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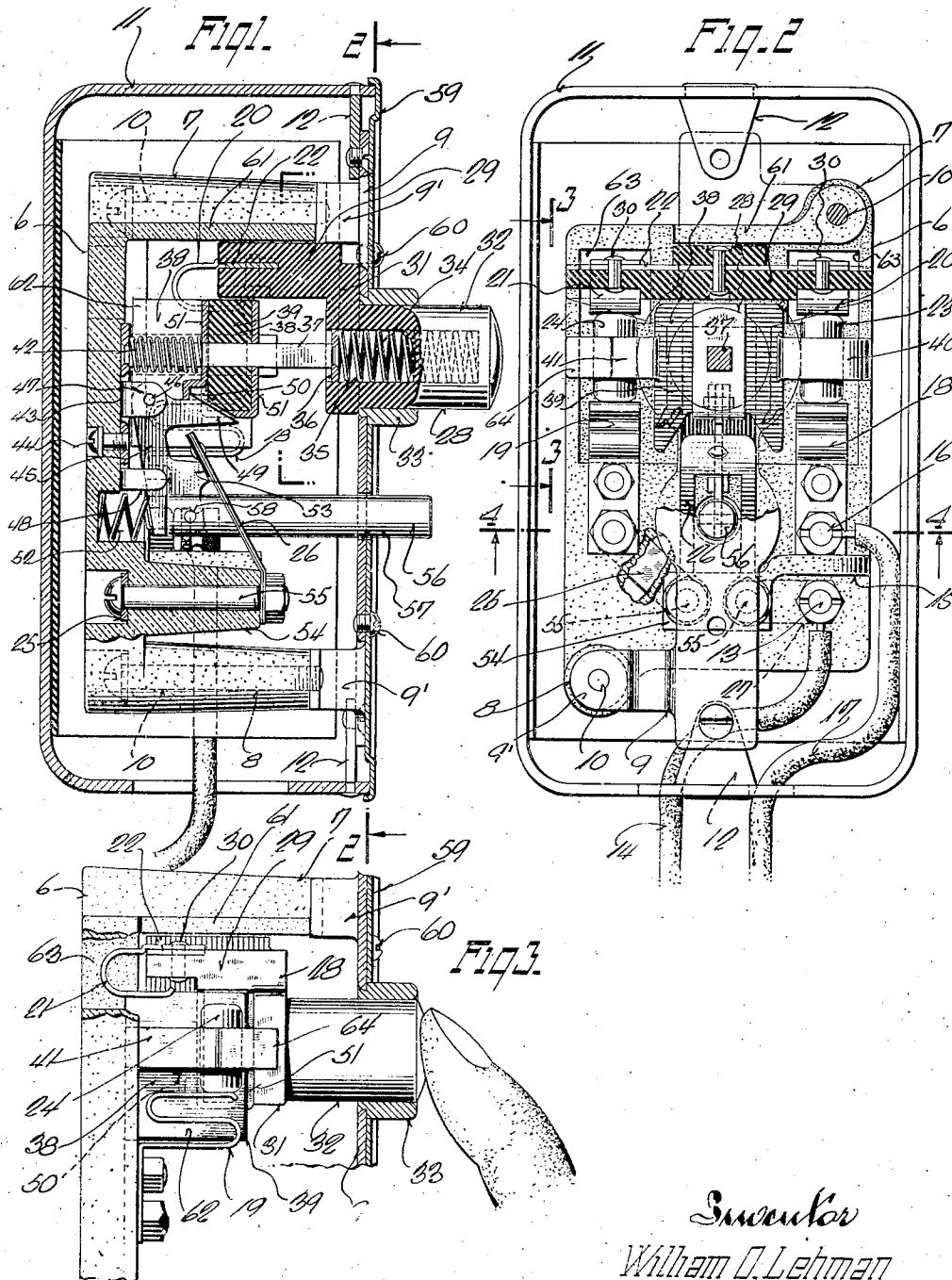
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1,928,940

ELECTRIC SWITCH

Filed April 1, 1931

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 4.

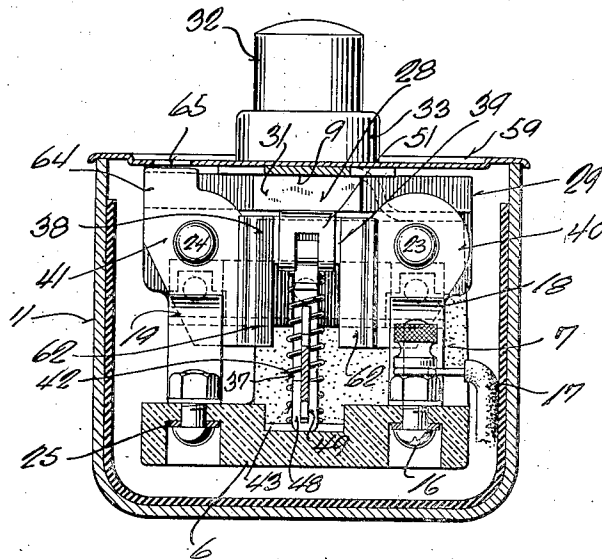
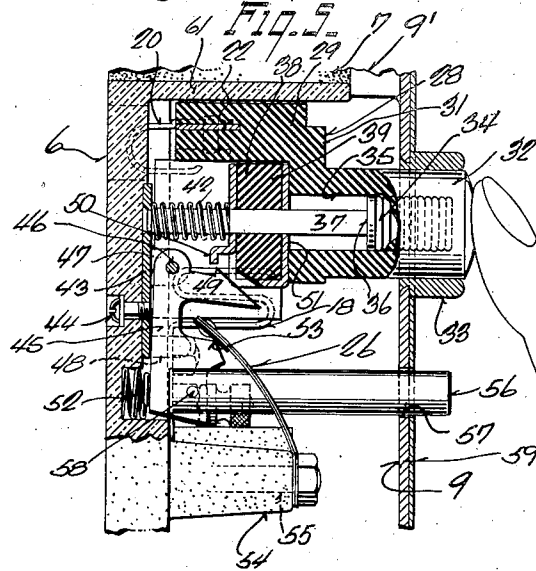


Fig. 5.



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## UNITED STATES PATENT OFFICE

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## ELECTRIC SWITCH

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Application April 1, 1931. Serial No. 526,911

15 Claims. (Cl. 200—116)

This invention relates to certain new and useful improvements in electric switches and refers more particularly to switches which embody a protective overload feature.

In its broad aspects this invention is similar to that described in the copending application of Gustav O. Wilms, Serial No. 321,317, filed November 23, 1928, and is embodied in a switch adapted to be closed manually and opened either manually or automatically, but in which closure of the switch depends upon the position of a latch element adapted to be moved out of its operative position by means responsive to an overload in the circuit in which the switch is included, so that it is impossible to hold the switch closed and thus defeat its overload protective feature.

It is an object of this invention to improve the construction of switches of this character.

Another object of this invention is to provide a switch of the character described in which the circuit is broken at four points to thus assure positiveness of operation.

Another object of this invention is to provide a switch of the character described, which is of unitary construction and may be mounted in and removed from an enclosing casing as a unit.

And a further object of this invention is to provide a switch of the character described in which the several elements are comparatively rugged.

And a still further object of this invention resides in the provision of a switch of the character described in which the possibility of arc-over is greatly diminished.

With the above and other objects in view which will appear as the description proceeds, my invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the herein disclosed invention may be made as come within the scope of the claims.

In the accompanying drawings I have illustrated one complete example of the physical embodiment of my invention constructed according to the best mode I have so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a longitudinal sectional view through a switch embodying my invention;

Figure 2 is a view partly in elevation and part-

ly in section, taken through Figure 1 on the plane of the line 2—2;

Figure 3 is a partial side elevation illustrating the position of the various contacts, upon depression of the main actuating button;

Figure 4 is a cross sectional view taken through Figure 2 on the plane of the line 4—4; and

Figure 5 is a view similar to Figure 1 of a portion of the mechanism illustrating the manner in which the thermally actuated protective device functions.

Referring now more particularly to the accompanying drawings, in which like numerals designate like parts, the numeral 6 represents a base on which the switch structure, to be later described, is mounted and which is formed of porcelain or molded insulating material. At two diagonally opposite corners the base 6 has upstanding projections 7 and 8 to which a mounting strap 9 is secured by screws 10 passed through openings in the base and threaded in offset side arms 9' on the mounting strap.

The mounting strap 9 is thus disposed above the central portion of the base and has its ends extended beyond the base to provide means by which the base and the switch mechanism, mounted thereon, may be supported in an enclosing casing 11, the ends of the mounting strap being secured to inwardly extending lugs 12, carried by the end walls of the casing.

A terminal screw 13 mounted at the lower portion of the base (with respect to Figure 2) is adapted to have a lead 14 connected therewith, and disposed on the other side of an insulating barrier 15 projected upwardly from the base adjacent the terminal screw 13, is a second terminal screw 16 to which a second lead 17 is adapted to be connected. The leads 14 and 17 are adapted to be electrically connected to complete the continuity of the circuit in which the said leads are included, by the switch mechanism now about to be described.

The switch mechanism comprises a pair of stationary contacts 18 and 19, a pair of movable contacts 20 and 21 electrically connected by a bridge piece 22, and a pair of contactors 23 and 24 adapted to electrically connect the stationary and movable contacts when the contacts and contactors are in certain relative positions. The stationary contact 18 is directly connected with the terminal screw 16 and the stationary contact 19 is connected with the terminal screw 13 through a conductor strip 25 at the under side of the base, a substantially U shaped thermal element 26,

and a conductor strip 27, which, like the strip 25, is disposed beneath the base.

As best illustrated in Figure 3, both stationary contacts 18 and 19 are formed of strips of spring metal bent to substantially S shape and securely mounted on the base to extend upwardly therefrom with their contact portions in substantially perpendicular relation to the base. The movable contacts 20 and 21, are as stated, electrically connected by a bridge piece 22 and together therewith are carried by an actuator indicated generally by the numeral 23.

The actuator 23 is formed of insulating material being preferably molded of a phenol condensation product or the like, and comprises a transverse arm 29 to the outer ends of which the movable contacts 20 and 21 are secured by rivets 30 which also pass through the ends of the bridge piece 22, and a medially disposed head 31 from which a cylindrical stem 32 projects to provide a push button. The cylindrical stem 32 which forms the push button is slidably disposed in a bearing sleeve 33 carried by the mounting strap 9 and the entire actuator is yieldably maintained in its outermost position illustrated in Figure 1 with the cylindrical stem 32 projected outwardly of its bearing 33, by an expansive spring 34 mounted in a bore 35 formed in the head of the actuator and confined between the bottom of the bore and a plate 36 on the outer end of a stem 37 fixed with respect to the base 6 and mounted therefrom in a manner to be later described.

The movable contacts 20 and 21, like the fixed contacts, are formed of spring metal and as best illustrated in Figure 3 are substantially U shaped with their contact surfaces disposed parallel with the contact surfaces of the fixed contacts, but in a plane spaced therefrom, the distance between the contact surfaces of the fixed and movable contacts being slightly less than the length of the movable contactors 23 and 24 so that when the movable contacts and the contactors are in certain positions relative to the fixed contacts the ends of the contactors will be engaged with the contact surfaces of the fixed and movable contacts under spring tension.

The contactors 23 and 24, which may be considered intermediate contacts, are carried by a movable head 38 slidably mounted on the stem 37. The stem 37 and the opening in the head in which it is received are square or of other polygonal shape to prevent rotation of the head 38 about the stem 37. The head 38 is molded from a phenol condensation product or other suitable insulating material and consists of a central substantially square portion 39 from the sides of which arms 40 and 41 project to mount the contactors 23 and 24 respectively. The member 38 is yieldably urged upwardly from the base 6 and toward the main actuator by an expansive spring 42 surrounding the stem 37 and confined between the central substantially square portion 39 on the movable member 38 and a mounting plate 43 to which the stem 37 is fixed to be mounted thereby from the base, the plate 43 being disposed in a suitable recess in the base 6 and being secured therein by a screw 44.

With the switch open the movable head 38, is held against the undersurface of the actuator head 31 so that the contactors 23 and 24 are not connected with either the stationary or movable contacts. Upon depression of the actuator by its push button portion as illustrated in Figure 3, the movable contacts 20 and 21 and the contactors 23 and 24 are simultaneously moved

toward the base, but inasmuch as the movable contacts move in advance of the contactors during their movement toward the base, engagement of the contactors with the stationary contacts does not complete the circuit. To effect complete closure it is necessary that the movable head 38 carrying the contactors be retained in its depressed position illustrated in Figure 1 and the actuator released to permit its spring 34 to retract the same to its outermost position at which the movable contacts 20 and 21 engage the adjacent ends of the contactors. It is noted that the actuator is positively guided in its movement by the stem 37 by reason of its reception in the actuator bore 35.

To hold the movable member 38 in its operative depressed circuit making position, a latch member 45 is provided. The latch member 45 is pivotally mounted as at 46 between a pair of upstanding lugs or ears 47 on the plate 43 and is guided for movement by a pair of lugs 48 also projected from the plate 43. A hooked arm 49 extended from the latch member forms the latch proper and engages a finger 50 carried by the movable head 38.

The finger 50 is formed by striking out a portion of a substantially U shaped strip 51 embracing the central portion 39 of the head 38, the arms of the U shaped member 51 being apertured to permit the stem 37 to pass therethrough. Engagement of the latch proper with the finger 50 upon inward movement of the head 38, is facilitated by the inclined leading edge of the outwardly extended arm 49, and a small coiled spring 52 is disposed in a suitable recess in the base beneath the outermost end of the latch member 45 to yieldably urge the same to operative position.

Under usual conditions, that is, as long as no overload exists in the circuit with which the switch is connected, the latch member 45 is free to function in the described manner, but upon the occurrence of an overload condition, the U shaped thermal element 26 which is formed of a bi-metallic strip, flexes as illustrated in Figure 5 and moves the latch member 45 about its pivotal mounting to disengage the latch proper from the finger 50 carried by the movable head 38, if the switch is closed, freeing the spring 42 and permitting the same to open the circuit by projecting the movable head 38 and the contactors carried thereby to its inoperative position.

Upon opening of the circuit the thermal element 26 cools and assumes its normal position permitting the latch member 45 to return to its operative position. If the overload condition is but momentary or has been relieved by the time the switch is again closed, the thermal element will retain its normal position permitting the switch to remain closed, but if the overload condition still exists the thermal element will again deflect and disengage the latch member permitting the switch to open.

To prevent grounding of the circuit by engagement of the thermal element with the latch member, an insulating medium 53 is fixed to the outer closed end of the bi-metallic member.

The bi-metallic member, as clearly illustrated in Figures 1 and 5, is mounted on the outer end of a projection 54 on the base, by bolts 55 which pass through openings therein and electrically connect the conductor strips 25 and 27 with the ends of the bi-metallic member.

The switch also may be opened manually by depressing a stem 56 projected through an open-

ing 57 in the mounting strap 9 and pivotally connected as at 58 with the outer end of the latch member 45, and a cover 59 is provided to close the open side of the casing 11 and is mounted by screws 60 threaded in the mounting strap 9.

It is noted that the construction of the base, and the movable head 38 carrying the contactors is such that the contacts are effectively separated by insulating barriers which cooperate to form arc shields. These barriers consist of an upstanding wall 61 on the upper end of the base, the transverse arms 40 and 41 of the head 38 to which the contactors 23 and 24 are respectively secured, and downwardly depending flanges 62 on the movable head 38.

It is also noted that the flanges 62 on the movable head 38 project from its portion 39 toward the base and engage the same to limit the movement of the movable head 38 and the actuator in closing the switch, and to permit the full movement of the actuator, the base has openings 63 for the reception of the movable contacts. The transverse arm 41, of the movable head has a raised projection 64 which, when the movable member 38 is in its circuit breaking position, is directly beneath an opening 65 in the cover 59 (see Figure 4) to visually indicate that the switch has been opened either manually or by the bi-metallic member.

With the switch in circuit making position as illustrated in Figure 1, the circuit extends from the terminal screw 13 through the U shaped bi-metallic member 26 and the stationary contact 19, through the contactor or intermediate contact 24 to the movable contact 20, and through the contactor 23 to the other fixed contact 18 with which the terminal screw 16 is directly connected.

Upon release of the latch member either by manual depression of the stem 56 or actuation of the bi-metallic member 26 brought about by an excessive current flow therethrough, the movable member 38 carrying the contacts 23 and 24 is quickly moved by its urging spring 42 to its position disengaged from both the stationary and movable contacts, and as the outer ends of the contacting surface of both the fixed and movable contacts are substantially in the same plane, the ends of the contactors 23 and 24 leave the same simultaneously. In this manner, the circuit is broken simultaneously at four points so that a tendency toward arcing is reduced to a minimum, and by reason of the effective insulating barriers the possibility of arc-over is considerably reduced, and creepage from one terminal to the other is practically impossible.

What I claim as my invention is:

1. In an electric switch of the character described adapted to open and close a circuit comprising a stationary contact, a plurality of movable contacts adapted when in predetermined relative positions with respect to each other and the stationary contact, to electrically connect all of the contacts and close the circuit, means for moving said movable contacts to said relative positions, and means for releasing one of the movable contacts, for movement out of engagement with both of its adjacent contacts.

2. A switch device for opening and closing an electric switch comprising spaced contacts one of which is movable, an intermediate contact, means movably mounting said intermediate contact, said intermediate contact being movable by the first mentioned movable contact to a position at which, upon a second movement of the

first mentioned movable contact, it engages said spaced contacts to close the circuit, means for releasably holding the intermediate contact in said position, means for releasing the intermediate contact for movement out of engagement with said spaced contacts, and means for moving said intermediate contact upon its release.

3. A switch device for opening and closing an electric circuit, comprising a stationary contact, a movable contact movable in a plane spaced from and substantially parallel to the stationary contact, means normally maintaining the movable contact in a position substantially opposite the stationary contact, an intermediate movable contact adapted to electrically bridge the stationary and first mentioned movable contacts when in a predetermined position, said intermediate contact being movable to said predetermined position upon movement of the first mentioned movable contact out of its normal position, said first mentioned movable contact moving in advance of the intermediate contact during the movement of the intermediate contact to its predetermined position whereby the circuit is completed only after the first mentioned movable contact is returned to its normal position, means for releasably holding the intermediate contact in said predetermined position, means for releasing the intermediate contact for movement out of its predetermined position, and means for moving the intermediate contact out of its predetermined position upon its release.

4. In a switch device adapted to open and close an electric circuit, a plurality of contacts, said contacts being electrically engaged to close the circuit when certain of the contacts are moved to predetermined positions, means whereby movement of one of said certain contacts in two directions is necessary to place the contacts in said predetermined positions, and means operable manually and upon an overload in the circuit to release one of said moved contacts for substantially simultaneous movement out of engagement with the other contacts to open the circuit.

5. In a switch device adapted to open and close an electric circuit, a plurality of contacts, said contacts being electrically engaged to close the circuit when certain of the contacts are moved to predetermined positions, means whereby movement of one of said certain contacts in two directions is necessary to place the contacts in said predetermined positions, releasable means for holding one of said moved contacts in its respective circuit closing position, means operable manually and upon an overload in the circuit to release said releasably held contact for movement out of circuit closing position, and means operable upon such release for simultaneously disengaging said contact from the other contacts with a snap action.

6. A switch device for closing and opening an electric circuit, comprising a stationary contact, a movable contact, and an intermediate movable contact adapted to electrically engage the stationary contact and first mentioned movable contact when in a predetermined position to complete the circuit, means normally maintaining the intermediate contact out of engagement with both the stationary contact and the first mentioned movable contact, means for simultaneously moving the movable contacts to a position at which the intermediate contact engages the stationary contact, means for releasably holding the intermediate contact in said position, and means for

moving the first mentioned movable contact to a position engaging the intermediate contact.

7. A switch device for closing and opening an electric circuit, comprising a stationary contact, a movable contact, an intermediate movable contact adapted to electrically bridge the stationary contact and first mentioned movable contact when in a predetermined position to complete the circuit, means normally maintaining the intermediate contact out of engagement with both the stationary contact and the first mentioned movable contact, means for moving the movable contact to a position at which the intermediate contact engages the stationary contact, means for releasably holding the intermediate contact in said position, means for moving the first mentioned movable contact to a position engaging the intermediate contact, and means operable manually and upon an overload in the circuit for releasing the intermediate contact for movement by its urging means to its normal position disengaged from both the stationary and the first mentioned movable contacts.

8. An electric switch device for closing and opening a circuit comprising a plurality of contacts adapted to be electrically engaged when in predetermined relative positions to close the circuit, one of said contacts being movable to circuit closing position only by actuation of another contact out of circuit making position whereby return of said last mentioned contact to its original position is necessary to close the circuit, means for releasably holding the first designated contact in circuit making position, means operable manually and upon the occurrence of an overload in the circuit for releasing said first designated contact, and means for moving said contact out of engagement with the other contacts with a snap action upon such release.

9. In an electric switch for closing and opening an electric circuit, a pair of spaced contacts, an intermediate bridging contact, means for moving one of the spaced contacts to move the intermediate contact to operative bridging position, said moved spaced contact moving in advance of the intermediate bridging contact whereby return of said moved spaced contact is necessary to engage it with the intermediate bridging contact and complete the circuit, means for returning said spaced contact, and means operable upon overload conditions in the circuit for effecting movement of the intermediate bridging contact out of electrical engagement with both of said spaced contacts.

10. An electric switch device for closing and opening an electric circuit comprising spaced contacts, an intermediate bridging contact adapted when electrically engaged with said spaced contacts to complete the circuit, means yieldably urging the intermediate bridging contact out of engagement with both of said spaced contacts, a latch subject to overload conditions in the circuit for releasably holding the intermediate bridging contact in its operative position against the action of its urging means, and means whereby movement of one of the spaced contacts in two directions is necessary to move the intermediate bridging contact into engagement with said latch and effect electrical engagement between all of said contacts.

11. In an electric switch for closing and opening an electric circuit, spaced contacts, one of said spaced contacts being movable an intermediate bridging contact adapted to, when engaged with said spaced contacts, close the circuit,

means yieldably urging the intermediate bridging contact to a position disengaged from both of said spaced contacts, a latch subject to overload conditions in the circuit for releasably holding the intermediate bridging contact in its operative position, and means including the movable spaced contact for moving the intermediate bridging contact to its latched operative position.

12. In an electric switch for closing and opening an electric circuit, spaced contacts, an intermediate bridging contact adapted to, when said contacts are in predetermined positions, electrically engage both of said spaced contacts to close the circuit, yieldable means urging the intermediate bridging contact out of electrical engagement with both of said spaced contacts and to a position fixed with respect to one of said spaced contacts, means movably mounting said spaced contact, movement of said spaced contact moving the intermediate bridging contact toward its operative position while maintaining said spaced contact electrically disengaged from said intermediate contact, a latch device subject to overload conditions in the circuit for releasably retaining the intermediate bridging contact in its operative position engaged with one of the spaced contacts, and means for returning the movably mounted spaced contact to its normal position to engage the same with the intermediate bridging contact.

13. In an electric switch device for closing and opening an electric circuit, spaced contacts, an intermediate bridging contact, means movably mounting the intermediate bridging contact and one of said spaced contacts, means yieldably urging the intermediate bridging contact out of electrical engagement with both of said spaced contacts, means for moving said movably mounted spaced contact, means whereby the intermediate bridging contact moves with the movable spaced contact toward the other spaced contact, said movable spaced contact moving in advance of the intermediate bridging contact whereby relative motion between the bridging contact and the movable spaced contact is necessary to engage the same, means yieldably opposing the movement of the movable spaced contact and tending to produce the motion necessary to engage the intermediate bridging contact and the movable spaced contact, latch means for holding the intermediate bridging contact engaged with the second mentioned spaced contact and stationary with respect to the movable spaced contact whereby the urging means of said movable spaced contact is enabled to engage the same with the bridging contact, and means responsive to overload conditions in the circuit and operative to move the latch means to inoperative position whereby completion of the circuit is impossible during overload conditions.

14. In an electric switch device for closing and opening an electric circuit, spaced stationary contacts, electrically connected spaced movable contacts, an actuator movable longitudinally along a fixed axis, said actuator carrying the spaced movable contacts and having a manually operable push button, means yieldably maintaining the actuator and the spaced movable contacts carried thereby in a predetermined position with respect to the fixed contacts, intermediate bridging contacts movable independently of the other contacts and adapted to electrically connect the adjacent fixed and movable contacts to complete the circuit, means yieldably urging the intermediate bridging contacts to a position disengaged from

the stationary and movable contacts and means subject to overload conditions in the circuit for holding said intermediate bridging contacts in operative positions against the action of the urging means.

15. In an electric switch for closing and opening an electric circuit, spaced stationary contacts, electrically connected spaced movable contacts spaced from the stationary contacts, an actuator carrying said spaced movable contacts and having a manually operable push button, means yieldably maintaining the actuator and the stationary contacts in a predetermined position with respect to the stationary contacts, intermediate movable bridging contacts adapted to electrically connect the stationary and movable contacts to close the circuit, means movably mounting said intermediate contacts for movement with the actuator and the movable contacts upon actuation of the push button, said intermediate contacts being

disengaged from the movable contacts during such movement, means yieldably urging the intermediate contacts to a position disengaged from both the stationary and movable contacts, latch means subject to overload conditions in the circuit for releasably holding the intermediate contacts against their urging means in a position engaged with the stationary contacts and to which the intermediate contacts are movable upon actuation of movable contacts through the actuator, the movable contactor moving relative to the intermediate contacts to engage the same and complete the circuit upon retraction of the actuator, and means operable manually and upon the occurrence of an overload in the circuit for releasing the intermediate contacts for simultaneous disengagement by their urging means from the stationary and movable contacts whereby the circuit is opened at a plurality of points.

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