Sept. 12, 1950 C. W. KUHN 2,522,048

PROTECTIVE SWITCH

Filed May 5, 1945 4 Sheets-Sheet 1

Fig. 1

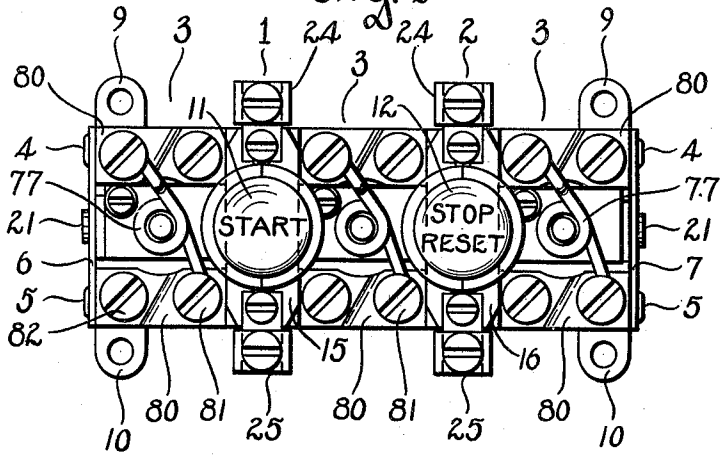
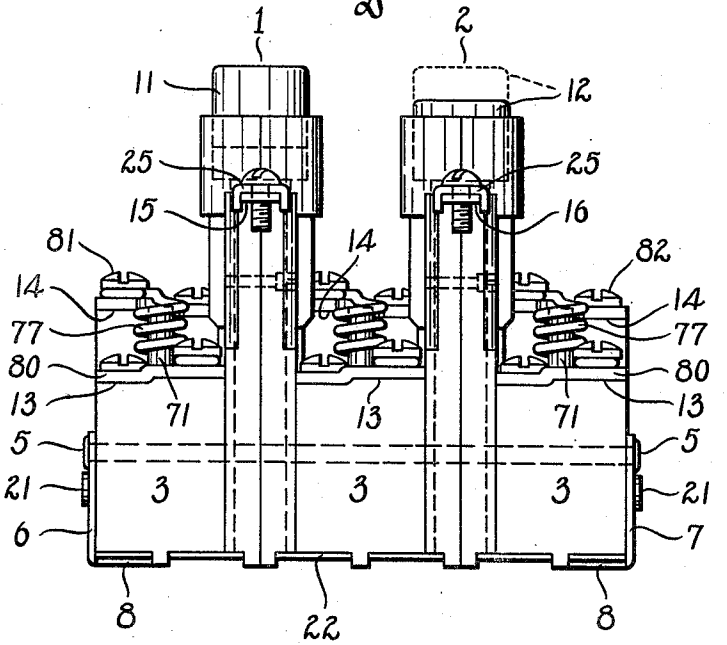


Fig. 2



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PROTECTIVE SWITCH

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Fig. 3

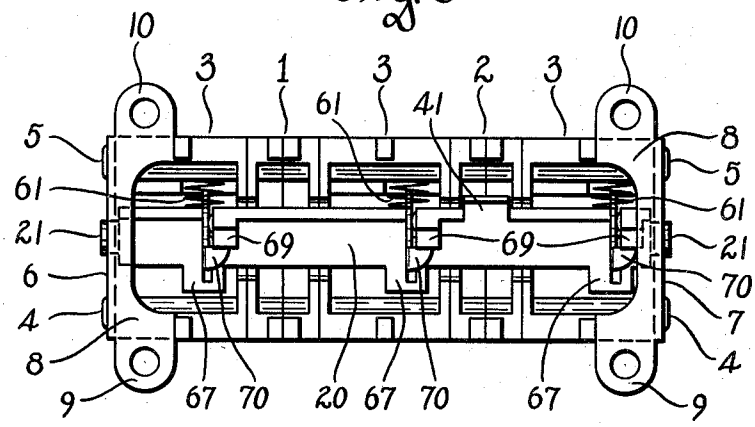


Fig. 4

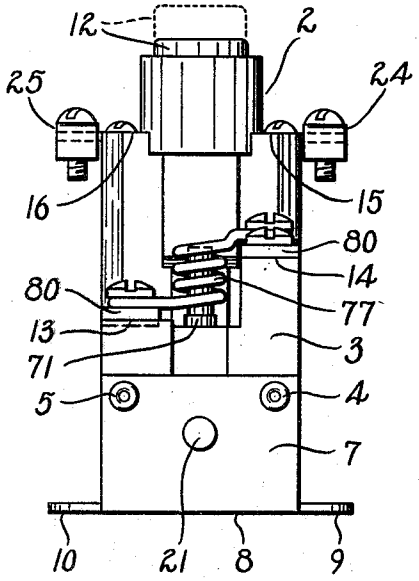
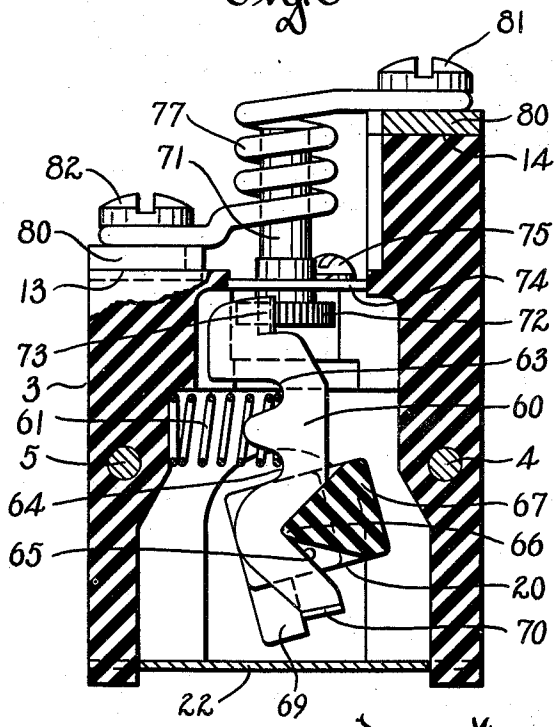


Fig. 5



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PROTECTIVE SWITCH

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Fig. 6

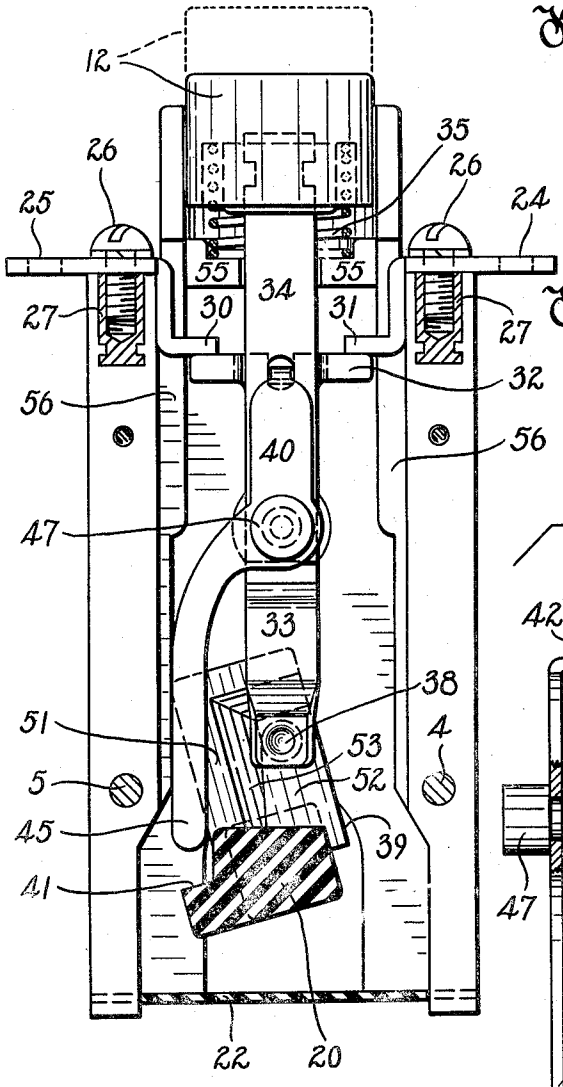


Fig. 7

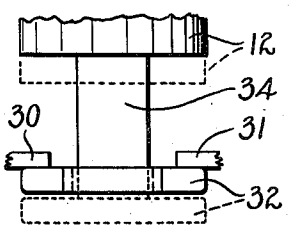


Fig. 8

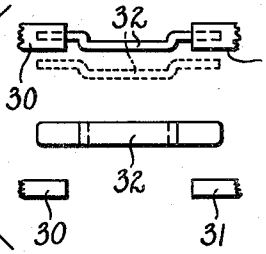
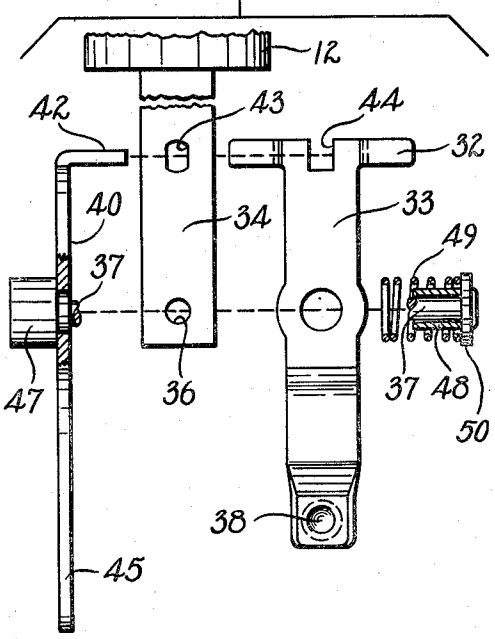


Fig. 9



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PROTECTIVE SWITCH

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Fig. 10

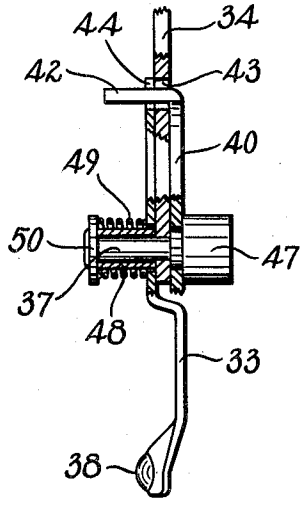


Fig. 11

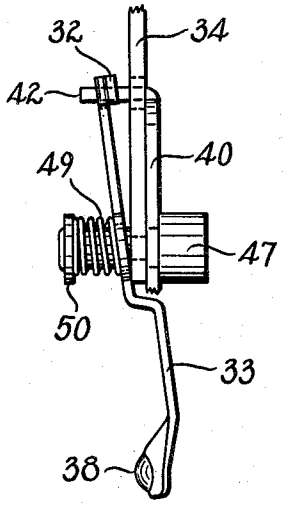


Fig. 12

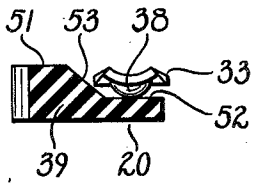


Fig. 13

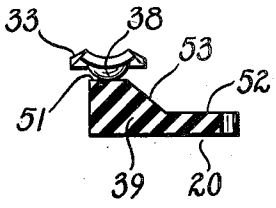


Fig. 14

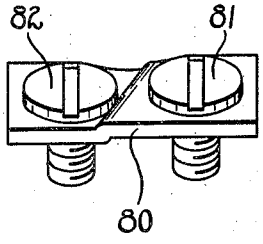
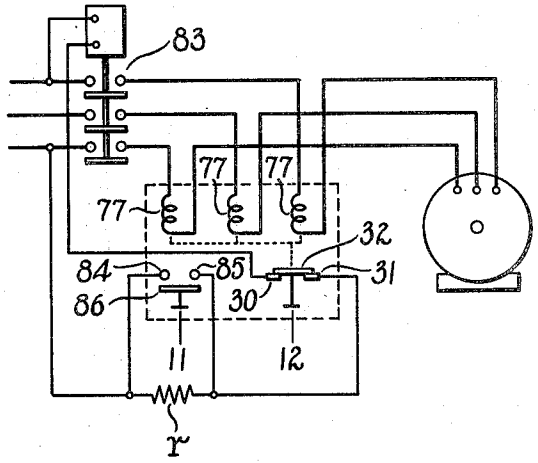


Fig. 15



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2,522,048

UNITED STATES PATENT OFFICE

2,522,048

PROTECTIVE SWITCH

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Application May 5, 1945, Serial No. 592,200

23 Claims. (Cl. 200—116)

1

This invention relates to improvements in protective switches, and while not limited thereto is particularly applicable to overload switches of the thermally responsive type employed for controlling a translating circuit through the medium of an electromagnetic contactor.

An object of the invention is to provide a protective switch of a type comprising units which may be assembled into various composite forms to meet different needs, especially as regards responsiveness to a different number of phases of an alternating current circuit when such is the controlled circuit.

Another object is to embody in separate units a switch mechanism and a thermally responsive control means for such switch unit, and to provide for use of the switch unit in conjunction with one or a multiplicity of the thermally responsive control units according to the number of lines of the controlled circuit, to which the switch is to be made sensitive.

Another object is to provide a switch unit of the type aforementioned, containing a switch of the free tripping type.

Another object is to provide in conjunction with such a switch unit and thermally responsive trip units therefor, a momentary contact switch unit, to afford a composite device having separate start and stop switches operable at will, the manual operating member for the stop switch constituting also a reset element for the thermally responsive trip units or any one of the same.

Another object is to so form all aforementioned units as to afford a very compact composite device of small dimensions for the service required thereof.

Another object is to so construct the switch unit which is subject to the control of the thermally responsive unit or units as to indicate whether such switch is set in closed position or is in tripped position.

Another object is to utilize in the thermally responsive units solder type thermal elements with heat coils therefor and to provide for any one of a number of predetermined relative adjustments of each solder element and its heater coil in a very simple and convenient manner.

Various other objects and advantages of the invention will hereinafter appear.

The accompanying drawing illustrates one embodiment of the invention which will now be described, it being understood that the units illustrated are susceptible of modification without departing from the scope of the appended claims and that the composite device selected for illustration is only one of numerous devices which may be produced using units of the forms shown.

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In the accompanying drawing,

Figure 1 is a front elevational view of a composite device which has separate start and stop switches and in which the stop switch has a tripping unit for each line of a 3 phase alternating current circuit;

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

Fig. 3 is a bottom plan view of the device of Figs. 1 and 2;

Fig. 4 is an end elevation of the device of Figs. 1 to 3;

Fig. 5 is an enlarged side elevation partly in section of one of the thermally responsive trip units;

Fig. 6 is an enlarged elevational view partly in section of the stop switch unit of Fig. 1;

Figs. 7 and 8 are more or less schematic views depicting the different relative movements to which the contacts of the switch shown in Fig. 6 are subject;

Fig. 9 shows in disassembled relation parts of the contact actuating mechanism of the switch of Fig. 6;

Figs. 10 and 11 show the parts of Fig. 9 assembled and occupying different relative positions;

Figs. 12 and 13 are enlarged detail views showing in different relations parts causing the elements of Figs. 10 and 11 to assume the different relations shown therein;

Fig. 14 is an enlarged detail view of a terminal plate employed, and

Fig. 15 is a diagrammatic showing of one use of the device shown in Figs. 1 to 13.

Referring to Figs. 1 and 2, the composite device comprises a unit 1 containing the start switch, a unit 2 comprising the stop switch and three like units 3 containing thermally responsive trip means for the stop switch of unit 2. Externally the switch units are identical, each being arranged between the center unit 3 and one of the extreme units 3 to produce a compact and symmetrical composite device, the several units being firmly secured together by through rivets 4 and 5. The through rivets 4 and 5 also secure the units within end plates 6 and 7 which as shown in Fig. 2 are of right angle form, the portions 8 of each being extended to provide oppositely disposed supporting lugs or ears 9 and 10.

Each of the units comprises a recessed insulating housing open at the bottom and provided adjacent to the bottom with side openings for a purpose hereinafter set forth. The

abutting faces of all units are flat and for economy of space the switch units have relatively thin sections for insertion between the thermally responsive units 3 and enlarged portions to receive push buttons 11 and 12, respectively, and also to accommodate parts hereinafter set forth. The housings of the thermally responsive units 3, as will be apparent from Figs. 2, 4 and 5, have terminal supporting faces 13 and 14 at different levels, whereas each switch unit has terminal supporting faces 15 and 16 at a third level, thereby adequately spacing the terminals and rendering all readily accessible. The aforementioned side openings in the switch units and thermally responsive units are substantially as shown in the lower portions of Figs. 5 and 6, extending upwardly sufficiently to give clearance throughout the length of the composite unit for a rocking trip bar 20, Figs. 3, 5 and 6, which has end bearings 21, Figs. 3 and 4, in the end plates 6 and 7. This trip bar 20 which will later be described in detail, is common to all of the thermally responsive units, to be actuated by any or all of the same, and it acts upon the stop switch to trip the same, the start switch being entirely independent of the trip bar. For closure of the under side of the several units there is preferably provided a sheet of insulating material 22, Figs. 2, 5 and 6, which is supported at its ends between the bottom edges of the end units and the right angle portions 8 of the end plates 6 and 7.

The start switch of unit 1 is merely a normally open switch to be closed by push button 11 so long as said push button is held depressed, and as it may be of any one of a number of well known forms its construction is not illustrated in detail. Such switch is schematically shown in the diagram of Fig. 15 as comprising a pair of stationary contacts and a bridging contact operable by push button 11. As will be understood, the switch is biased to open position, and as shown on Fig. 1 the switch has terminals 24 and 25 which are integral extensions of its stationary contacts, which contacts may be of the form shown in Fig. 6 for the stop switch. In the case of both the start switch and the stop switch the combined contacts and terminals are secured to the switch unit housings by screws 26 threading into sockets 27, Fig. 6.

Referring to Figs. 6 and 9, which show the switch to be controlled by the thermally responsive elements, said switch comprises stationary contacts 30 and 31 and a movable bridging contact 32. The bridging contact 32 is an integral part of a member 33 connected to the stem part 34 of push button 12, said push button being biased by spring 35 normally to effect engagement of bridging contact 32 with contacts 30 and 31. As shown in Fig. 9 the stem part of the push button is relatively short and has an opening 36 adjacent its lower extremity to receive a pin 37 by which the contact carrying element 33 is attached to said stem part. The element 33 extends downwardly beyond the stem part of the push button and at its lower extremity has a projection 38 better shown in Figs. 10 and 11, to cooperate with a stepped cam member 39 carried by the trip bar 20, of the several thermally responsive units. Also the push button stem part 34 has attached thereto through the medium of the pin 37 an element 40 to coact with a laterally extending lug 41 on the trip bar 20 (Figs. 3 and 6). The upper portion of the element 40 aligns with the stem part of the push button and at its upper extremity has a projecting lug 42 which projects through a second orifice 43 in part 34 and an open notch 44 provided in the upper extremity of the contact carrying element 33, thus interlocking the three elements 33, 34 and 40 against any appreciable relative rotation about the pin 37 connecting said members. The member 40 has a curved extension 45 which is curved for close approach to the trip bar 20 while affording for a purpose later set forth clearance for the portion of the contact carrying element 33 extending downwardly from the pin 37. The openings for the pin 37 provided in the elements 33 and 40 are larger than the opening provided in the stem part of the push button, the pin 37 being provided at one end with a head 47 and having its shank adjacent the head of a diameter to snugly fit the opening in member 40 while having the remainder of its shank of reduced diameter to pass through the smaller opening 36 in the push button stem part. The pin is passed progressively through the elements 40, 34, 33 and a tubular element 48 to be loosely fitted into the opening in the contact carrying element 33. The tubular element 48 carries a helical spring 49 to be confined between the face of contact carrying element 33 and a collar 50 riveted onto or otherwise secured to the pin 37 for securement in assembled relation of the elements threaded by the pin. It will thus be seen that while all of the elements 33, 34 and 40 are mounted in alignment the contact carrying element 33 is permitted a rocking motion (Fig. 11) against the pressure of spring 49, with the lower extremity of the stem part 34 of the push button as its fulcrum and the downwardly extending part of element 33 having clearance for such rocking motion by virtue of the curvature of the extremity 45 of the overlying element 40. Such rocking motion is imparted to the element 33 by coaction of the projection 38 thereon with the cam member 39. As indicated in Figs. 12 and 13, the cam member 39 has surfaces 51 and 52 at different levels and a connecting inclined surface 53. With the projection 38 of member 33 in engagement with the surface 52 the element 33 assumes the relation to the element 34 depicted in Fig. 10, whereas as the projection rides over the camming surface 53 onto the surface 51, element 33 is tilted as depicted in Fig. 11, the cam part 39 being so mounted on the trip bar 20 that the projection 38 normally rests on the surface 52 and rides onto the surface 51 only when said trip bar functions under abnormal conditions.

Fig. 6 shows the aforedescribed switch parts in their normal relation with the cam part 39 disposed to permit the part 33 to assume the position shown in Fig. 10. Under such conditions the bridging contact 32 engages the under sides of the contacts 30 and 31 and is firmly held thereagainst by the bias exerted on the push button by the spring 35. It is thus possible at any time to disengage the bridging contact 32 from its stationary contacts by merely depressing the push button 12 against the action of spring 35, which spring of course returns the bridging contact into engagement with the stationary contacts upon release of the button. This movement of the bridging contact by depression of the push button is depicted in Fig. 7, whereas Fig 8 depicts motion of the bridging contact as a function of automatic tripping resulting from rocking of the trip bar 20 and the cam part 39. Such rocking of the trip bar effects the aforedescribed rocking motion of the contact carrying element 33, as depicted in Fig. 11, and this re-

sults in moving the bridging contact 32 laterally out of engagement with its stationary contacts, as depicted by dotted lines in Fig. 8. Thereupon the biased push button 12 is relieved of restraint by the switch contacts 30 and 31 and said push button if not manually restrained moves upwardly to the dotted line position shown in Fig. 6, drawing upwardly with it the bridging contact 32 into a position above the contacts 30 and 31, as depicted in the lower portion of Fig. 8. This lateral and upward motion of the bridging contact results in disengagement of the contacts with a snap action under the influence of the spring 35, which snap action is initiated by the lateral movement of the bridging contact to clear the stationary contacts. On the other hand, quick disengagement of the contacts by lateral movement of the bridging contact is insured even should the push button be manually restrained against upward motion for the cam part 39 tilts the element 33 sufficiently to afford disengagement of the contacts with an adequate gap, and as will later appear the trip bar 20 is spring actuated and imparts a snap to the lateral motion of the member 33 for quick disengagement of the contacts even though the push button 12 be manually restrained against movement by spring 35.

The switch just described is after tripping thereof resettable by merely depressing the push button 12. Such operation of the push button 12 moves the bridging contact to the plane below the stationary contacts, as depicted in dotted lines in Fig. 7. Moreover in so moving the bridging contact downwardly the push button moves the curved extremity 45 of element 40 downwardly against the lug 41 on the rocking trip bar to rock said trip bar and cam member 39 in a direction to permit element 33 to move from the tilted position shown in Fig. 11 to the position shown in Fig. 10 whereby upon release of the push button the bridging contact 32 will be permitted again to engage the under sides of the contacts 30 and 31. As will be understood, the parts are so coordinated as to permit the member 33 to rock back to normal position only after depression of the bridging contact 32 into a plane sufficiently below the contacts 30 and 31 as to insure against re-engagement of said contacts by lateral movement of the bridging contact. It will thus be apparent that the switch contacts cannot be re-engaged while the push button 12 is in a position to block tripping action of the tripping means.

A switch mechanism of the construction just described enables enclosure thereof in a housing of very simple construction, such being the character of the housing illustrated. The housing, as heretofore pointed out, is of thin rectangular form except for the upper portion which is enlarged to receive the push button and to receive and seat the contacts and terminals. The enlarged push button receiving portion of the housing has therewithin a number of spaced step ledges 55 to form down stops for the push button and a seat for the helical spring 35 which is partially contained within the push button 12. These ledges form the sole support of the switch mechanism which in its entirety except for the stationary contacts is carried by the push button stem part 34. The stationary contacts in turn through cooperation therewith of the bridging contact 32 restrain the push button in the desired normal intermediate position, and thus no other connection between the housing and the switch mechanism is required. The stationary contacts 30 and 31 are insertable into the housing from the outside through suitable side openings and are seated on and secured to the housing externally, as hereinbefore described, and as shown in Fig. 6. Preferably the housing is so formed internally as to provide grooves or slots 56 to receive parts of the stationary contacts and grooves or slots to guide one or more parts of the switch mechanism and prevent turning of the mechanism within the housing. Preferably the housing is as shown divided longitudinally into sections to receive therebetween the mechanism described, the sections being secured together by screws or in any other suitable manner.

Each thermally responsive unit comprises a unitary recessed insulating block of generally rectangular form but having its upper surface stepped for support of terminal plates at different levels, as aforedescribed. Within each block is a flat, semifloating element 60, of a form best shown in Fig. 5, which element is engaged midway of its end by a helical spring 61 confined between the same and a seat for said spring provided within the insulating block. The element is shown with notches 63 and 64 in which one end of the spring helix seats, and said element adjacent one end has a V-shaped notch 65 to receive a narrower V-shaped portion of the rocking trip bar 20 against which it is pressed by the spring 61. As shown in Fig. 3, the parts of the trip bar 20 disposed within the several units 3 have in each instance a laterally projecting lug 67 and are slotted transversely into said lug to receive the element 60 and to form within such lug the V-shaped part 66 received by the V-notch in element 60. Also as shown in Figs. 3 and 5, the trip bar 20 has within each unit 3 a projecting lug 69 to be engaged by a laterally projecting tip 70 of the element 60. The coordination of the parts just described is such that each spring 61 presses its element 60 into the seat provided therefor in the trip bar and exerts pressure on element 60 tending to rock the trip bar clockwise when element 60 is in the relation to the trip bar shown in Fig. 5. Also the coordination is such that with element 60 restrained in the position shown in Fig. 5 the trip bar is free for a given degree of such clockwise movement relative to element 60 and such movement of the trip bar is adequate for the earlier explained tripping of the switch of unit 2. Conversely, after the trip bar has been rocked clockwise through the medium of any element 60, counterclockwise rocking of the trip bar moves with it such element 60 against the pressure of its spring 61.

Each unit 3 has latching means for its respective element 60 to releasably restrain it in the position shown in Fig. 5. More specifically, each unit 3 has a solder type thermal device 71 comprising a solder-restrained ratchet wheel 72 with which engages a detent 73 provided on element 60 at the upper end thereof. The thermal device 71 which may be of any one of numerous well known forms is carried by a plate 74 with the ratchet wheel offset from said plate to be projected into a top opening in unit 3, said plate covering said opening and being secured to the unit as by a screw 75. As is customary, the soldered device has a stem to be subjected to the influence of a heat coil 77, said stem projecting from the top of unit 3 and being surrounded by said heat coil. Thus as will be understood, the thermal responsive unit may be made sensitive to the electrical condition of the controlled cir-

cuit by including in such circuit its heat coil, and each unit will afford independent operating means for the trip bar common thereto and acting upon the switch of unit 2. Also it will be understood from the foregoing description that continued restraint of the element 60 of any unit will in nowise interfere with operation of the trip bar by any other unit and that any released element 60 may be reset and latched by reverse movement of the trip bar through the medium of the stop and reset push button 12 and the element 45 operable thereby and engageable with the lug 41 on the trip bar.

In practice it is desirable to provide for adjustment of each heat coil longitudinally of the stem surrounded by it thereby to adjust the respective thermal device for trip at a selectable value of the current traversing said coil. Also it is desirable to discourage tampering with the adjustment by inexperienced persons and to have a safe limit of adjustment. To these ends provision is made in each unit for several predetermined adjustments which are easy to make and unlikely to be disturbed by inexperienced persons. More specifically each coil is provided with one offset terminal shown in Fig. 4 as the upper terminal but in Fig. 5 as the lower terminal, and it will be obvious that one given adjustment is afforded by mere reversal of the coil on its support, the degree of adjustment being determined by the degree of offset of the one terminal mentioned. Also each coil has for both of its terminals stepped terminal plates 80 best shown in Fig. 14, which plates are fixed to the supporting block and are provided with binding screws 81 and 82 on different steps of the plates, the binding screws affording a medium for attachment of the plates to the block. Thus further adjustment of the heat coil may be effected by securing its terminals against different steps of the plate 80 and obviously with a coil provided with an offset terminal and with two-step terminal plates enable the coil to be assembled in four different predetermined relations with the stem of the thermal device sensitive to the heat of said coil. Such adjustments will ordinarily be sufficient.

As shown in Fig. 15, the composite device selected for illustration may be employed to control an electroresponsive main switch for a 3-phase alternating current translating circuit. The main switch designated as 83 is shown as having its coil connected across the outside supply lines through a resistance r and the contacts 30, 31 and 32 of the switch of unit 2. The contacts of the switch of unit 1 are designated as 84, 85 and 86 and these contacts control a short circuit for the resistor r. Thus assuming the contacts 30, 31 and 32 to be set in an engaged relation momentary engagement of contacts 84, 85 and 86 establishes an energizing circuit for the main switch, whereas disengagement of the latter contacts re-inserts in the resistor r which is of a value such that the current flow permitted thereby will maintain the switch 83 energized but will be insufficient to effect closure of said switch when in open position. The heat coils of the units 3 are respectively included in the three branches of the translating circuit, and as hereinbefore indicated abnormal increase in current in any one of said coils as a result of abnormal conditions in the corresponding branch of the translating circuit provides for tripping the contact 32 to interrupt the maintaining circuit of the switch 83, thereby effecting interruption of the translating circuit. Thereafter the contacts 30, 31 and 32 may be reengaged by depression of the push button 12, as earlier described, but without again energizing the switch 83 until the push button 11 is depressed to again momentarily short-circuit resistor r.

As will be understood, the number of units 3 employed may be varied according to the protection desired, and the start switch may if desired be omitted from the composite device. Also it will be understood that whereas in the composite device shown each pair of units 3 has a switch unit interposed between the same, such units might be grouped together with a switch unit at either end of the group. While the composite device shown is not wired it will be apparent that its terminal arrangement enables any desired wiring thereof easily and quickly.

What I claim as new and desire to secure by Letters Patent is:

1. A composite device comprising individually enclosed units secured together in an intimate relation with unitary appearance, two of said units being exteriorly alike and each comprising a switch with exposed manual operating means, and three other of said units being alike and each comprising a tripping instrumentality for a certain one of said switches, said units being arranged with each switch unit between two of said three like units and said three like units and the switch controlled thereby having interconnections which are concealed by the composite enclosure of the composite device and which afford said tripping instrumentalities joint and individual control of the last mentioned switch.

2. A composite device comprising individually enclosed units secured together in an intimate relation with unitary appearance, certain of said units comprising only circuit making and breaking means and other of said units comprising only electrically controlled trip means for certain of said units, all of said units having wiring terminals exposed on one side of the composite device, and the composite enclosure providing seats for said terminals at three different levels, one for the terminals of said circuit making and breaking means, and two for the opposite terminals of said electrically controlled trip means.

3. A composite device comprising an individually enclosed switch unit and an individually enclosed tripping unit for said switch unit, said units being secured together in an intimate relation with unitary appearance and having interconnections concealed by their enclosures collectively, said tripping unit being of the thermally responsive type and having a heat coil and stepped terminal plates therefor to afford predetermined bodily adjustment of said coil axially.

4. A thermally responsive trip unit having a sensitive element and a heat coil for said element, said unit carrying stepped terminal plates for electrical connection and support of said coil, said coil being shiftable from one step to another on said plates for adjustment relative to said sensitive element.

5. A thermally responsive trip unit having a sensitive element and a heat coil for said element, said unit carrying stepped terminal plates for electrical connection and support of said coil, said coil being shiftable from one step to another on said plates for adjustment relative to said sensitive element and said coil having one of its extremities offset to afford by reversal of

said coil relative to said terminal plates further adjustment relative to said sensitive element.

6. A composite device comprising an individually enclosed switch unit, individually enclosed units comprising tripping instrumentalities for said switch unit, said units being secured together in an intimate relation with a unitary appearance and with the switch unit interposed between two of the trip units and a rocking trip bar interconnecting said switch unit and said trip units and concealed by the composite enclosure of the composite device, said rocking trip bar being separately supported by said composite enclosure.

7. A composite device comprising an individually enclosed switch unit, individually enclosed units comprising tripping instrumentalities for said switch unit, said units being secured together in an intimate relation with a unitary appearance and with the switch unit interposed between two of the trip units and a rocking trip bar interconnecting said switch unit and said trip units and concealed by the composite enclosure of the composite device, said trip bar and said tripping instrumentalities being connected for switch tripping operation of said bar by said instrumentalities collectively or individually and for resetting of said instrumentalities by reverse operation of said bar.

8. The combination with a switch unit having a rocking trip bar, of a tripping unit comprising an element formed to be slipped into interfitting relation with said bar to constitute an operating lever therefor, and said tripping unit further comprising electrically controlled latching means for said element, and a spring exerting pressure on said element to hold it in cooperative relation with said trip bar and to cause said element when free of said latching means to effect tripping movement of said bar, said element and said trip bar interfitting with play therebetween permitting reset of said element in its latched position by reverse movement of said trip bar and allowing tripping movement of said bar by other means while said element remains latched.

9. The combination with a switch unit having a rocking trip bar, of a tripping unit comprising an element formed to be slipped into interfitting relation with said bar to constitute an operating lever therefor, and said tripping unit further comprising electrically controlled latching means for said element, and a spring exerting pressure on said element to hold it in cooperative relation with said trip bar and to cause said element when free of said latching means to effect tripping movement of said bar, said element and said trip bar having interengaging parts including a V-shaped projection on one engaging in a wider V-shaped notch in the other and affording a positive operative connection but allowing tripping movement of said bar by other means while said element remains latched.

10. An enclosed switch unit comprising stationary contacts, a bridging contact and supporting and operating means for said bridging contact including a push button and biasing means, said biasing means yieldingly holding said bridging contact in engagement with said stationary contacts subject to disengagement by said push button through movement of said bridging contact perpendicularly of the plane of said stationary contacts, said supporting and operating means further including means affording sliding disengagement of said bridging contact from said stationary contacts followed by a right angle movement of said bridging contact under the influence of said biasing means to maintain said contacts disengaged pending a given subsequent operation of said push button.

11. An enclosed switch unit comprising stationary contacts, a bridging contact and supporting and operating means for said bridging contact including a push button and biasing means, said biasing means yieldingly holding said bridging contact in engagement with said stationary contacts subject to disengagement by said push button through movement of said bridging contact perpendicularly of the plane of said stationary contacts, said supporting and operating means further including means affording sliding disengagement of said bridging contact from said stationary contacts followed by a right angle movement of said bridging contact under the influence of said biasing means to maintain said contacts disengaged pending a given subsequent operation of said push button, said push button occupying an intermediate position when said contacts engage and assuming an extreme position when said bridging contact is moved by said biasing means following sliding disengagement of said bridging contact from the stationary contacts.

12. An enclosed switch unit comprising stationary contacts, a bridging contact, a push button reciprocably mounted in said unit and projecting therefrom, means biasing said push button outwardly, and means connected to and supported by said push button to support said bridging contact normally in engagement with said stationary contacts subject to disengagement by depression of said push button, the last specified means affording also sliding disengagement of said bridging contact from said stationary contacts for following movement perpendicularly of the plane of said stationary contacts as a function of said biasing means.

13. A composite device comprising a switch unit, an electrically controlled trip unit and interconnections therebetween, said switch unit comprising stationary contacts, a bridging contact, a push button having means biasing the same in one direction and means connected to said push button to support said bridging contact normally in engagement with said stationary contacts subject to disengagement by depression of said push button, the last specified means affording also sliding disengagement of said bridging contact from said stationary contacts for following movement of said bridging contact perpendicularly of the plane of said stationary contacts as a function of the bias of said push button, and said trip unit comprising means acting through said interconnections with said switch unit to effect the aforementioned sliding disengagement of said bridging contact from said stationary contacts.

14. A composite device comprising a switch unit, an electrically controlled trip unit and interconnections therebetween, said switch unit comprising stationary contacts, a bridging contact, a push button having means biasing the same in one direction, and means connected to said push button to support said bridging contact normally in engagement with said stationary contacts subject to disengagement by depression of said push button, the last specified means affording also sliding disengagement of said bridging contact from said stationary contacts for following movement of said bridging contact perpendicularly of the plane of said sta-

tionary contacts as a function of the bias of said push button, and said trip unit comprising means acting through said interconnections with said switch unit to effect the aforementioned sliding disengagement of said bridging contact from said stationary contacts, said bridging contact then requiring for realignment with said stationary contacts depression of said push button to space said bridging contacts from said stationary contacts as where the push button is depressed to disengage said bridging contact from stationary contacts.

15. A composite device comprising a switch unit, an electrically controlled trip unit and interconnections therebetween, said switch unit comprising stationary contacts, a bridging contact, a push button having means biasing the same in one direction, and means connected to said push button to support said bridging contact normally in engagement with said stationary contacts subject to disengagement by depression of said push button, the last specified means affording also sliding disengagement of said bridging contact from said stationary contacts for following movement of said bridging contact perpendicularly of the plane of said stationary contacts as a function of the bias of said push button, and said trip unit comprising means acting through said interconnections with said switch unit to effect the aforementioned sliding disengagement of said bridging contact from said stationary contacts, said trip unit requiring for resetting thereof depression of said push button as in the case of use of said push button to disengage said bridging contact from said stationary contacts and said trip unit retaining said bridging contact out of alignment with said stationary contacts pending movement of said push button to a position necessitating its release for reengagement of the realigned contacts.

16. A composite device comprising separate units, one having a switch mechanism inclusive of tripping means affording it only manual tripping and another of one of said units having automatic tripping mechanism for said switch mechanism, said tripping means requiring manual resetting after tripping operation thereof and interconnections between said switch mechanism and said tripping mechanism rendering the former responsive directly to the latter and rendering the former effective to reset the latter, said units having protecting parts enabling assembly of said units in an intimate side by side relation in which said protecting parts afford protecting enclosure of said mechanisms and said interconnections.

17. A composite device comprising separate units, one having a switch mechanism and others each having an automatic tripping mechanism for said switch mechanism, and means interconnecting said mechanisms when said units are arranged in a side by side relation, which means render said switch mechanism directly responsive to the tripping mechanism of any of a plurality of said other units, said switch unit per se affording said switch mechanism only manual tripping, each of said units having protecting parts, and such parts affording protecting enclosure of said mechanisms and said interconnecting means.

18. A composite device comprising separate units, one having a switch biased in one direction and provided with a rectilinearly movable push button to trip it against its bias, and other of said units each having automatic tripping means for said switch, and means interconnecting said units when placed in a side by side relation to subject said switch to tripping directly by said tripping units individually, all said units each having enclosing parts providing protecting enclosure of said switch, said tripping means and said interconnecting means.

19. In combination, a switch, a thermally responsive device, interconnections between said switch and said device for tripping of the former by the latter, said device having a sensitive element, a heat coil for said element and stepped terminal plates for electrical connection and support of said coil and constituting a medium of adjustment of said coil relative to said sensitive element thereby to vary the conditions under which said tripping device trips said switch.

20. In a switch, in combination, stationary contacts, a bridging contact, and supporting and operating means for said bridging contact comprising an element normally biased to yieldingly hold said bridging contact in alinement with said stationary contacts, a push button, and biasing means holding said bridging contact in engagement with said stationary contacts subject to disengagement by said push button through movement of said bridging contact perpendicularly of the plane of said stationary contacts, said element being movable against its bias to move said bridging contact out of alinement with said stationary contacts thereby to disengage said bridging contact from said stationary contacts and to free said bridging contact for movement past said stationary contacts by said biasing means, said contacts then remaining disengaged pending a given subsequent operation of said push button.

21. In a switch, in combination, stationary contacts, a bridging contact, a supporting member for said bridging contact, a reciprocable member for moving said supporting member in reverse directions, means biasing said supporting member to yieldingly hold said bridging contact in alinement with said stationary contacts, a push button secured to said reciprocable member and means biasing said push button for movement in one direction to afford engagement of said bridging contact with said stationary contacts when in alinement subject to disengagement by depression of said push button, said supporting member being movable against its bias to move said bridging contact out of alinement with said stationary contacts thereby to disengage said bridging contact from said stationary contacts and to free said bridging contact for movement past said stationary contacts as a function of the bias of said push button, said contacts then remaining disengaged pending a given subsequent operation of said push button.

22. In a protective switch device, in combination, a switch, an electrically controlled trip and interconnections therebetween, said switch comprising stationary contacts, a bridging contact and supporting and operating means for said bridging contact including an element normally biased to yieldingly hold said bridging contact in alinement with said stationary contacts, a push button and biasing means normally holding said bridging contact in engagement with said stationary contacts subject to disengagement by said push button through movement of said bridging contact perpendicularly of the plane of said stationary contacts, said element being movable against its bias to move said bridging contact out of alinement with said stationary contacts and to free

said bridging contact for movement past said stationary contacts as a function of said biasing means and said trip comprising means acting through said interconnections with said switch to effect the aforementioned movement of said element against its bias.

23. In a protective switch device, in combination, a switch, and electrically controlled trip and interconnections therebetween, said switch comprising stationary contacts, a bridging contact, a supporting member for said bridging contact, a reciprocable member for moving said supporting member in reverse directions, means biasing said supporting member to yieldingly hold said bridging contact in alinement with said stationary contacts, a push button secured to said reciprocable member and biased for movement in one direction to afford engagement of said bridging contact with said stationary contacts when in alinement subject to disengagement by depression of said push button, said supporting member being movable against its individual bias to move said bridging contact out of alinement with said stationary contacts thereby to disengage said bridging contact from said stationary contacts and to free said bridging contact for movement past said stationary contacts as a function of the bias of said push button, and said trip comprising means acting through said interconnections with said switch to effect the aforementioned movement of said supporting member against its individual bias.

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