

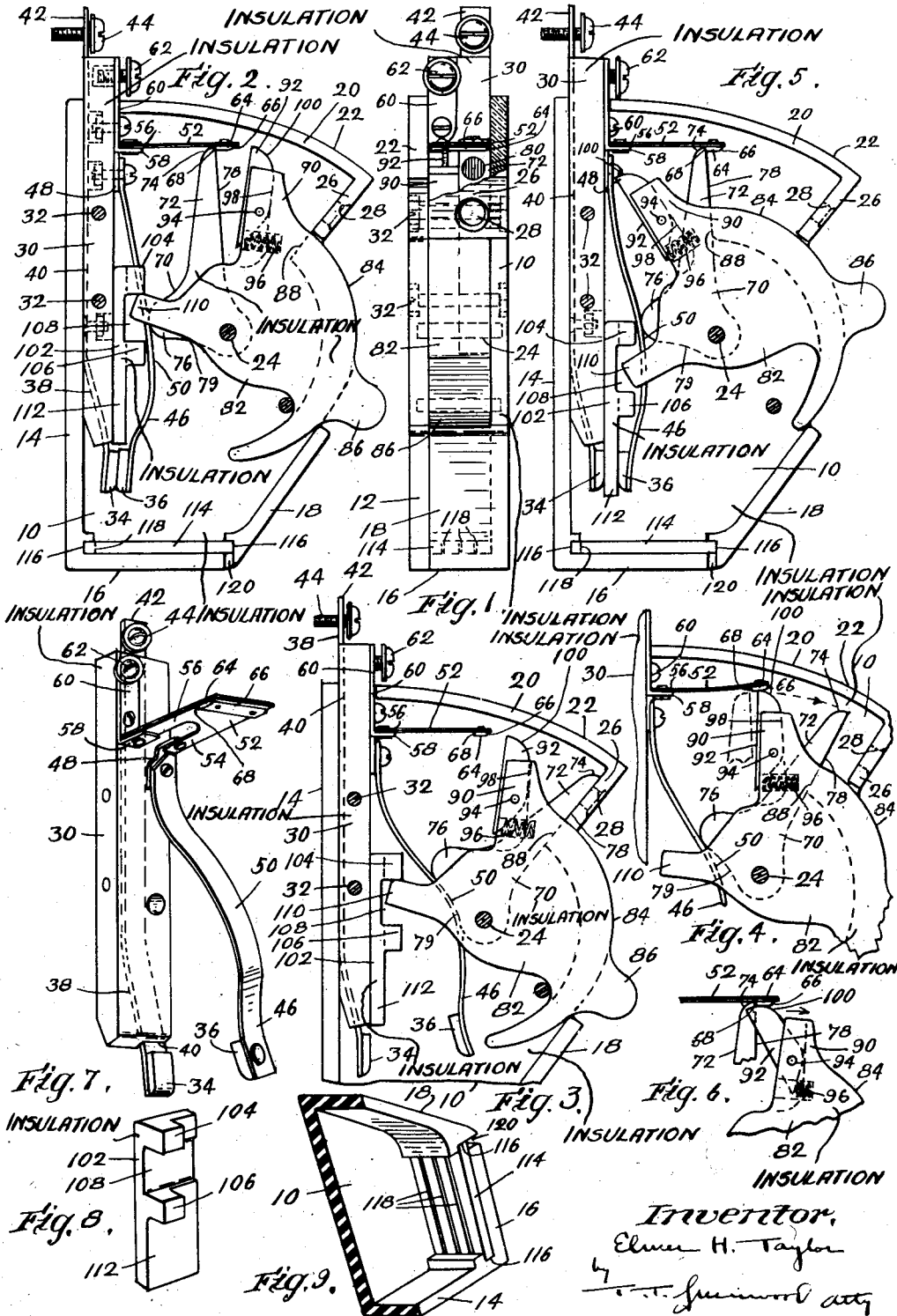
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E. H. TAYLOR

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ELECTRIC SWITCH

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ELECTRIC SWITCH

Elmer H. Taylor, Newburyport, Mass., assignor to
The Chase-Shawmut Company, Newburyport,
Mass., a corporation of Massachusetts

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This invention relates to electric switches and circuit breakers, especially adapted for location at distribution centers to control and also to provide overload protection to electric circuits of moderate current carrying capacity, such as the various lighting and small power capacity circuits of residences.

One of the objects of the present invention is the provision of a switch and circuit breaker so arranged that it can be opened and closed manually and also opened electrically to provide protection against overload on accidental short circuits on moderate power transmitting circuits and characterized by being relatively narrow in its transverse dimensions so that a series of such switches can be installed side by side in a suitable box or cabinet and occupy but a relatively small space therein.

A further object of the invention is the provision of a switch and circuit breaker of the type above set forth having terminals so arranged and disposed that the connection of the switch to the circuit is facilitated.

Another object of the invention is the provision of a switch and circuit breaker having an improved and simplified form of operating mechanism which provides for manual opening and closing and also electrical opening of the breaker.

A yet further object of the invention is the provision of a switch and circuit breaker having an improved form of mechanism by which rapid closing as well as rapid opening of the contact members is secured independently of a corresponding movement of the manually actuated operating member.

Because of the rather sizeable short circuit current that the switch may be called upon to interrupt, especial means is provided to secure rapid extinction of the circuit interrupting arc and the cooling and venting of the arc gases; and such means constitutes a further object of the invention.

A further object is generally to improve the construction and operation of electric switches and circuit breakers.

Fig. 1 is a front elevation of a switch and circuit breaker embodying the present invention.

Fig. 2 is a side elevation of the switch of Fig. 1 with the cover plate removed and with the switch in closed position.

Fig. 3 is a view similar to Fig. 2 but illustrating the electrically opened position of the parts.

Fig. 4 is a detail illustrating the relation of the parts for the manual opening of the switch.

Fig. 5 is a view similar to Fig. 2 but illustrating

the position of the parts biased for rapid closing but with the contact members separated.

Fig. 6 is a detail illustrating the operation of the latch member of the manually actuated operating member for causing the movement of the contacts into closed position without actuating the tripping mechanism.

Fig. 7 is a perspective view of the contact members and thermal tripping member.

Fig. 8 is a perspective view of the insulating plate that controls the rapid closing of the switch.

Fig. 9 is a perspective detail of the arc quenching and gas cooling plate.

The switch and circuit breaker embodying the present invention comprises a casing having a side wall 10, and parallel and spaced therefrom, a removable side wall or cover 12. The side wall and cover are similar in configuration. The side wall has preferably integral therewith and perpendicular thereto the back wall 14 and end wall 16, a front wall 18 inclined with respect to the end wall 16, and an arcuate end wall 20, which walls constitute the side enclosure of the casing. The wall 10 and the cover plate 12 are formed with corresponding arcuate surfaces 22 struck from the shaft 24 as a center, said shaft traversing the casing enclosure and having a support in both walls 10 and 12. The wall 10 also has a radial side wall 26 at which the arcuate portion 22 terminates, said wall 26 constituting an abutment for the switch operating member. Said wall 26 has an aperture 28 therethrough through which a portion of the operating member is visible to indicate the electrically opened condition of the switch.

The switch casing contains an insulating bar 30 which occupies the bottom part of the casing recess adjacent the back wall 14 and is independent of the casing walls, although it can be integral therewith. The bar is secured to the side wall 10 and the cover 12 by screws 32. The co-operating separable contact members 34 and 36 are carried by said bar. The contact member 34 is secured to the end of a conducting strip 38 which is located for the most part in a slot 40 that extends longitudinally of said bar in the bottom face thereof. Said strip has an upturned resilient inner end to which the contact member 34 is secured and an outer end 42 which projects beyond the end of the housing and terminates in a connecting screw 44 by which a circuit conductor can be attached to said strip. The cooperating contact member 36 is secured to the inner end of a resilient strip 46 which is extended generally parallel with the strip 38 on the opposite

side of the bar 30 and has the end opposite the contact member secured to one foot of a bracket 48 carried by the bar 30. The strip 46 is inherently resilient and is so arranged that when there is no pressure exerted thereon in a switch closing direction it assumes a circuit open position spaced from the cooperating strip 38, as illustrated in Fig. 7. The strip 46 is provided with an intermediate inclined or cam portion 50 which cooperates with operating mechanism, as will presently appear. The main portion of the strip is also spaced away from the inner face of the insulating bar 30. An upstanding bifurcated thermally expansible latch member 52, composed of two metals having different coefficients of expansion secured together back to back, has one of its legs 54 secured to the upstanding leg of the bracket 48. The other leg 56 of said thermally expansible member is secured to the upturned end 58 of a terminal strip 60 which is secured to said bar 30 and is provided with a conductor attaching screw 62. The terminal strip 60 and the terminal end 42 of the contact supporting strip 38 are laterally offset from each other, as indicated in Figs. 1 and 7, so that connections thereto may be readily made.

The top portion of the thermally expansible latch member 52 is provided with a transverse thin bar 64 having a tapered upper face 66 and an abrupt inner face 68 which provides a latching projection that when engaged with a suitable part of the switch operating member serves to hold the switch releasably in closed position.

The operating mechanism for the switch comprises an operating member 70, preferably composed of insulating material, pivoted on the shaft 24 and having an extended latch engaging finger 72 that is adapted to be held in switch closed position by engagement with the face 53 of the latching projection 64 of the thermally expansible member, the finger having a curved lower face 74, so that in the movement of the finger in a switch closing direction, the curved face can cam the thermally actuated member outwardly to permit the latch finger to move under the latching projection.

The switch operating member 70 is provided with an arcuate portion or cam 76 that in the switch closed position of the latch member is adapted to bear forcibly upon the intermediate inclined or cam portion 50 of the strip 46, as illustrated in Fig. 2, and thereby force the contact members into and hold them in closed position. The arrangement of the cam portion of the strip and the cam 76 of the operating member is such that when the switch is closed the line of engagement between the two cam portions is close under the shaft 24, although definitely to the upper side thereof. The cam 76 of the operating member thus acts as a toggle cam to hold the contact members closed, the toggle, however, being constantly biased for movement into open position by the inherent resiliency of the strip 46. When an overload traverses the switch and the thermally expansible member, the member heats and expands away from the latch engaging finger of the operating member, thereby releasing the finger and permitting the contact members to be moved rapidly into switch open position by the inherent resiliency of the strip 46, the switch open position being illustrated in Fig. 3. In the switch open position the latch member 72 has its outer flat face 78 in engagement with or at least in close proximity to the wall 26 of the casing and underlies the aperture 28 there-

through. The face 78 of the latch member is provided with a distinctive mark 80, see Fig. 1, which can be a colored disc, that is visible through the opening 28, and thereby indicates the electrically tripped condition of the switch.

The operating member preferably although not necessarily has a curved face 79 that conforms with the configuration of the cam portion 50 of the strip 46 and is adapted to register therewith in the switch open position of the strip and operating member, so that the strip serves to hold the operating member in the switch open position thereof.

The switch is opened and closed manually by an actuating member 82 which is pivoted on the shaft 24 beside the operating member 70. The actuating member 82 is preferably composed of insulating material and is provided with an arcuate outer face 84 that operates in the opening of the casing and constitutes a closure therefor, a button or knob 86 outstanding from the arcuate face and constituting means by which the actuating member may be moved manually between switch open and closed positions. The actuating member is free from positive connection with the operating member 70 except that it has an abutment 88 that overlies the face 78 of the latching member and can engage said face to move the operating member from an electrically tripped position thereof into a switch closed position.

The manual opening of the switch is accomplished by effecting tripping the latch member 72. For this purpose the actuating member is provided with an ear 90 having a slot in which a tripping plate 92 is pivoted on a pin 94, the plate being urged for clockwise movement by a compression spring 96 which holds the plate normally against the bottom wall 98 of the slot against rotation in a clockwise direction. In the operation of the actuating member to trip the switch manually the actuating member 82 is rotated in a counterclockwise direction, or the button 86 is moved upwardly, thereby to cause the upper end of the tripping member 92 to move over the sloping face of the thermally actuated member and to force the member outwardly away from holding relation with the latch finger of the operating member, thereby to effect the tripping of the operating member and the rapid or snap opening of the switch. When the switch is closed and the tripping member 92 is under the latching projection of the thermally actuating member, as illustrated in Fig. 5, the actuating member can be rotated in the opposite or clockwise direction without tripping the latch member, the tripping member having an arcuate outer face 100 which rides over the latch projection 64 of the actuating member and the spring 96 yielding, as illustrated in Fig. 6, to permit such movement without tripping the latch member.

Means are provided to secure the rapid closing as well as the rapid opening of the switch independently of a corresponding movement of the actuating member. Said means includes an insulating plate 102 which is slidable upon the inner face of the bar 30 and between it and the movable contact strip 46. The plate 102 is provided with a pair of spaced projections 104 and 106 respectively which form between them a slot 108 in which a finger 110 of the actuating member is loosely received. The arrangement is such that when the actuating member is rotated in a clockwise direction, which is a switch closing direction, the finger 110 is caused to engage the

projection 104 to effect the movement of the plate in a switch closing direction. When the actuating member is rotated in a counter-clockwise direction the finger 110 is caused to engage the other projection 106 to move the plate in the opposite direction.

The plate 102 is provided with a part 112 which is movable in a position between the contact members, as illustrated particularly in Fig. 5. The arrangement is such that when the switch is open and the actuating member is operated to close the switch the actuating member is first rotated in a counter-clockwise direction, or the knob 86 moved upwardly, for the purpose of resetting the operating member and at the same time causing movement of the contact members towards each other. This movement of the actuating member moves the plate 102 downwardly into a position between the contact members while the contact members are yet separated so that when the latch member is in latched condition the separated contact members are in pressure engagement with the part 112 of the plate, the plate thus holding the contact members separated although the latch member is in latched position. To cause the closing of the switch the actuating member is then rotated in a clockwise direction or the knob 86 moved downwardly. This movement of the actuating member withdraws the plate 102 from position between the contact members and allows the contact members to suddenly snap closed due to the inherent resiliency of the strip.

The arrangement is such that, while the inherent resiliency of the movable contact member supporting strip, as a whole, biases the movable contact member for movement into switch open position the action of the operating member in exerting pressure upon the intermediate cam portion of the strip to force the movable contact member against the plate causes that portion of the strip between the intermediate portion thereof and the contact member to be biased to move the contact member in a switch closing direction. Thus when the plate is withdrawn from between the contact members, the movable contact member snaps into engagement with the stationary contact member.

The switch is tripped manually by raising the knob 86, the switch being opened when the knob 86 is in about the mid position of the arcuate part of the casing, this position being indicative of the manual switch open position of the switch. The switch is closed manually by further raising the knob 86 upwardly to effect the resetting of the operating member 70 and then moving the knob downwardly into the position illustrated in Fig. 2 to withdraw the plate 102 from the contacts and to cause the sudden engagement of the contacts.

The switch is tripped electrically by the flexing of the thermally actuated member 52 and its release of the operating member. The operating knob 86 remains in its lowermost position but the appearance of the colored disc 80 in the opening 28 indicates the electrically tripped condition of the switch.

If the rapid closing of the switch is not desired the plate 102 can be dispensed with.

While the switch and circuit breaker herein illustrated are adapted for the protection of circuits carrying only moderate amounts of power the switch, nevertheless, is required to interrupt quite heavy short circuit currents so that the circuit interrupting arc can be quite substantial;

and the switch is herein so constructed and arranged as to minimize the duration of the arc and to quench the arc and to cool and vent the arc gases. To this end an arc quenching and arc cooling plate 114, see especially Figs. 2 and 9, is located within the casing against the inner face 16 of the bottom wall and close to and parallel with the arc zone between the contact members. The plate is preferably removably retained in position with its ends located in grooves 116 of the bottom wall 14 and the outer wall 18 respectively. The plate 114 is relatively massive and is made of good heat conducting material, as copper, so that the arc and the arc gases coming in contact therewith are rapidly cooled. The plate is provided with a plurality of longitudinal grooves or channels 118 therethrough, which are parallel with the arc zone and communicate at their upper ends with a venting slot 120 formed at the junction of the walls 16 and 18. The contact supporting strips 42 and 46 are parallel with each other so that, when traversed by heavy currents, they set up a strong magnetic field which not only exerts a strong blow out effect upon the arc but forces the arc against the plate 114 so that the plate can act to chill and quench the arc. The arc gases are additionally cooled when passing along the narrow slots 118 to the vent passage 120.

I claim:

1. An electric switch comprising cooperating stationary and movable contact members, a resilient support for said movable contact member, said support having means providing a cam face, an operator having a toggle cam cooperating with said cam face and movable in a switch closing direction into substantially dead center position to hold said contact members in switch closed position, and latching means engageable with said operator operable to hold said operator releasably in a position corresponding to the engaged position of said contact members.

2. An electric switch comprising cooperating stationary and movable contact members, a resilient support for said movable contact member, said support having means providing a cam face, an operator having a toggle cam cooperating with said cam face to move said contact members into switch closed position, and latching means engageable with said operator operable to hold said operator releasably in a position corresponding to the engaged position of said contact members, and manually actuated means for tripping said latching means and also for moving said operator into switch closed position.

3. An electric switch comprising cooperating stationary and movable contact members, a resilient support for said movable contact member, said support having means providing a cam face, an operator having a toggle cam cooperating with said cam face to move said contact members into switch closed position, latching means engageable with said operator operable to hold said operator releasably in a position corresponding to the engaged position of said contact members, an actuator structurally independent of said operator having means for operating it, and electro-responsive means for operating said latch means to release said operator.

4. An electric switch comprising cooperating stationary and movable contact members, a resilient support for said movable contact member, said support having means providing a cam face, an operator having a toggle cam cooperating with said cam face to move said contact members into

switch closed position, latching means engageable with said operator operable to hold said operator releasably in a position corresponding to the engaged position of said contact members, and thermo-responsive means for effecting disengagement of said latching means and operator.

5. An electric switch comprising cooperating stationary and movable contact members, a resilient support for said movable contact member, said support having means providing a cam face, an operator having a toggle cam cooperating with said cam face to move said contact members into switch closed position, latching means engageable with said operator operable to hold said operator releasably in a position corresponding to the engaged position of said contact members, said latching means including a thermo-responsive member having a projection engageable with said operator, and means operative for circulating through said thermo-responsive member a heating current.

6. An electric switch comprising cooperating stationary and movable contact members, a resilient strip carrying said movable contact member at one end and having a support for its other end, said strip having an intermediate cam surface, a pivoted operating member having a toggle cam cooperating with said cam surface for moving said movable contact member toward and for holding it in engagement with said stationary contact member, a thermo-responsive latch for said operating member, and manually actuated means normally free from positive interconnection with and structurally independent of said operating member operative to move said operating member into switch closed position thereof.

7. An electric switch comprising cooperating stationary and movable contact members, a resilient strip carrying said movable contact member at one end and having a support for its other end, said strip having an intermediate cam surface, a pivoted operating member having a toggle cam cooperating with said cam surface for moving said movable contact member toward and for holding it in engagement with said stationary contact member, a thermo-responsive latch for said operating member, manually actuated means normally free from positive interconnection with said operating member operative to move said operating member into switch closed position thereof, and also having means for operating said thermal latch to effect the release of said operating member and the separation of said contact members.

8. An electric switch comprising cooperating stationary and movable contact members, a resilient strip carrying at one end said movable contact member and having a support for its other end, said strip having an intermediate cam surface, a pivoted operating member having means constituting a toggle cam cooperating with said cam surface and operable to move said movable contact member toward and to hold it into engagement with said stationary contact member, latching means for said operating member, and a pivoted actuating member having means operative to move said operating member into the switch closed position thereof and also to trip said latching means.

9. An electric switch comprising stationary and movable contact members, an operating member for said contact members, latching means for holding said operating member in switch closed position thereof, and an actuating member op-

erative in one direction to effect movement of said contact members toward a switch closed position and movable in the same direction to trip said latching means and effect the movement of said operating member and said contact members into switch open position.

10. An electric switch comprising separable contact members, means for releasably holding said contact members in closed position, latching means for said holding means, and an actuating member movable in one direction to bias said contact members for engagement and movable in the same direction to effect the tripping of said latching means.

11. An electric switch comprising separable contact members, means for opening and also for closing said switch with a snap action, an operating member forming a part of said means and normally biased for movement in a switch opening direction when the switch is closed, latching means for holding said operating member in switch closed position and maintaining the switch closed, and an actuating member movable in one direction to effect the movement of said operating member and said contact members into switch closed position and movable in the opposite direction to effect the tripping of said latching means.

12. An electric switch comprising separable contact members, means for opening and closing said switch with a snap action, said means including means constantly acting on at least one of said contact members to urge it for movement in a switch opening direction, an operating member operative to move said contact member toward and to hold it in switch closed position against said biasing means, releasable means releasably holding said operating means in switch closed position, and actuating means for effecting movement of said operating means in a switch closing direction and also for effecting the release of said releasable means.

13. An electric switch comprising stationary and movable contact members, resilient supporting means for said movable contact member normally biasing said contact member for movement away from said stationary contact member, means for moving said resilient supporting means in a switch closing direction, and means for biasing a part of said resilient supporting means for movement in a switch closing direction and for suddenly permitting said biased part to operate to effect the rapid closing of the switch.

14. An electric switch having stationary and movable contact members, means operative as a whole for biasing said movable switch member constantly for movement away from switch closed position, means operative on said biasing means for biasing a part thereof for movement of said contact member into switch closed position, and means for rendering said biased part suddenly effective for effecting the rapid closing of the switch.

15. An electric switch comprising separable contact members, operating mechanism therefor including a resilient member normally inherently biased as a whole to separate said contact members, and means for changing the direction of stress of a part only of said member to effect the rapid engagement of said members.

16. An electric switch comprising separable contact members, operating mechanism therefor including a resilient member normally inherently biased as a whole to separate said contact members, means for changing the direction of stress of a part only of said member to effect the rapid

engagement of said contact members, said resilient member having a free end carrying one of said contact members and said means including an operating member which engages an intermediate part of said resilient member and is operative to force it into a position corresponding to the engaged position of said contact members, and removable means engageable with the free end of said resilient member for opposing movement of said movable contact member in a contact engaging direction, whereby to stress the free end of said resilient member in a direction to effect rapid engagement of said contact members upon removal of said removable means.

17. An electric switch comprising stationary and movable contact members, means including a resilient member normally acting on said movable contact member in a direction to move it into circuit opening position, means acting on an intermediate part of said resilient member in a direction to bias another part thereof to move said movable contact member in a switch closing direction, whereby to obtain both rapid closing and opening of the switch under the action of said resilient means, removable means to hold said other part releasably from movement in the direction of its bias and means to remove said removable means from holding relation with said other part to obtain rapid engagement of said contact members.

18. An electric switch comprising stationary and movable contact members, a resilient strip carrying said movable contact member at one end and having a support for its other end, said resilient strip constantly biasing said movable contact member for movement in a switch opening direction, means acting on an intermediate part of said strip to move a part of said strip and said movable contact member in a switch closing direction, and means operative to retain the contact member part of said strip from movement in a circuit closing direction whereby upon continued movement of said operating means in a switch closing direction to stress said part for movement in a switch closing direction, and means to remove the restraint upon said part whereby to effect the rapid closing of the switch.

19. An electric switch comprising stationary and movable contact members, resilient means associated with said movable contact member for urging it constantly for movement in a switch opening direction, means for moving said resilient means in a switch closing direction, and removable means for opposing the movement of a part of said resilient means in a switch closing direction whereby to stress said part for quick movement in such direction upon removal of said removable means.

20. An electric switch comprising stationary and movable switch members, resilient means associated with said movable switch member, means for moving said resilient means and the associated movable switch member in a switch closing direction, and means to oppose movement of said movable contact member whereby to stress said resilient means in a switch closing direction, and means to remove the opposition to switch closing movement of said contact member, whereby to effect its sudden movement into switch closed position by said stressed resilient means.

21. An electric switch comprising stationary and movable contact members, an abutment controlling the movement of said movable contact member into switch closed position, operating mechanism movable into a position correspond-

ing to switch closed position to effect the movement of said movable contact member into switch closed position, resilient means moved into engagement with said abutment and thence stressed in a switch closing direction by such movement of said operating mechanism, and means for removing said abutment to render said stressed resilient means operative to move said contact member suddenly into switch closed position.

22. In an electric switch comprising stationary and movable contact members, an insulating plate movable into and out of position between said contact members, operating mechanism including resilient means for moving said movable contact member into pressure engagement with said insulating plate, and means for moving said plate from between said contact members whereby to render said resilient means effective in suddenly moving said movable contact member into engagement with said stationary contact member.

23. In an electric switch comprising stationary and movable contact members, a resilient strip carrying said movable contact member at one end and having a support for the other end, an operating member operative to exert pressure on an intermediate part of said strip to move said strip and said movable contact member in a switch closing direction, an insulating plate movable into and out of position between said contact members, and means to move said plate into position between said contact members during the movement of said operating member and thereafter to move said plate away from the aforesaid position whereby to effect the rapid engagement of said contact members.

24. An electric switch comprising stationary and movable contact members, means normally biasing said contact members for separating movement, an insulating plate movable into and out of position between said contact members, and switch operating mechanism having means to move said plate into position between said contact members and said movable contact member in a switch closing direction into yielding pressure engagement with said plate, and thereupon to move said plate out of its aforesaid position between said contact members whereby to effect the rapid movement of said movable contact member into engagement with said stationary contact member.

25. An electric switch comprising stationary and movable contact members, a resilient arm carrying said movable contact member, said arm being biased to urge said movable contact member constantly in a switch opening direction, and switch operating mechanism having means for reversing the direction of spring action on the movable contact member for effecting the rapid disengagement and also the rapid engagement of said contact members by the resiliency of said arm.

26. An electric switch comprising stationary and movable contact members, resilient means acting upon said movable contact member constantly in a direction to move it into a switch open position, and operating mechanism for effecting both the rapid disengagement and also the rapid engagement of said contact members by said resilient means.

27. An electric switch comprising stationary and movable contact members, resilient means acting on said movable contact member constantly in a direction to move it into switch open position, an operating member acting on said means to move it in a switch closing direction, latching

means for holding said operating member releasably in a switch-closed position, and actuating means for tripping said latching means and effecting the rapid disengagement of said contact members and also for effecting the rapid engagement of said contact members by said resilient means.

28. An electric switch comprising stationary and movable contact members, a resilient strip carrying said movable contact member at one end and having a support for its other end, said strip having an intermediate cam surface, an operating member including a toggle cam engageable with said cam surface for moving said switch in a switch closing direction, a thermo-responsive latch member for holding said operating member releasably in switch closing direction, an insulating plate movable into and out of position between said contact members, and an actuating member movable in one direction for tripping said latch member and also for moving said operating member into switch closed position and further moving said plate into position between said contact members, and movable in an opposite direction to remove said plate from position between said contact members.

29. An electric switch comprising separable contact members, means biasing said contact members for movement into separated position, a thermo-responsive latch for holding said contact members releasably engaged, and a switch

operating handle having means for effecting the engagement of said contact members and also the tripping of said latch by the movements of the handle in the opposite direction.

30. An electric switch including a switch arm movable between switch open and closed positions, an operator acting on said arm to effect the movement thereof between such positions, a latch engageable with said operator for holding it releasably in switch closed position, and an actuator for actuating said operator, said actuator being movable in opposite directions into a latch-tripping position and having latch-tripping means movable therewith and constructed and arranged to effect the tripping of said latch in but one of the two opposite directions of movement of said actuator.

31. An electric switch comprising separable contact members, an actuator movable between switch closed and open positions, means operated by said actuator during movement thereof to a switch open position for biasing said contact members for switch closing movement, and means restraining said contact members from engagement when so biased, said actuator having provision for removing said restraining means upon movement of said actuator into switch closing position to effect rapid engagement of said contact members.

ELMER H. TAYLOR.