March 23, 1954 C. W. KUHN ET AL 2,673,268

PROTECTIVE SWITCH

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Fig. 1

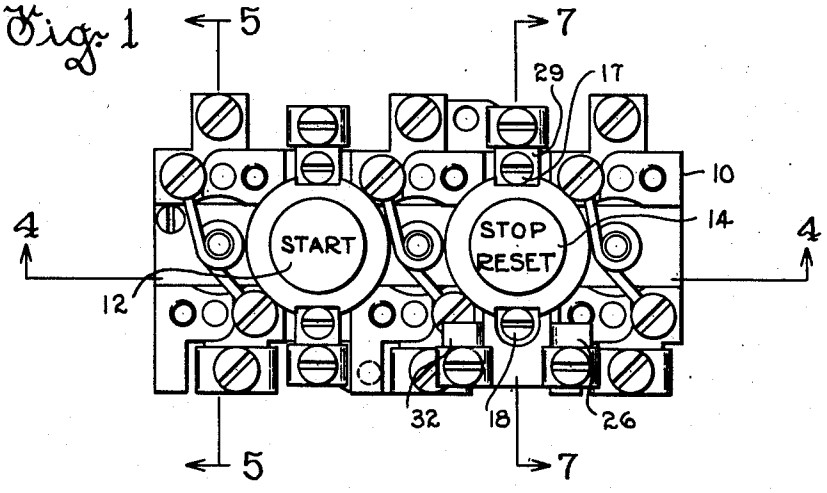


Fig. 2

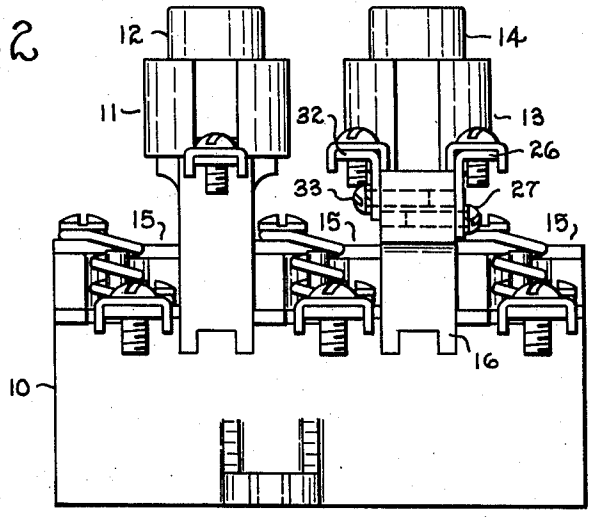
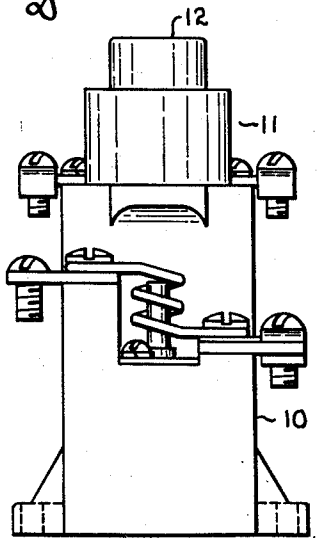


Fig. 3



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Fig. 4

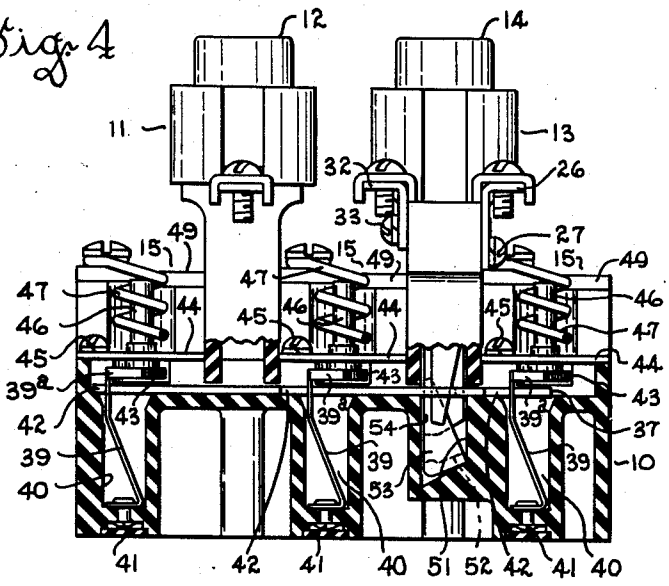


Fig. 5

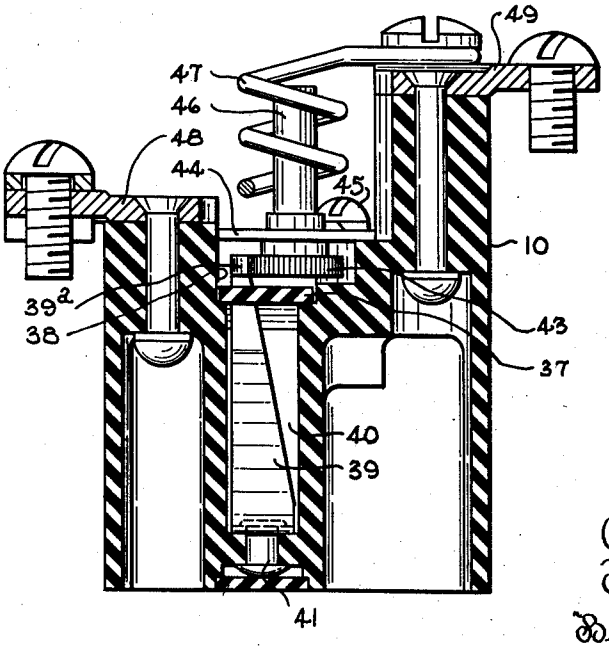
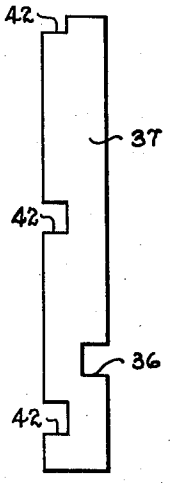


Fig. 6



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Fig. 7

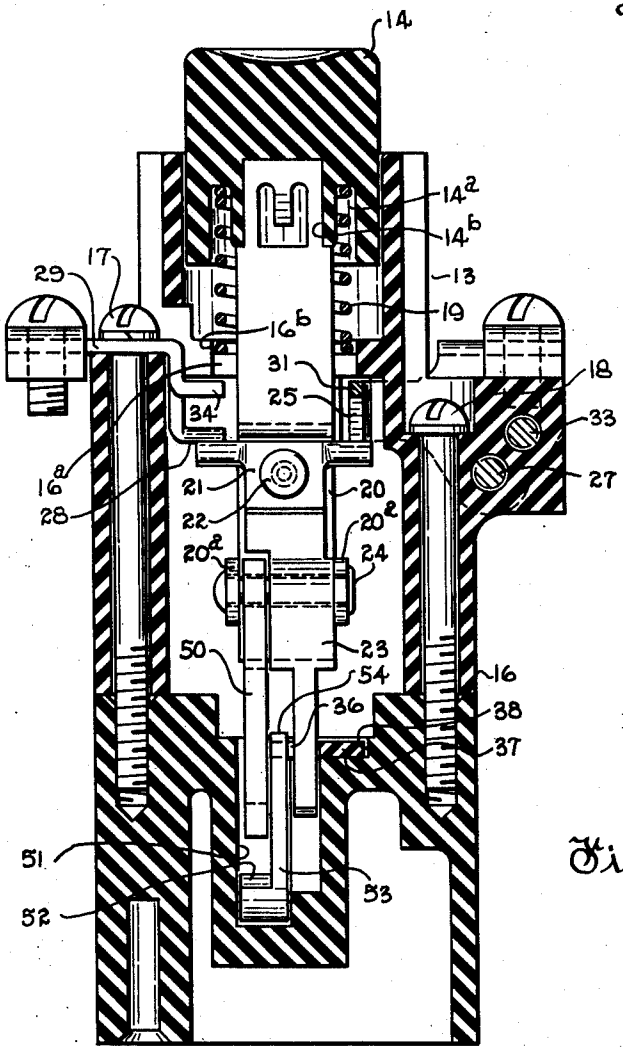


Fig. 9

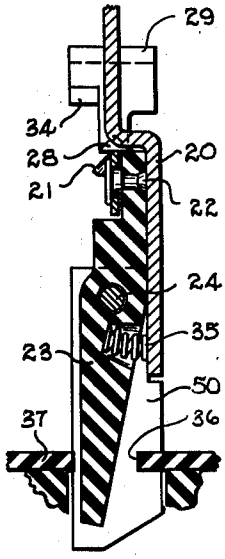


Fig. 10

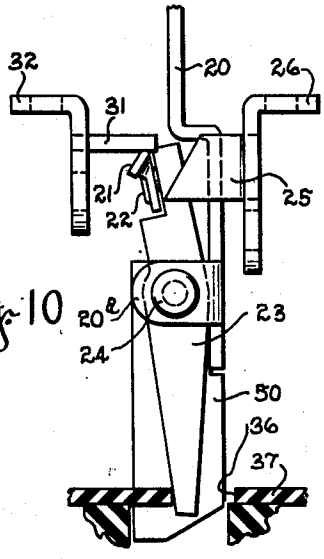
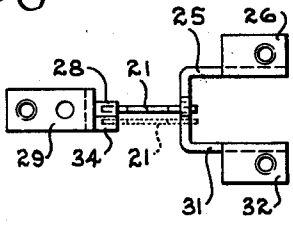


Fig. 8



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UNITED STATES PATENT OFFICE

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PROTECTIVE SWITCH

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Application April 26, 1951, Serial No. 223,108

16 Claims. (Cl. 200—124)

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This invention relates to an improved protective switch, which while not limited thereto is particularly adapted for use as a thermally responsive overload switch for controlling a translating circuit through the medium of an electromagnetic contactor.

The subject matter of the present invention is in certain respects similar to that shown and described in the Kuhn Patent No. 2,522,048, issued September 12, 1950, and is an improvement.

A primary object of the present invention is to provide an improved thermally responsive protective switch which is reliable in operation and simple to construct.

A more specific object is to provide a switch of the aforementioned type having an improved form of resettable thermal overload unit.

Another object is to provide a switch of the aforementioned type employing a slide bar type contact tripping mechanism.

A further object is to provide a switch of the aforementioned type having an improved form of resetting mechanism, and

A still further object is to provide a protective switch having auxiliary contacts to afford completion of a tell-tale circuit following tripping of the main contacts.

Other objects and advantages of the invention will hereinafter appear.

The accompanying drawings illustrate a preferred embodiment of the invention which will now be described, it being understood that the embodiment illustrated is susceptible of various modifications in respect of details without departing from the scope of the appended claims.

In the drawings,

Figure 1 is a top plan view of a protective switch device constructed in accordance with the invention;

Fig. 2 is a side elevational view of Fig. 1;

Fig. 3 is an end elevational view of the device of Figs. 1 and 2;

Fig. 4 is a view, partly in elevation and partly in section, taken along the line 4—4 of Fig. 1;

Fig. 5 is a view in vertical section taken along the line 5—5 of Fig. 1;

Fig. 6 is a plan view of a slide bar element shown in Figs. 4 and 5;

Fig. 7 is a view in vertical section taken along the line 7—7 of Fig. 1;

Fig. 8 is a plan view showing the operating relations of a bridging contactor to stationary contacts in the device;

Fig. 9 is a fragmentary section of certain elements shown in Fig. 7 looking toward the left of Fig. 7; and

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Fig. 10 is a fragmentary view showing the bridging contactor in tripped position.

Referring to Figs. 1 through 3, a unitary, molded insulating base 10 has mounted thereon a starting switch unit 11 having a push button 12, and a stop-reset switch unit 13 having a push button 14. Switch unit 11 may be any of a number of well-known, normally open switches which afford completion of a circuit so long as push button 12 is maintained depressed. When the protective device is utilized for control of an electromagnetic main contactor in a polyphase alternating current translating circuit, in the manner shown in the aforementioned patent (see particularly Fig. 15 thereof) momentary operation of push button 12 affords energization of the operating coil of the main contactor. Following such operation of switch unit 11 a holding circuit for the operating coil is established through main contacts of switch unit 13, subject to interruption by tripping of the main contacts in response to overload current conditions in any one of the branches of the translating circuit with which the main contactor is associated.

Switch unit 13 has associated therewith three thermally responsive overload units 15. Each such overload unit is adapted to be subjected to the influence of the current flowing in an associated branch of a three phase alternating current translating circuit, and if its associated branch becomes overloaded, the overload unit will respond to afford tripping of the main contacts in switch unit 13, thereby affording deenergization of the electromagnetic main contactor.

Switch unit 13 comprises a molded insulating housing 16, which in longitudinal vertical cross section is preferably of the form shown in Fig. 7. Housing 16 is secured to base 10 by means of screws 17 and 18. A coiled compression spring 19 seats at its lower end against a pair of integral half-moon shaped ledges 16a which are disposed on opposite sides of a narrow rectangular passage (not shown) within housing 16. The lower end of the spring is restrained against lateral displacement by upstanding semi-annular shoulders 16b. At its upper end the spring seats within an annular recess 14a formed in push button 14 and urges the latter outwardly of housing 16.

Push button 14 is provided with a rectangular slot 14b within which is anchored the upper end portion of a stem member 20. Outward movement of button 14 is limited by engagement of bridging contactor 21, rockably mounted on a rivet 22 on the upper end of lever 23 pivoted on pin 24 between ears 20a adjacent the lower end of member 20, with either of two pairs of sta-

tionary contacts. The first or lower pair of contacts are the main contacts, and comprise contact 25 projecting inwardly from an integral terminal 26 mounted on the right-hand side of housing 16 (see Figs. 1, 2 and 10) by means of a screw 27, and lower contact 28 struck from terminal 29 mounted on the opposite side of the switch unit (see Figs. 1, 7 and 9) by screw 17. The second or upper pair of stationary contacts comprise contact 31 projecting inwardly from terminal 32 mounted on the left-hand side of housing 16 (see Figs. 1, 2 and 10) by screw 33, and upper contact 34 struck from terminal 29 on the opposite side of housing 16.

When push button 14 is depressed, bridging contactor 21 moves downwardly with respect to the stationary contacts, and spring 35, compressed between lever 23 and member 20, moves the bridging contactor clockwise until lever 23 lies against member 20 and the bridging contact underlies the lower pair of contacts 25, 28. When released, button 14 moves outwardly until the bridging contactor engages the lower pair of contacts. The bridging contactor, being rockable on rivet 22, compensates for any misalignment of the stationary contacts. The lower end of lever 23 depends into notch 36 in non-conductive slide bar 37 which is slidably mounted in a channel 38 formed in base 19. When the slide bar moves to the right (Figs. 4, 9 and 10) lever 23 moves the bridging contactor away from the lower pair of stationary contacts 25, 28 to lie under the upper pair of stationary contacts 31, 34 and spring 19 drives the button outwardly to carry the bridging contactor into engagement with the upper contacts (Fig. 10), and when in circuit with a tell-tale device afford indication that the stop-reset switch has been tripped.

Slide bar 37 moves to the right to trip the stop-reset switch as above described when any branch of the translating circuit is overloaded. Each overload unit 15 comprises leaf spring 39 mounted in the bottom of well 40 formed in base 10 by rivet 41. The upper end of each spring 39 projects through cooperating notch 42 in slide bar 37 and has detent 39a adapted to engage solder-restrained ratchet wheel 43 on the underside of plate 44 covering channel 38 which houses the wheel and detent. Plate 44 is secured to base 10 by screw 45 and is provided with a hollow cylindrical stem 46 projecting from the top and subjected to the heat of a coil 47 which is adapted for connection in a branch of a translating circuit.

Each coil is connected to a front, stepped terminal plate 48 and a rear, stepped terminal plate 49 and the length of coil effective in heating stem 46 may be adjusted to meet the particular response requirements by securing the coil terminals to the different steps. The matching steps are diagonally disposed and merely changing the diagonal disposition of the coil terminals affords two response conditions. The coil may also be turned over and mounted in either of the two positions to provide two more responsive conditions to make a total of four adjusted positions. Further details of this coil mounting may be found in the aforementioned Kuhn patent.

When stem 46 has been heated sufficiently by coil 47 the solder in the stem melts and allows ratchet wheel 43 to rotate, thus freeing the leaf spring for movement against the edge of the notch 42 in slide bar 37. This drives the bar to the right (Figs. 4, 9 and 10) to trip the stop-reset switch as described above. The notches in the slide bar are of such size as to permit any one of the overload devices to operate independently of the others.

In order to reset the switch and return the slide bar to its inoperative position, button 14 is depressed to drive finger 50, mounted on pin 24 on member 20 to depend into well 51 adjacent the slide bar (Fig. 7), down alongside the slide bar to act on lug or lever 52 projecting laterally from a substantially triangular shaped member 53 disposed in well 51 to pivot the arm 54, the upper end of which projects into a notch 36 in slide bar 37 adjacent trip lever 23, counterclockwise (Fig. 4) and drive the slide bar to the left. As the bar moves to the left the spring detent which was released is latched in engagement with the ratchet wheel which, by this time, is non-rotatable due to resolidification of solder in its stem 46. At the same time member 53 resets the slide bar, the trip lever in the stop-reset switch is freed for movement by spring 35 to align the bridging contactor with the lower or main contacts. Thus, when one of the thermally responsive units is subjected to overload current the corresponding ratchet wheel is freed and the leaf spring drives the slide bar to actuate the switch trip lever and pivot member 53 about its bottom, right-hand corner (Fig. 4). When button 14 is depressed, finger 50 acts on lug 52 to return member 53 to its normal position, thus driving the slide bar to its normal operating position, latching the spring detent, and permitting the trip lever to return to its normal position with the bridging contactor aligned for engagement with the lower stationary contacts 25, 28 upon release of button 14.

Since the bridging contactor may be moved to a position lower than the stationary contacts to reset the switch, button 14 may be depressed, when desired, to serve as a "stop" switch. Thus the switch serves as a stop-reset switch and also affords tell-tale indication when tripped in response to an overload condition.

To summarize, assuming the stop-reset switch to be in normal operating condition, start button 12 is pushed in to complete the circuit through the closing circuit for the electromagnetic main contactor. When button 12 is released the holding circuit is completed through bridging contactor 21 and lower stationary contacts 25, 28 and each of the three branches of the three-phase translating circuit is protected against overload by one of three heat responsive units 15. The response condition of each unit may be any one of four afforded by the stepped terminals for coils 47, each of which heats stem 46 of a solder-restrained ratchet mechanism holding leaf spring 39 in latched position. When the branch is overloaded the solder melts, permitting the ratchet wheel to turn and spring 39 to drive slide bar 37 which trips lever 23 and pivots member 53. When lever 23 is actuated, bridging contactor 21 disengages the lower stationary contacts (breaking the holding circuit) and becomes aligned with the upper stationary contacts. Spring 19 drives button 14 outwardly and the bridging contactor engages the upper stationary contacts.

To reset the switch, button 14 is depressed to drive finger 50 against lug 52 and pivot member 53 to the left (Fig. 4) to return the slide bar and the released spring detent to their normal operating positions. When thus latched the spring will remain inoperative until the branch is again overloaded. Returning the slide bar to its inoperative position relieves trip lever 23 of external

force and allows spring 35 to return the bridging contact to alignment with the lower stationary contacts for engagement therewith upon release of button 14. It will be appreciated that in order to reset the slide bar, button 14 must be depressed to such an extent that the bridging contact is below the lower stationary contacts. Since the button may be depressed to such an extent it may be so actuated at any time to move the bridging contact from the lower stationary contacts to break the main switch holding circuit and operate, therefore, as a stop switch.

While this device has been described in connection with a particular use, it will be appreciated that the invention is not so limited. It will also be appreciated that the device may be modified in respect of the number of overload units, and that the switch unit 11 may be omitted if desired.

We claim:

1. In a protective switch device, a pair of stationary contacts, a lever carrying a bridging contactor for said contacts, a slide bar movable from a normal extreme position to an opposite extreme position to move said lever to a position disengaging said contactor from said contacts, a member having a resilient portion engageable with said slide bar, said resilient portion having bias when said slide bar is in its normal extreme position tending to drive the latter to its opposite extreme position, and a solder-restrained element engaging said member and releasing in response to a given thermal condition to permit drive of said slide bar under the bias of said resilient portion of said member.

2. In a protective switch device, a casing, a pair of stationary contacts in said casing, a lever carrying a bridging contactor for said contacts, a bar slidably mounted in said casing for longitudinal movement from a normal extreme position to an opposite extreme position to move said lever to a position disengaging said contactor from said contacts, a member mounted in said casing and having a resilient portion engageable with said slide bar, said resilient portion having bias when said slide bar is in its normal extreme position tending to drive the latter to its opposite extreme position, and a solder-restrained element engaging said member and releasing in response to a given thermal condition to permit drive of said slide bar under the bias of said resilient portion of said member.

3. In a protective switch device, a casing, a pair of stationary contacts in said casing, a lever carrying a bridging contactor for said contacts, a bar slidably mounted in said casing for longitudinal movement from a normal extreme position to an opposite extreme position to move said lever to a position disengaging said contactor from said contacts, a plurality of members mounted in said casing, each member having a resilient portion engageable with said slide bar, said resilient portions each having bias when said slide bar is in its normal extreme position independently tending to drive the latter to its opposite extreme position, and a corresponding number of solder-restrained elements each engaging a respectively associated one of said members and releasing in response to a given thermal condition to permit drive of said slide bar under the bias of the resilient portion of its associated member.

4. In a protective switch, in combination, a switch including a pair of stationary contacts, a push button, means biasing the button outwardly, an oscillatable bridging contactor carried by the button and normally engaged with the contacts, a slide bar movable from a normal extreme position to an opposite extreme position to effect oscillation of said bridging contact to disengage the same from said stationary contacts, and means carried by the push button for moving said slide bar to its normal extreme position.

5. In a protective switch, in combination, a switch including stationary contacts, a push button, means biasing the push button outwardly, a rotatable lever carried by the push button, a bridging contactor carried by the lever and means biasing the lever to a position affording engagement of said contactor with said stationary contacts, a slide bar movable from a normal extreme position to an opposite extreme position to rotate said lever to effect disengagement of said contactor from said stationary contacts and permit said push button to move outwardly, thermally responsive means acting in response to a given thermal condition to effect movement of said slide bar from its normal to its opposite extreme position, and reset means operable when said button is pushed inwardly to act on said slide bar and move the bar to its normal extreme position.

6. A protective switch according to claim 5 in which said reset means comprises, a reset lever engageable with said slide bar, and a member carried by said button and engageable with said reset lever when the button is depressed to actuate said lever to move said slide bar to its normal extreme position.

7. In a protective switch, in combination, a switch including stationary contacts, a pushbutton, means biasing the pushbutton outwardly, a lever carried by the pushbutton, a bridging contactor carried by the lever and means biasing the lever to a position affording engagement of said contactor with said stationary contacts, a slide bar movable from a normal extreme position to an opposite extreme position to move said lever to effect disengagement of said contactor from said stationary contacts and permit said pushbutton to move outwardly, thermally responsive means acting in response to a given thermal condition to effect movement of said slide bar from its normal to its opposite extreme position, and reset means operable when said button is pushed inwardly to act on said slide bar and move the bar to its normal extreme position, said reset means comprising a reset lever engageable with said slide bar, and a member carried by said button and engageable with said reset lever when the button is depressed to actuate said lever to move said slide bar to its normal extreme position, said pushbutton being movable inwardly beyond the normal position in which said bridging contactor engages said stationary contacts in order to effect resetting of said slide bar in its normal extreme position and said bridging contactor being manually disengageable from said contacts by movement of said bushbutton inwardly beyond said normal position.

8. A protective switch according to claim 7 including a second set of stationary contacts and in which said bridging contactor engages said second set of stationary contacts when said pushbutton moves to its outermost position as a result of movement of said slide bar to its opposite extreme position.

9. A protective switch comprising, a reset

switch including a set of stationary contacts, a push button, means biasing the push button outwardly, a lever carried by the push button, a bridging contactor carried by said lever, means biasing said lever to a position in which said bridging contact is aligned and engaged with said stationary contacts, a slide bar operable to act on said lever to move said bridging contact out of alignment with said stationary contacts and to free said bridging contactor for movement outwardly past the stationary contacts under influence of the button biasing means, another set of stationary contacts positioned outwardly with respect to the first set of stationary contacts, said bridging contactor being aligned with said other set of stationary contacts when out of alignment with the first set of stationary contacts and being engageable therewith when the push button has moved outwardly.

10. A protective switch according to claim 9 including means for moving said slide bar to a normal extreme position when said push button is depressed and in which said push button may be depressed when said bridging contactor is engaged with the first set of stationary contacts to move the bridging contactor inwardly out of engagement with the first set of stationary contacts.

11. A switch comprising a housing, a push button mounted for reciprocation in said housing, a pair of stationary contacts in said housing, a lever pivotally mounted on said button, a bridging contactor mounted on said lever, means biasing said lever to a position in which said bridging contactor is aligned with said stationary contacts, means biasing said button outwardly to engage said bridging contactor with said stationary contacts when aligned therewith and to move the bridging contactor outwardly of said stationary contacts when the bridging contact is not aligned with the stationary contacts, said lever being actuatable to misalign the bridging contact and the stationary contacts, and a second pair of stationary contacts mounted in said housing outwardly of the first pair of stationary contacts and in alignment with the bridging contactor when the lever has been actuated to misalign the bridging contact and the first pair of stationary contacts, a slide bar operable from a normal extreme position to an opposite extreme position to act on said lever to misalign the bridging contactor with respect to the first pair of stationary contacts, means responsive to a given thermal condition to move said bar from its normal extreme position to its opposite extreme position, an arm mounted in said housing for engagement with said bar, and means carried by said button and engageable with said arm when the button is depressed to move the arm to return the bar to its normal extreme position and allowing the lever biasing the means to return the lever to the position in which the bridging contactor is aligned with the first pair of stationary contacts, said bridging contactor being moved inwardly of the first pair of stationary contacts when the button is depressed and engageable with the first pair of stationary contacts upon release of the button.

12. In a protective switch device, a pair of stationary contacts, a lever carrying a bridging contactor for said contacts, a slide bar movable from a normal extreme position to an opposite extreme position to move said lever to a position disengaging said contactor from said contacts, a member having a resilient portion directly engageable with said slide bar, said resilient portion having bias when said slide bar is in its normal extreme position tending to drive the latter to its opposite extreme position, and a thermally sensitive element engaged by said member for restriction of the latter and releasing in response to a given thermal condition to permit drive of said slide bar under the bias of said resilient portion of said member.

13. The combination with a slide bar movable from a first position to a second position to actuate a switch, of a leaf spring having one end fixed and having a free end engaging the slide bar and biasing the bar to said second position, and a thermally sensitive element normally engaging and restraining said free end of said spring against movement of said bar when the latter is in its first position, and releasing said spring to permit movement of said bar to its second position in response to a given thermal condition.

14. In combination, a switch including a pair of stationary contacts, an oscillatable bridging contactor depressible to effect disengagement thereof from said stationary contacts, means normally biasing said bridging contactor to engagement with said stationary contacts, a slide bar movable from a normal extreme position to an opposite extreme position to effect oscillation of said bridging contact to disengage the same from said stationary contacts, and means depressible with said bridging contactor for moving said slide bar to its normal extreme position.

15. In a protective switch, in combination, a switch including stationary contacts, a depressible rotatable lever, a bridging contactor carried by the lever and means biasing the lever to a position affording engagement of said contactor with said stationary contacts, a slide bar movable from a normal extreme position to an opposite extreme position to rotate said lever to effect disengagement of said contactor from said stationary contacts and permit said lever to move outwardly, thermally responsive means acting in response to a given thermal condition to effect movement of said slide bar from its normal to its opposite extreme position, and reset means operable when said lever is depressed to act on said slide bar and move the bar to its normal extreme position.

16. A protective switch according to claim 15 in which said reset means comprises a reset lever engageable with said slide bar and a member depressible with said lever and engageable with said reset lever when said lever is depressed to actuate said reset lever to move said slide bar to its normal extreme position.

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