with terminals 1*c* and 1*d* respectively. The thermostatic assembly for actuating the relay contacts is denoted as a whole by numeral 2. This assembly is placed in an opening traversing the base 1 (Fig. 2) and in-

cludes a disc element 3 of thermostatic bimetal, a retaining cylinder 4 having a shoulder 5, and a calibrating spider 6. An adjusting screw 7 is in threaded engagement with the spider 6 and held in place by a lock nut 8 (Figs. 2 and 7). The screw extends with its head portion through a central opening of the thermostatic disc element 3. The spider 6 is secured in the cylinder 4 by press fit or other means and holds the outer edge of disc 3 against shoulder 5.

The cylinder 4 is secured in base 1 with the aid of an annular member 10 of spring steel which has two leaf-spring legs 10*a* and two further legs 10*b* uniformly spaced around the periphery of the member. The legs 10*a* have each a radially extending lug portion 10*c* which in assembled condition of the relay engages a corresponding shoulder 9 formed by the base 1 (Figs. 2, 5 and 7). The end portions of legs 10*a* adjacent lugs 10*c* are curved relatively to the axis of the concentric arrangement so that they engage the cylinder 4 resiliently when assembled, while the base portion of each leg 10*a* presses against the wall of the surrounding opening of base 1 (Figs. 5 and 7). The legs 10*b* are curved so that their middle portions press against the bore of base 1 while their ends abut against the cylinder 4 (Figs. 6 and 7). The annular base portion of member 10 is preferably so bent that it exerts spring pressure against the bottom and flange 5 of cylinder 4.

Due to the just-mentioned characteristics of the spring member 10, the cylinder 4 and the elements housed therein are correctly centered in the opening of base 1 with allowance for inaccuracies in the dimensions of the opening. Because of the pressure of legs 10*a* and 10*b* on the cylinder and the wall of the opening, the centering is not affected by shocks. The significance of this function will be understood from a consideration of other details of the relay and hence will be referred to in a later place.

The switch to be actuated by the above-described thermostatic assembly is also mounted on the base 1. It contains two terminals 11 and 12 connected with respective stationary contacts 13 and 14 which cooperate with a movable contact bridge 15 (Figs. 2 and 3). This bridge is attached to a rigid lever 16 fulcrumed about a bolt 17 and biased by a spring 18 which is seated on the bolt 17 and tends to keep lever 16 and bridge 15 in contact-closing position. A threaded stud 19 is rigidly secured to lever 16 at or near its mid-portion, and a threaded button 20 of insulating material is mounted on the stud 19 (Fig. 2). The stud 19 is threaded and engages a threaded metal insert (not shown) of the button 20. The engaging threads, after proper adjustment, are soldered in place and then gauged again to ascertain an accurate setting of the thermostatic operation. It will be noted that the switch 15 may be caused to interrupt the interconnection of the terminals 13 and 14 when the button 20 is actuated toward the right.

A heater element 21 is secured to the base 1 so that its loop portion 21*a* lies partly or fully within the cylinder 4 in proximity to the bimetallic disc 3 (Figs. 1, 2 and 7). The heater is formed of a strip of resistance material and has two lugs 21*b* and 21*c* removably attached to respective bars 1*a* and 1*b*. When using the relay, the terminals 1*c* and 1*d* are connected in the circuit to be protected. Hence, the load current flows through the heater 21 so that the heat produced by the heater and transmitted to the thermoresponsive disc 3 is a measure of the current intensity. The heater is exchangeable for others of different rating to make the relay applicable for different purposes and rated load currents.

It is an essential feature of the heater that its loop portion 21*a* (Figs. 2 and 7), i. e. the portion effective for the transfer of heat to the thermoresponsive assembly proper, is shaped so that its shortest current path lies in a substantially cylindric surface and hence extends over an appreciable distance axially along the cylinder 4, as is best apparent from Fig. 2. Some remarks appear proper to explain the significance of this feature.

In the known overload relay of this general type, the loop portion of the heater is formed by an annular flat body which extends substantially in a radial plane relative to the axis of the thermoresponsive assembly. The shortest current path in such a flat body extends along its thin inner edge. As a result, there is a tendency for the current lines to crowd near the inner edge. At heavy overloads, this may lead to local overheating and burning or melting of the heater material near its inner edge. Consequently, repeated overloads and short-circuits will affect the heater and its heating effect on the assembly. This, in turn, changes the calibration of the device and reduces its lifetime or its period of undisturbed operation.

In contrast thereto, the current flowing through a heater according to the invention has no tendency to overstress the thin edge of the material since the shortest current path is not determined by a thin edge but extends axially over a relatively elongated cylinder surface. Consequently, heavy overloads are less apt to damage the heater or to affect the accurate calibration of the thermoresponsive device. This, together with the above-described improved centering of the cylindric thermostat elements, affords an extremely high stability of calibration so that the relay, once adjusted, maintains its desired operating characteristic after an increased number and intensity of overload interruptions.

The modifications of the heater shown in Figs. 9 and 10 differ from the heater 21 of Figs. 1 and 7 only as regards the shape of the transitory sections denoted by 21*d* and 21*e* respectively, while their loop portion 21*a* is also shaped so as to form substantially a cylinder coaxial or parallel to that of the thermostatic assembly. Hence, the modifications according to Figs. 9 and 10 are also in accordance with the last-mentioned aspect of the invention, although we consider it preferable to employ a heater as represented in Figs. 1 and 7.

As mentioned, part of the heat developed by the heater is transmitted to the bimetallic disc 3 (Figs. 2 and 7). This disc is of the general type disclosed in the Patent No. 1,448,240 to John A. Spencer. That is, the disc has such characteristics that when its temperature is below a predetermined value, the shape of the disc is substantially as shown in Figs. 2 and 7, but when heated to a higher temperature of predetermined value the disc will assume a reverse curve position with a snap action thereby moving button 20 to the right, which movement is transmitted through stud 19 and lever 16. The lever 16 is thus deflected in a clockwise direction (Fig. 2) about the pivot at 17. The connection established between contacts 13 and 14 is thus interrupted by the movement of the contact 15 toward the right.

The use of the relay is such that the operation of contact 15 in the manner explained opens the

circuit for the electric heater element 21 whereby heat is no longer transmitted to the disc 3. As soon as disc 3 is cooled to a predetermined lower temperature, it snaps back into the position shown. The result is that the connection between contacts 13 and 14 is reestablished. The time interval between the opening of the circuit and the reestablishment of the circuit connection can be adjusted to some extent by the proper positioning relative to each other of the screw 7, and the disc 3. Normally, button 20 is adjusted on stud 19 so as to contact screw 7 after the contact 15 engages contacts 13 and 14. Ordinarily the thermostat is adjusted at the factory and operates automatically to reset itself within a fixed time interval, but when the relay is not arranged for automatic resetting, then the time of manual resetting of the relay is dependent on the will of the attendant. The resetting time of disc 3 is substantially constant for a constant ambient temperature but varies somewhat with the difference in temperature between the ambient temperature and the tripping temperature of disc 3. The time constant of the disc 3, even for a constant ambient temperature, may be varied somewhat by subjecting the disc 3 to an initial stress by a proper positioning of screw 7 on the spider 6.

Since the motion of the disc 3 is relatively slight and because of the particular curvature of the disc, a radial displacement of the disc along the button 20 (Fig. 2) and out of its correctly centered position is apt to affect the setting or time adjustment of the relay to a considerable extent. Hence, it will now be more fully understood that the elastic centering and automatic recentering of the disc 3 by means of the above-described holding member 10 and its legs 10*a* and 10*b* contribute essentially to achieving the desired accuracy and stability of adjustment and operation.

From the description hereinbefore given, it is apparent that the relay, when operating automatically, will open a circuit and then close the same circuit after a predetermined time interval. If the relay is to protect a motor, it is evident that the relay may be so connected that an overload will cause the relay to operate to disconnect the motor from its source of energy but since it resets itself the motor circuit will be reestablished after a short time interval. If the overload is still present, the relay will function again and again till the circuit breakers operate. Such operation may be undesirable. The preferred operation may be such that the relay produces an effective restarting only if manually reset.

To permit a manual reset, the relay is provided with a plunger 22 which is disposed in base 1 so as to be capable of axial displacement and also of revolution when in a certain axial position. The plunger has two radially projecting lugs 23 and 24 respectively. Lug 23 matches an axially extending recess 25 of base 1. Lug 24 is adjacent a surface portion 26 of base 1 so as to abut against it when the plunger is moved in the direction toward this surface portion. A spring 27 serves to bias the plunger in the opposite direction. Lug 24 has a ledge portion 28 of smaller height, and lug 23 forms an incline 30 (Figs. 3 and 4). The plunger 22 has a squared or flattened surface portion at 31 to cooperate with the contact lever 16 (Figs. 3, 4 and 8); it has further a cylindrical end portion 32 and carries a push button 33 at its other end. A pointer 34 formed on the push button serves to indicate to the operator the position of revolution and may cooperate with corresponding indicia (not shown) on the base 1 of the relay.

Referring now to the axial and revolutional position of the plunger shown in Figs. 2 and 3, the plunger is so biased by its spring 27 that the ledge 28 abuts against the right-hand edge of the contact lever 16, thus blocking the plunger from moving farther towards the left of Fig. 3. When the thermostatic disc operates, the lever 16 is moved clockwise (see Fig. 2) and in consequence, the switch 15 opens the connection between terminals 13 and 14, and the plunger 22 is permitted to be moved by spring 27 toward the left (see Fig. 3). Plunger 22 is thus drawn under the lever 16 so that the lug 24 engages the right-hand edge of the lever. When the thermostatic disc snaps back to its original, shown position, the connection at contacts 13 and 14 thus remains open, since the lever 16 remains on the ledge 28. If the connection is to be reestablished, the plunger must be moved inwardly—toward the right in Fig. 3 so that the lever 16 snaps off the ledge 28 to the position shown in Fig. 3.

When the plunger is manually actuated toward the right (Fig. 3), the incline 30 may act like a wedge under the lever 16 to lift it in order to thus actuate switch 15. The plunger thus acts as a stop switch as well as a means for manually resetting the relay.

Referring to Fig. 3, it will be seen that in the illustrated angular position of the push button wherein the plunger permits performing the above-mentioned functions, its lug 23 engages the recess 25 of base 1 so as to prevent revolutions of the plunger. If in this angular position of the plunger the contact lever 16 is lifted from the stationary contacts by an extraneous force, for instance for testing purposes, and to such an extent that the lever 16 is beyond the reach of lug 24, the lug 23, forced toward the left by spring 27, will abut against the bottom of recess 25 and thus prevent the plunger from accidentally dropping or shooting out of the base 1, as it may occur in the known devices of this type. Nevertheless, the plunger can be easily removed intentionally without the use of a screw driver or other tools by virtue of the design described in a later place.

The base 1 has a cavity 35 at its bottom side and contains in this cavity a relatively strong leaf spring 36 which rests against the end portion 32 of the plunger 22 or against the bore in base 1 containing the end portion 32 (Figs. 3 and 4). When pushing the button 33, as shown in Fig. 3, toward the base 1 in opposition to both springs 27 and 41, the plunger can be moved only until lug 24 abuts against the surface 26 of base 1. In the axial position then reached by the plunger, its lug 23 has moved out of the recess 25 so that now the push button and plunger can be turned 90 degrees in either direction of revolution. If the button is turned so that the lugs 23 and 24 in Fig. 3 move upwardly, the position shown in Fig. 4 is reached. In this position, the lug 23 and incline 30 enter a cavity 37 of base 1 so that the lug 23 abuts against a radial surface 39 of base 1 which blocks the plunger from moving towards the left. As a result, when now the button 33 is released, the plunger retains the position according to Fig. 4 with both springs 27 and 36 stressed in opposition to their biasing force. Since in this position both lugs 23 and 24 are turned out of the way of the contact lever 16, the lever is capable of effecting

free contact opening and closing motions. That is, the relay is now set for the automatic resetting operation described previously. Turning the button and plunger back by 90 degrees will place the lug 23 in registry with recess 25 so that spring 27 shifts the plunger back into the position of Fig. 3 for manual reset. Hence the device permits an easy adjustment of the relay for either type of reset.

When, starting from the position of Fig. 3, the button 33 is pushed all the way down and then turned so that lugs 23 and 24 move 90 degrees downwardly, i. e. into an angular position diametrically opposite to that shown in Fig. 4, the lug 23 will register with a slot 38 in base 1 which permits pulling the plunger toward the left entirely out of the base. Thus, if the relay is to be used only for purposes which do not require a manual reset, the plunger can readily be removed from the relay.

Being aware of the fact that those skilled in the art may readily modify the elements of our invention without departure from its objects and essential features, we wish this specification to be understood as illustrative and not in a limiting sense.

We claim as our invention:

1. In an automatic switch, the combination of a base structure, a contact member movable between two contact positions, means for actuating said member in response to a control condition, an axially displaceable resetting element revolvable between two angular positions and having two lateral projections spaced axially from each other, one of said projections being disposed relative to said member for blocking it in one of said contact positions when said element is in one of said angular positions, spring means for axially biasing said element so as to displace said one projection into blocking position when said member moves into said one contact position in order to require an axial displacement of said element in opposition to said spring means for resetting said member, and an abutment formed by said base structure for engaging said other projection when said element is in said other angular position to maintain said one projection out of blocking engagement with said member for automatic reset of the switch.

2. In an automatic switch, the combination of a base structure, a contact member movable between two contact positions, means for actuating said member in response to a control condition, an elongated resetting element axially displaceable in said base and revolvable between three angular positions, said element having two lateral projections spaced axially from each other, one of said projections being disposed relative to said member for blocking it in one of said contact positions when said element is in one of said angular positions, spring means for axially biasing said element so as to displace said one projection into blocking position when said member moves into said one contact position in order to require an axial displacement of said element in opposition to said spring means for resetting said member, an abutment formed by said base structure for engaging said other projection when said element is in another angular position to maintain said one projection out of blocking engagement with said member for automatic reset of the switch, said base structure having a recess for the passage of said projections when said element is in the third angular position to permit removing said element from said base.

3. In an automatic switch, the construction of a base structure, a plunger mounted in said base structure so as to be axially displaceable and revolvable relative thereto and having a lateral projection, a contact member movable between two contact positions radially towards and away from said plunger, spring means for biasing said member toward said plunger, thermostatic means for moving said member away from said plunger, spring means for axially biasing said plunger so as to move said projection into the path of said member upon its actuation by said thermostatic means and when said plunger is in a given angular position, and blocking means formed by said base structure and plunger for holding said plunger and projection in an ineffective position when said plunger is turned into another angular position.

4. In an automatic switch, the combination of a base structure, a plunger mounted in said base structure so as to be axially displaceable and revolvable relative thereto, a contact member movable between two contact positions radially towards and away from said plunger, spring means for biasing said member towards said plunger, thermostatic means for moving said member away from said plunger, said plunger having two lateral projections arranged at opposite sides respectively of said member when said plunger is turned into a given angular position, spring means for moving one of said projections into the path of said member upon its actuation by said thermostatic means so that an axial displacement of said plunger in opposition to said latter spring means is necessary for resetting said member, and an abutment formed by said base structure and located to engage said other projection when said plunger is turned into another angular position for maintaining said one projection out of the path of said member for automatic reset.

5. In an automatic switch, the combination of a base structure, a push-button plunger axially displaceable and revolvable in said structure and having two lateral projections axially spaced from each other, a spring biased contact lever movable radially towards and away from said plunger and arranged to lie between said projections in a given angular and axial position of said plunger, thermostatic means for moving said lever in opposition to its spring bias away from said plunger, spring means for axially biasing said plunger so as to move one of said projections into the path of said lever upon its actuation by said thermostatic means, said structure having means slidably engaging said other projection over a limited axial distance so as to maintain said plunger in said given angular position while permitting said plunger to be turned into another angular position when pushed against its spring bias for more than said axial distance, and an abutment formed by said structure for engaging said other projection when said plunger is pushed and turned into said other angular position in order to maintain one projection out of the path of said member for automatic reset.

6. In an automatic switch, the combination of a molded insulating base structure, a push-button plunger axially displaceable and revolvable in said structure and having two lateral projections axially spaced from each other, a spring biased contact lever urged toward said plunger, thermostatic means for moving said lever in opposition to its spring bias away from said plunger, spring means for axially biasing said plunger so as to

move one of said projections into the path of said lever upon its actuation by said thermostatic means, said structure having a recess extending over a limited axial distance for slidably receiving said other projection in order to maintain said plunger in said given angular position while permitting said plunger to be turned into another angular position when pushed against its spring bias for more than said axial distance, another recess formed by said structure and displaced angularly and axially relative to said first recess for receiving said other projection when said plunger is pushed beyond said distance and turned into another angular position in order to maintain one projection out of the path of said member for automatic reset, and a slot formed by said structure and displaced angularly relative to both said recesses so as to form a passage for said two projections in a third angular position of said plunger in order to permit the removal of said plunger from said structure.

7. In an automatic switch, the combination of a base structure, a plunger axially displaceable and revolvable in said structure and having a push button at one end and two axially spaced projections at its peripheral surface, a spring biased contact member movable radially towards and away from said plunger and arranged to lie between said projections in a given angular and axial position of said plunger, thermostatic means for moving said member in opposition to its bias away from said plunger, a spring disposed between said push button and said structure for biasing said button away from said structure so as to move one of said projections into the path of said member upon its actuation by said thermostatic means, said structure having means slidably engaging said other projection over a limited axial distance so as to maintain said plunger in said given angular position while permitting said plunger to be turned into another angular position when pushed against its spring bias for more than said axial distance, a spring stronger than said push-button spring and mounted on said structure to engage the end of said plunger opposite to said button for exerting force in addition to that of said push-button spring when said plunger is moved beyond said distance, and an abutment formed by said structure for engaging said other projection when said plunger is pushed and turned into said other angular position in order to maintain one projection out of the path of said member for automatic reset.

8. In an automatic switch, the combination of a base structure, a spring biased contact member movably mounted on said structure, a thermostatic assembly for actuating said member against its bias including a snap action disc and a retaining cylinder surrounding said disc, and a heater mounted on said structure and having a loop portion of less than a complete single turn and substantially cylindrical shape, said loop portion extending into said cylinder and being formed so as to have a circular end facing said disc and peripheral long-edge surfaces substantially concentric to said cylinder.

9. In an automatic switch, the combination of a base structure having an opening and an annular ledge around said opening, a spring biased contact member movably mounted on said structure in front of said opening, a thermostatic assembly disposed in said opening and having a thermoresponsive disc for actuating said member against its bias, a retaining cylinder surrounding said disc, and a holding member engaging said

cylinder and having leaf-spring extensions disposed between said cylinder and the surrounding wall of said opening and provided with lugs for engaging said ledge and other leaf-spring extensions so curved as to resiliently engage said cylinder and said wall for centering said cylinder in said opening.

10. In an automatic switch, the combination of a base structure having an opening and an annular ledge around said opening, a spring biased contact member movably mounted on said structure in front of said opening, a thermostatic assembly disposed in said opening and having a thermoresponsive disc for actuating said member against its bias, a retaining cylinder surrounding said disc, and a holder having an annular portion engaging a bottom edge of said cylinder and leaf-spring members extending from said portion and disposed between the periphery of said cylinder and the surrounding wall of said opening, some of said leaf-spring members having lugs for engaging said ledge and being curved so as to touch said cylinder near said lugs and said wall near said annular portion, and others of said members being shorter than those first-mentioned and so curved as to engage said cylinder at their ends and said wall at a place between said ends and said annular portion.

11. In an automatic switch, the combination of a base structure having an opening and an annular ledge around said opening, a spring biased contact member movably mounted on said structure in front of said opening, a thermostatic assembly disposed in said opening and having a thermoresponsive disc for actuating said member against its bias, a retaining cylinder surrounding said disc, and a holder having an annular portion engaging a bottom edge of said cylinder and four leaf-spring members spaced equally from one another and extending from said annular portion between the peripheral surface of said cylinder and the surrounding wall of said opening, two opposite of said members being longer than the others and forming radially projecting lugs for engaging said ledge, said two shorter members being curved so as to engage said cylinder and said wall for centering said cylinder in said opening.

12. In an automatic switch, the combination of a base structure having an opening and an annular ledge around said opening, a spring biased contact member movably mounted on said structure in front of said opening, a thermostatic assembly disposed in said opening and having a thermoresponsive disc for actuating said member against its bias, a retaining cylinder surrounding said disc, and a holder having an annular portion engaging a bottom edge of said cylinder and four leaf-spring members spaced equally from one another and extending from said annular portion between the peripheral surface of said cylinder and the surrounding wall of said opening, two opposite of said members being longer than the others and forcing radially projecting lugs for engaging said ledge, said longer members being curved so as to engage said cylinder near said lugs and said wall near said annular portion, and said shorter members being curved so as to engage said cylinder near their ends and said wall at a place between said end and said annular portion.

13. In an automatic switch, the combination of a base structure, a spring biased contact member movably mounted on said structure, a thermostatic assembly for actuating said member

against its bias, and a heater exchangeably mounted on said structure and formed of strip material so as to have a loop portion in heat transferring relation to said assembly, said loop portion having less than a complete single turn of substantially cylindric shape and having an elongated cross section whose long edges extend substantially in parallel to the geometric axis of

the loop portion and are of multiple length as compared with the short edges of said cross section so that the shortest current paths of said loop portion extend along a peripheral long-edge surface.

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