

Feb. 18, 1947.

W. C. FURNAS

2,416,253

SWITCH

Filed Nov. 22, 1943

3 Sheets-Sheet 1

Fig. 1.

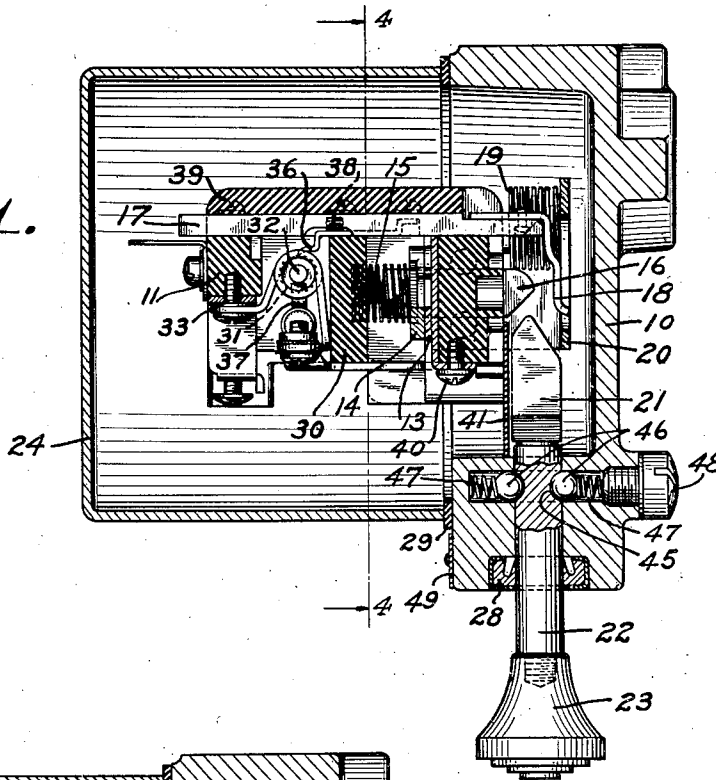
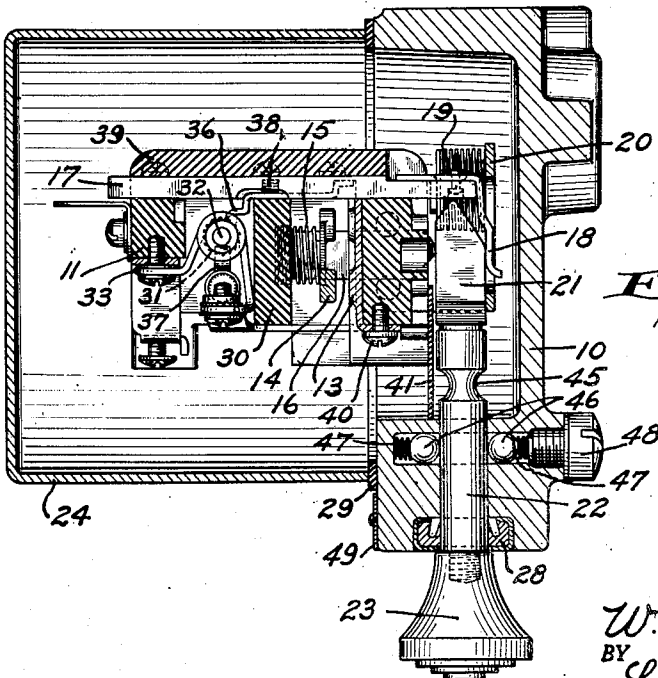


Fig. 2.

INVENTOR.
W. C. Furnas
BY
Lieber & Lieber
ATTORNEYS.

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W. C. FURNAS

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Fig. 3.

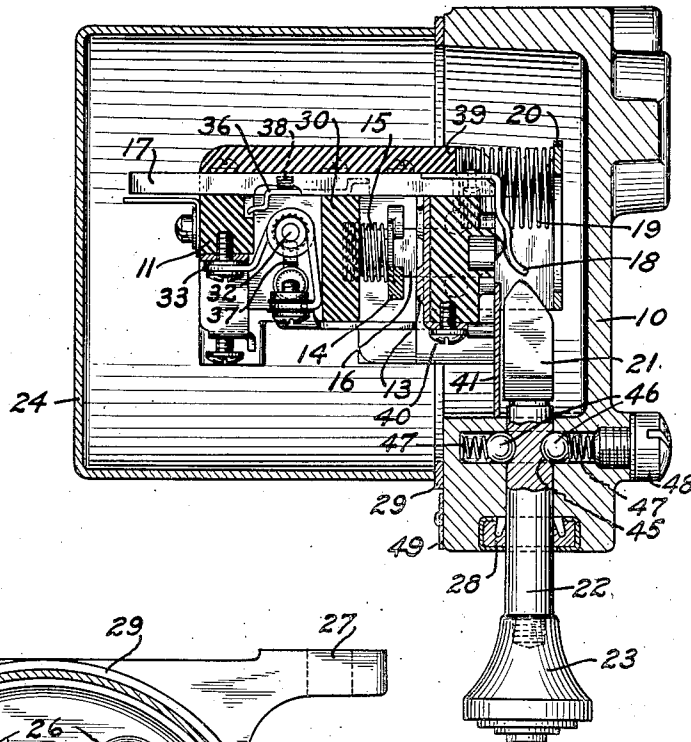
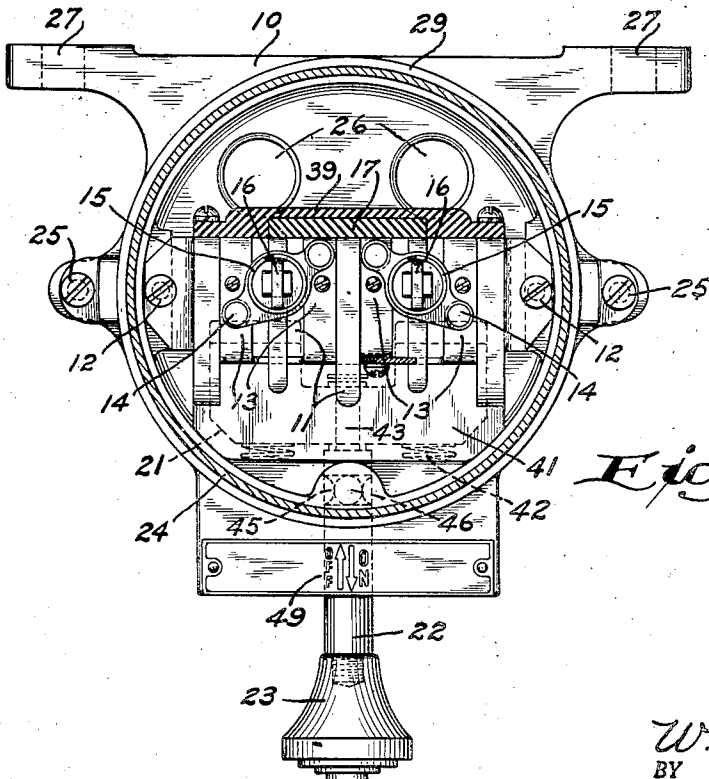


Fig. 4.

INVENTOR.
W. C. Furnas
BY
Lieber & Lieber
ATTORNEYS.

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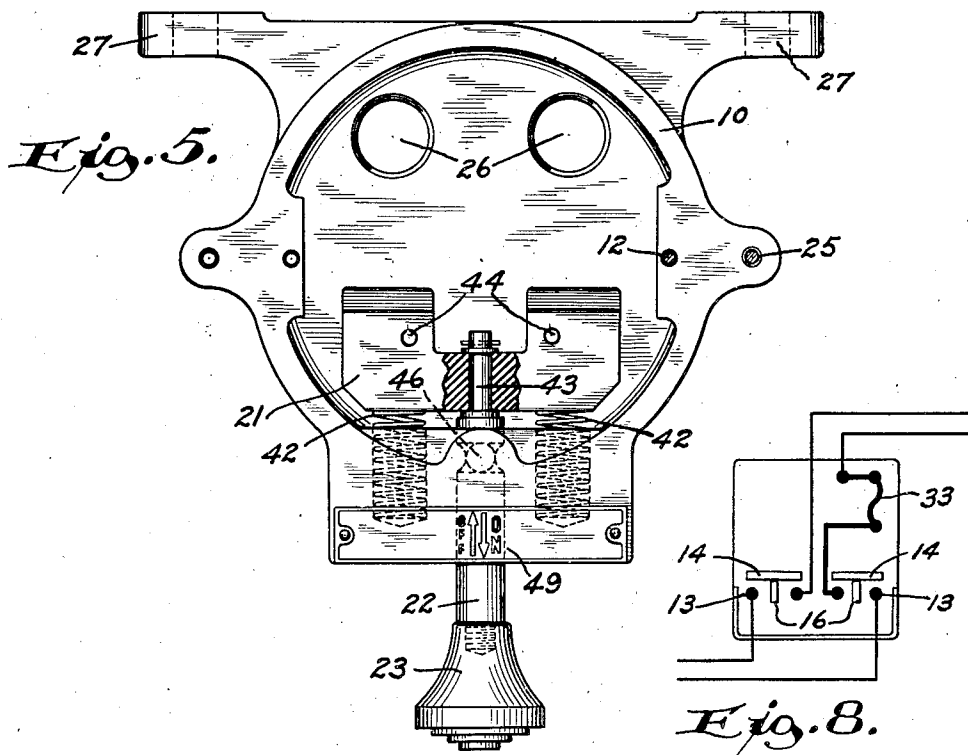
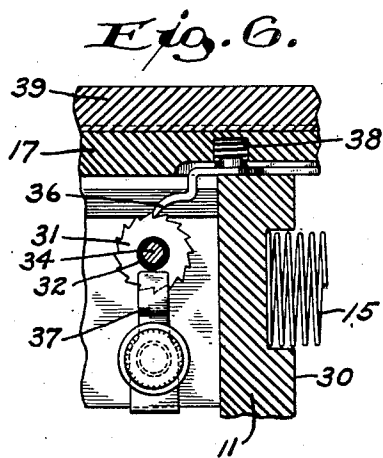
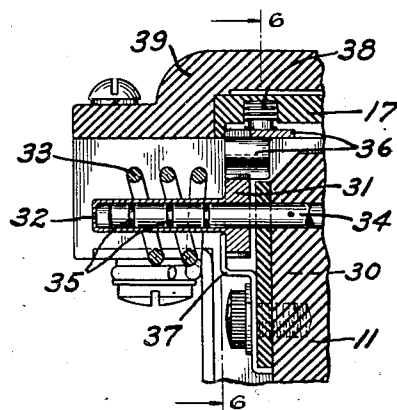
W. C. FURNAS

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3 Sheets-Sheet 3



INVENTOR.
W. C. Furnas
BY
Lieber & Lieber
ATTORNEYS.

UNITED STATES PATENT OFFICE

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SWITCH

William C. Furnas, Batavia, Ill., assignor to
Furnas Electric Company, Batavia, Ill., a cor-
poration of Illinois

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13 Claims. (Cl. 200—124)

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This invention relates generally to improvements in switches, and relates more specifically to improvements in the construction and operation of combined manually actuatable and automatically operable electric switch assemblies.

The primary object of the present invention is to provide a new and useful electric switch assemblage which is simple and compact in construction, and which is also extremely reliable and efficient in use.

Many different types of electric switch mechanisms for diverse purposes, have heretofore been proposed and used extensively, and in some of these prior switch structures provision has been made for automatically interrupting the electric circuits in case of dangerous overloading thereof. Thermal overload devices of various kinds, wherein the circuit is broken under overload conditions, by means of a heating element or coil coacting with a solder pot and ratchet mechanism for releasing the movable contacts for quick opening, have also been previously used; and in some of these prior thermal overload switches, the overload release coacted with the same switch contacts which were normally manually actuatable to open and close the circuit. While a number of these prior combined manually manipulable and thermal overload operable switch assemblies were quite satisfactory in use, most of them were unduly complicated and unreliable in operation, and required intricate and sensitive mechanisms which were costly to construct, difficult to assemble, and which could not be repeatedly operated for long periods of time and under severe conditions without requiring replacement of parts resulting in loss of valuable time. It is also necessary in thermal overload switches of this class, to provide means for promptly and safely restoring the switch to normal by resetting the overload device after actuation thereof, and most of the prior assemblies lacked simple and conveniently manipulable means for so doing, so that all of the previous thermal overload switch assemblies embodied one or more highly objectionable features.

It is therefore a more specific object of my present invention to provide an improved combined thermal overload and switch device wherein all of the above mentioned objectionable features are eliminated, and which is always "trip free" for operation of the thermal overload mechanism.

Another specific object of this invention is to provide a sturdy electric switch in which the same contacts are operable to control a circuit, both normally and under emergency conditions, with the aid of common actuating means, and wherein the operating member need merely be pushed or struck in order to interrupt the circuit.

A further specific object of the invention is to

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provide a combined manually actuatable electric switch and thermal overload device, wherein the normal actuator for the switch is also utilized to effect prompt resetting of the overload device after operation thereof, and in which normal use of the switch actuator in no way interferes with proper functioning of the device.

Still another specific object of the present invention is to provide an improved overload tripped switch assemblage for electric circuits, which is extremely compact and durable in structure, and all parts of which are normally thoroughly concealed and protected while being readily accessible for inspection.

An additional specific object of my invention is to provide an improved electric switch which is shock resistant and water-proof, and which can be manufactured at moderate cost so as to withstand severe service for a long period of time.

These and other specific objects and advantages of the invention will be apparent from the following detailed description.

A clear conception of the several features constituting my present improvement, and of the construction and operation of a combined manually operable switch and thermal overload device embodying the invention, may be had by referring to the drawings accompanying and forming a part of this specification wherein like reference characters designate the same or similar parts in the various views.

Fig. 1 is a central section through the supporting bracket and enclosing casing and an off-center section through the overload device and contact mechanism, of one of the improved switches, showing the overload slide set and the switch contacts in closed position;

Fig. 2 is a similar section through the switch assemblage, showing the overload slide still set and the switch contacts in open position;

Fig. 3 is another similar view of the switch mechanism, showing the overload slide tripped so as to place the switch contacts in open position, while the normal switch actuating elements are in contact closed position;

Fig. 4 is a transverse section through the switch assembly, taken along the line 4—4 of Fig. 1;

Fig. 5 is an inside view of the supporting bracket of the switch assemblage, showing the pivotal mounting for the actuating wedge in section;

Fig. 6 is an enlarged fragmentary transverse section through the latching and release mechanism of the thermal overload device;

Fig. 7 is a similarly enlarged fragmentary longitudinal section through the latching and release mechanism of the thermal overload device; and

Fig. 8 is a simple wiring diagram showing a typical electric circuit adapted to be opened and

closed with the aid of the improved switch mechanism.

While the improved features have been shown and described herein as being embodied in a direct current switch assemblage, it is not my desire or intent to thereby unnecessarily restrict the scope or utility of the improvements which are adapted for more general application to alternating current control switches as well.

Referring to the drawings, the present improved electric switch mechanism comprises in general, a rigid mounting or supporting bracket 10; a combined overload and switch contact carrier frame 11 detachably secured to the bracket 10 by means of screws 12; two pairs of fixed contacts 13 rigidly secured to the frame 11 in laterally spaced relationship; two corresponding movable bridge contacts 14 formed of conducting material and biased toward the adjacent fixed contacts 13 by helical compression springs 15, and being mounted upon reciprocable parallel stems 16 formed of insulating material and slidably coacting with slots in the frame 11; a thermal overload device of the solder pot type also carried by the frame 11 and having a ratchet release cooperable with a slide 17 which is movable along the frame 11 in a direction parallel to the contact carrier stems, the slide 17 being provided with transverse fingers 18 movable in alignment with the stems 16; a helical compression spring 19 coacting with an end of the slide 17 and reacting against a transverse yoke 20 secured to the frame 11, this spring constantly tending to urge the slide 17 toward contact opening position; a tapered element or wedge 21 movable into and out of the gap between the fingers 18 and the adjacent ends of the contact carrier stems 16, by means of a reciprocable rod 22 and a manipulating knob 23; and a closure cover or housing 24 detachably secured to the bracket 10 by screws 25.

The mounting or supporting bracket 10 may be formed by casting or otherwise, and is provided with threaded openings 26 adapted for attachment of the electrical conductor conduits, and also has integral attaching flanges 27, see Figs. 4 and 5. The main bracket 10 is furthermore provided with a waterproof seal 28 embracing the rod 22, and with an annular sealing gasket 29 against which the housing 24 may be forced by the screws 25 so as to provide a moisture-proof enclosure for the thermal overload and switch mechanisms, as illustrated in Figs. 1 to 5, inclusive. The closure housing 24 is, however, readily removable so as to reveal the normally concealed mechanism for inspection, and the bracket 10 may obviously be suspended in any desired position.

The normally concealed frame 11 which is removably attached to the bracket 10 by means of the screws 12, is formed of durable insulating material, and is provided with two separate chambers within which the two sets of fixed and movable switch contacts 13, 14 are confined. As previously indicated, the two movable bridge contacts 14 are constantly urged toward the adjacent stationary contacts 13 by means of helical compression springs 15 as depicted in Figs. 1 to 4 inclusive, and these springs 15 surround the inner ends of the movable contact supporting bars 16 and are seated in sockets formed in the central transverse wall 30 of the frame 11. The parallel contact supporting bars 16 are formed of bars of suitable insulating material and have their outer ends chamfered and pointed as shown

in Fig. 1, for proper cooperation with the slide fingers 18 and with the wedge 21.

The thermal overload device which is also carried by the frame 11, is of the type disclosed in Patent No. 2,296,157, granted September 15, 1942, being shown in detail in Figs. 1, 2, 3, 6 and 7, and comprises a ratchet wheel 31 having a solder pot 32 formed integral and concentric therewith; a heating coil 33 surrounding the solder pot 32 and being connected in series with one of the fixed contacts 13; a fixed shaft 34 permanently secured to the center wall 30 of the frame 11 and having therein annular grooves 35 containing solder slugs with which the pot 32 coacts; a pawl 36 cooperable with the teeth of the ratchet wheel 31 and being resiliently mounted upon the reciprocable slide 17; and the compression spring 19 which is cooperable with the end of the slide 17 as illustrated in said patent, so as to constantly urge the fingers 18 toward the outer ends of the movable contact carrier bars or stems 16.

The ratchet wheel 31 is normally retained within the path of movement of the pawl 36 by a retainer 37, and while the wheel 31 is normally soldered to the fixed shaft 34 by means of the solder slugs disposed within the grooves 35, the coil 33 will become heated under overload conditions and will melt the solder and thereby release the ratchet wheel 31 for free rotation about the fixed shaft 34. The pawl 36 is constantly urged toward the ratchet wheel 31 by means of a small spring 38 as shown in Figs. 6 and 7; and the slide 17 is formed of wear resistant material and is guided along the frame 11 for movement parallel to the switch contact carrying stems 16 by means of a removable plate 39. The fingers 18 and the transverse yoke 20 against which the tripping spring 19 reacts, may be formed of metal stampings; and while the pawl 36 normally coacts with the fixed ratchet wheel 31 to compress the spring 19 and hold the fingers 18 out of the normal range of movement of the outer ends of the contact stems 16 as in Figs. 1 and 2, release of the wheel 31 due to overload conditions will cause the spring 19 to trip the slide 17 and will open both of the movable contacts 14 as shown in Fig. 3.

The tapered block or wedge 21 which is movable transversely of the direction of travel of the stems 16 and slide 17, by means of the rod 22 and knob 23, may be formed of hard rubber or other suitable wear-resistant material, and has two oppositely inclined wedge surfaces of different lengths. This wedge 21 is disposed within a cavity in the bracket 10 and is normally movable into and out of the gap between the fingers 18 and the outer ends of the movable contact carrier stems 16, by means of the rod 22 and knob 23, as will be noted from Figs. 1 and 2. In order to shield the wedge 21 from the fixed contact terminal screws 40, an insulating shield 41 may be provided, see Figs. 1 to 4 inclusive. The wedge 21 coacts with helical compression springs 42 confined within recesses in the bracket 10, and is pivotally mounted upon the reduced inner end portion 43 of the actuating shaft 22 as indicated in Fig. 5. The shorter taper of the wedge 21 is normally adapted to coact with the outer chamfered ends of both contact stems 16 when the button or knob 23 is pushed inwardly, so as to simultaneously open both movable contacts 14, as shown in Fig. 2; and when the knob 23 and wedge 21 are pulled outwardly, the springs 15 will simultaneously close both of the movable contacts 14. However, when the wedge 21 is

withdrawn and the overload device becomes active as in Fig. 3, then the fingers 18 are brought into engagement with the outer ends of both stems 16, thereby automatically opening both movable contacts 14 and breaking the circuit through both sets of fixed and movable contacts 13, 14; and the longer taper of the wedge 21 may thereafter be utilized to reset the overload device.

The flexible suspension of the wedge 21 upon the actuating rod or shaft 22, will permit the wedge to float and properly contact both of the stems 16 and fingers 18 without undesirably stressing the parts, and small sockets 44 may be provided in the wedge face as shown in Fig. 5 in order to receive and retain the pointed ends of the stems 16 and these sockets 44 will maintain the wedge 21 in position when said wedge and the rod or shaft 22 are in contacts open position. To retain the wedge 21 and the rod 22 in contacts closed position, the rod is provided with an annular groove 45 as indicated in Figs. 1 and 3. The balls 46 are pressed toward the rod 22 by means of springs 47, and are removably confined within a bored socket in the bracket 10 by a screw 48. The bracket 10 may also be provided with one or more index plates 49 for indicating on and off movement of the rod 22 and knob 23, and all assembly screws of the mechanism may be provided with lock washers for preventing loosening thereof due to shock or vibration.

The improved two pole switch and overload protective assemblage may be applied to a direct current electric circuit in the manner shown diagrammatically in Fig. 8, and the conductors leading to and from the switch mechanism may be extended through moisture-proof conduits connected to the threaded bracket openings 26. After proper installation of the assemblage in an electric circuit, the manually manipulable knob 23 and rod 22 may be utilized to make or break the circuit, without interference by the overload protective device, by merely pushing or pulling on the knob 23. When this knob has been pulled out as in Fig. 1, the springs 15 are active to close both sets of switch contacts 13, 14 and the overload mechanism is free to function if excessive overloading of the circuit should occur. If the knob 23 and rod 22 are pushed inwardly to the position shown in Fig. 2, both sets of switch contacts 13, 14 are opened thus interrupting the circuit in two places and eliminating all possibility of overload. However, when the circuit is closed by withdrawal of the wedge 21, and excessive overload conditions are established, then the heating coil 33 melts the solder slugs within the solder pot 32 thereby releasing the ratchet wheel 31 for free rotation about the fixed stub shaft 34, and the pawl 35 and slide 17 are quickly released and urged toward the extreme left as viewed in Fig. 3, thus causing the fingers 18 to contact the outer ends of the stems 16 and quickly opening both sets of switch contacts 13, 14. This movement of the overload slide 17 is produced by the spring 19; and in order to thereafter reset the overload device, it is only necessary to await solidification of the solder slugs and to subsequently push the knob 23 and wedge 21 inwardly until the wedge 21 coacting with the fingers 18 has shifted the slide 17 and the pawl 35 back into engagement with the teeth of the relocked ratchet wheel 31. It will thus be noted that the single wedge 21 serves not only to effect normal actuation of the switch contacts, but is also utilized to reset the overload device, and this wedge in no manner interferes with the

automatic functioning of the overload protective mechanism.

From the foregoing detailed description it must be apparent that my present invention provides an improved combined electric switch and overload protective assemblage which is extremely simple, compact and durable in construction, and which is moreover highly efficient in operation. The thermal overload device while being free to function automatically and quickly when the switch is closed, can be just as rapidly reset with the same simple wedge assembly which is normally employed to actuate the switch. The same sets of contacts are also utilized to make and break the circuit during both manual and automatic operation, and additional protection is afforded by utilizing two sets of contacts which may be simultaneously either opened or closed. The improved wedge structure also performs its various functions in an effective manner without subjecting the various parts to undesirable stresses, and serves to equalize the pressures on both of the contact carrier stems by virtue of its improved construction and mounting. The switch assemblage is moreover shock-resistant, moisture-proof, and of sturdy and durable construction, while all elements thereof are conveniently accessible for inspection and operation. The improved switch while being quickly and conveniently operable cannot be accidentally placed in contacts closed position by shock or bumping of the assemblage. The new switch mechanism can also be manufactured at moderate cost for use with either direct or alternating current, and has proven highly satisfactory and successful in actual use.

While the improved switch actuating mechanism has been shown and described herein as being applied to a switch having only two sets of contacts, it is also applicable to switches having more than two sets of contacts and to thermal overload devices having more than one heater, such as shown in Furnas Patent No. 2,296,157.

It should be understood that it is not desired to limit this invention to the exact details of construction or to the precise mode of use, herein shown and described, for various modifications within the scope of the appended claims may occur to persons skilled in the art.

I claim:

1. In combination, relatively movable switch contacts for closing and opening an electric circuit, a slide coacting with said contacts and being operable by thermal overloading to separate said contacts and to thereby automatically open the circuit, and a wedge having oppositely inclined wedge surfaces one of which is normally operable to selectively move said contacts in order to effect both closing and opening of said circuit, the other of said wedge surfaces being cooperable with said slide to reset the latter after said automatic opening of the circuit.

2. In combination, relatively movable switch contacts for closing and opening an electric circuit, a slide coacting with said contacts and being operable by thermal overloading to separate said contacts and to thereby automatically open the circuit, a wedge having oppositely inclined wedge surface one of which is normally operable to selectively move said contacts in order to effect both closing and opening of said circuit, the other of said wedge surfaces being cooperable with said slide to reset the latter after said automatic opening of the circuit, and manually operable means for reciprocating said wedge to effect both nor-

mal opening and closing of the circuit and return of said slide to inactive position.

3. In combination, two sets of fixed and movable contacts for simultaneously making and breaking the same electric circuit, a thermal overload device for automatically separating the contacts of both sets to break the circuit, and a single wedge having opposite wedge surfaces one of which is normally movable to separate said contacts and the other of which is movable to reset said device after automatic operation thereof.

4. In combination, two sets of fixed and movable contacts for simultaneously making and breaking the same electric circuit, a thermal overload device for automatically separating the contacts of both sets to break the circuit, a single wedge having one wedge surface normally movable to separate said contacts and also having an opposite wedge surface movable to reset said device after automatic operation thereof, and manually actuable means for moving said wedge in like manner during both normal making and breaking of said circuit and during resetting of said device following automatic operation thereof.

5. In combination, two sets of fixed and movable contacts for simultaneously making and breaking the same electric circuit, the movable contacts of said sets having reciprocal parallel guide stems, a slide movable parallel to said stems and being normally out of engagement with the stems but cooperable therewith to move said movable contacts and to break the circuit under overload conditions, and a wedge movable transversely of the direction of movement of said stems and slide to effect normal movement of said movable contacts and to also reset said slide.

6. In combination, two sets of fixed and movable contacts for simultaneously making and breaking the same electric circuit, the movable contacts of said sets having reciprocal parallel guide stems, a slide movable parallel to said stems and being normally out of engagement with the stems but cooperable therewith to move said movable contacts and to break the circuit under overload conditions, a wedge movable transversely of the direction of movement of said stems and slide to effect normal movement of said movable contacts and to reset said slide, and a single wedge movable across said stems and slide to break said circuit and to also reset said slide after normal conditions have been restored.

7. In combination, two sets of fixed and movable contacts, the movable contacts of said sets having laterally spaced simultaneously movable reciprocable carrier stems, a wedge movable laterally of said stems to simultaneously move the latter in the same direction, and an actuating rod for said wedge upon which the wedge is pivotally mounted the pivotal axis of said rod being disposed transversely of and between said stems.

8. In combination, two sets of fixed and movable contacts, the movable contacts of said sets having laterally spaced simultaneously movable reciprocable carrier stems, a wedge movable laterally of said stems to simultaneously move the latter in the same direction, an actuating rod for said wedge upon which the wedge is pivotally mounted, and an overload protective device cooperable with the circuit controlled by said contacts and having a tripping slide provided with fingers movable in the planes of reciprocation of said stems, said wedge also being cooperable with said fingers to reset said device.

9. In combination, two sets of fixed and movable contacts, the movable contacts of said sets having laterally spaced parallel and simultaneously reciprocable carrier stems and being spring biased toward closed position, and a pivotally suspended wedge movable laterally of said stems and being cooperable therewith to simultaneously open said movable contacts the pivotal axis of said wedge being disposed transversely of and between said stems.

10. In combination, two sets of fixed and movable contacts, the movable contacts of said sets having laterally spaced parallel and simultaneously reciprocable carrier stems and being spring biased toward closed position, a pivotally suspended wedge movable laterally of said stems and being cooperable therewith to simultaneously open said movable contacts, and an overload protective device connected in series with said contacts and having a tripping slide provided with fingers movable in the planes of reciprocation of said stems, said wedge also being cooperable with said fingers to simultaneously reset said device and to open said movable contacts.

11. In combination, a set of fixed and movable contacts, the movable contact of said set having a reciprocable carrier stem, a wedge cooperable with the end of said stem to move said movable contact, and an actuating element for moving said wedge, the wedge being pivotally suspended from said element and the pivotal axis being disposed transversely of said stem.

12. In combination, a set of fixed and movable contacts, the movable contact of said set having a reciprocable carrier stem, a wedge cooperable with the end of said stem to move said movable contact, an actuating element for moving said wedge, the wedge being pivotally suspended from said element, and an overload protective device connected in the same circuit with said contacts and having a tripping member provided with an element movable in the plane of reciprocation of said stem, said wedge also being cooperable with said element to simultaneously reset said device and to open said movable contact.

13. In combination, a set of fixed and movable contacts, the movable contact of said set having a reciprocable carrier stem, a wedge cooperable with the end of said stem to move said movable contact, an actuating element for moving said wedge, the wedge being pivotally suspended from said element, and an overload protective device connected in the same circuit with said contacts and having a tripping member provided with an element movable in the plane of reciprocation of said stem, said wedge also being insertible between said stem and element to simultaneously move said member and said movable contact.

WILLIAM C. FURNAS.

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