

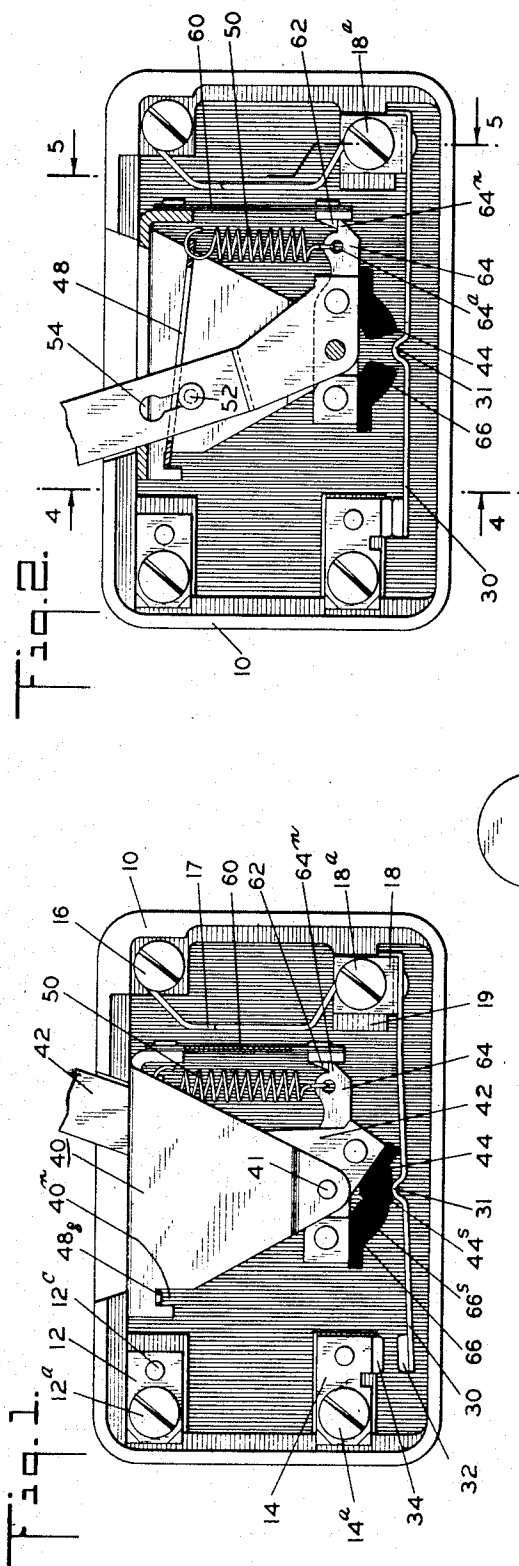
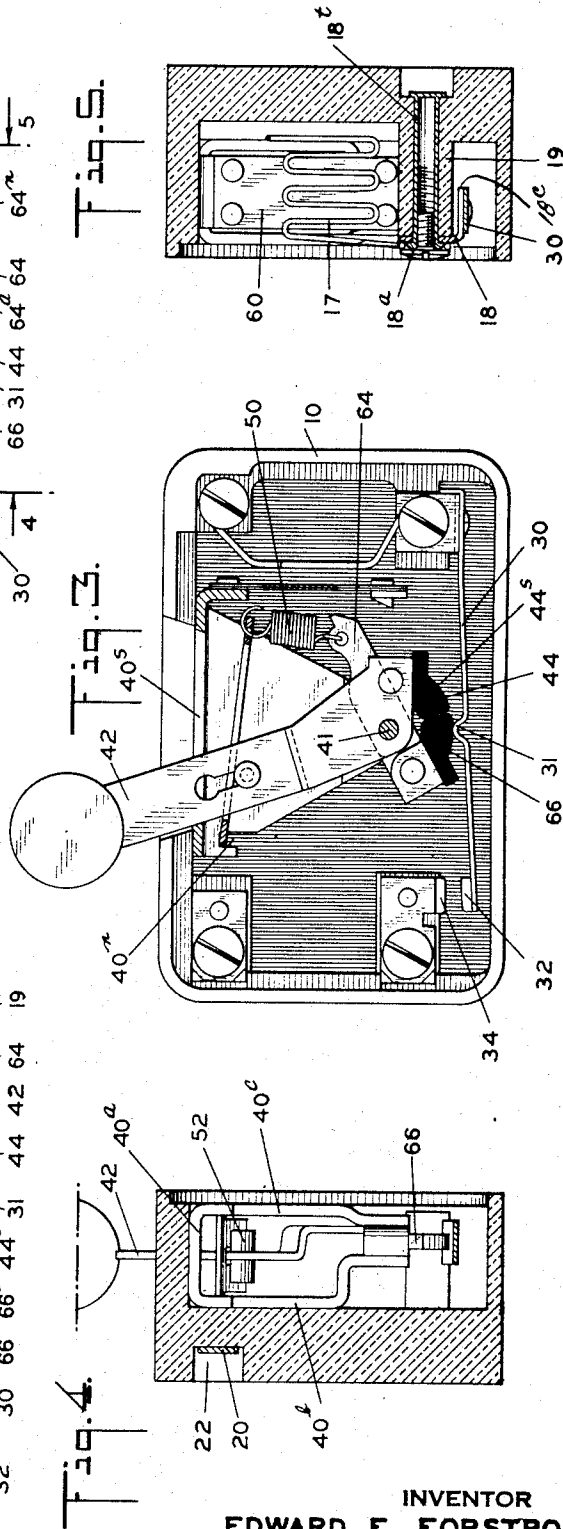
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SWITCH WITH THERMAL RELEASES

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SWITCH WITH THERMAL RELEASES

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This invention relates to manually operable switches which are provided with means to automatically open the switch on the occurrence of a predetermined overload in the circuit.

More particularly this invention relates to switches for use in alternating current circuits in which switches the contacts are capable of manual operation, but the speed of separation of the contacts during such manual operation is under control of the handle or lever. In further particular, this invention relates to switches of the type just mentioned which are provided with a thermally responsive means and automatically operated mechanism under the control of the thermally operated means to cause contact separation upon the occurrence of a predetermined overload.

It is an object of my invention to provide a manually operable switch device particularly adapted for use in alternating current circuits, which device is provided with a thermally responsive means for separating the contacts upon the occurrence of a predetermined overload current.

Another object of my invention is to provide a switch of the above type which may not be held closed by the handle or operating lever during the continuance of an overload.

Another object of my invention is to provide a simplified and inexpensive construction of a switch for controlling alternating current circuits which device shall be provided with an automatic means for opening the circuit upon the occurrence of an overload current.

Another object of my invention is to provide a switch for controlling alternating current circuits, in which device the mechanism for controlling the movement of the switch contacts may be inserted as a unit in the switch casing while the contacts and other parts are inserted separately.

Other objects and advantages of my invention will become apparent as it is described in connection with the accompanying drawing.

In the drawing:—

Figure 1 is a side elevation view of the interior of a switch device embodying my invention, with the parts shown in manually opened position.

Figure 2 is a side elevation view of the device shown in Figure 1 but with a portion of the switch frame broken away, and with the parts in closed position.

Figure 3 is a view similar to Figure 2 but with the parts in the position they take after automatic switch opening.

Figure 4 is a transverse section view of my invention taken along line 4—4 of Figure 2.

Figure 5 is a transverse section view of my invention taken along the line 5—5 of Figure 2.

Referring to the drawing the switch mechanism is housed in a hollow casing 10 of any suitable insulating material. The casing may have any convenient shape but in the embodiment of the invention illustrated, it is substantially rectangular in side elevation and has rounded corners and is of such depth or thickness as required for convenient accommodation of the switch mechanism. Adjacent each of the four corners of the casing there are provided platforms upon which are mounted terminals 12, 14, 16 and 18.

The terminals 12 and 14 comprise small plates which are provided with binding screws 12a and 14a according to conventional practice. The terminal plate 12 is secured to the casing by a bolt 12c passing through the rear of the casing from back to front. This bolt 12c also connects the plate with one (the left) end of a bus bar 20 which is seated in a channel 22 formed in the back face of the casing and extending along the back face from a position under the terminal 12 to the other end of the casing under the terminal 16. The terminal 16 comprises a tubular rivet passing through from the rear of the casing and having its front or open end peened over to secure it in position and also internally screw threaded for the reception of a screw. The tubular rivet is in electrical contact with and passes through the other (right) end of the bus bar 20. The terminal 18 comprises a plate through which passes the hollow end of a tubular rivet 18t extending through the casing from the rear. The open end of the rivet 18t is screw threaded internally for the reception of a screw 18a and is peened over upon the plate to hold it in position. The terminal plate 18 has a portion 18c bent down at right angles to the face of the terminal and lying along the side face of the platform or post 19 upon which the terminal 18 is mounted. To this bent down portion 18c is riveted one end of a spring contact member 30 formed of a strip of metal of good conductivity and having considerable resilience. This contact member 30 extends parallel to the bottom wall of the casing 10 and has a contact button 32 mounted upon its other end in position to engage with a stationary contact button 34 which is mounted upon a portion bent down at right angles from the terminal plate 14.

Bent up from the central portion of the con-

tact is a semicylindrical portion 31 forming a cam surface which is adapted to be engaged by cams 44 and 66 actuated by the handle or lever of the switch and by the automatic tripping mechanism as will hereinafter be described.

The terminals 16 and 18 are electrically connected by a heater 17 formed of resistance wire whose ends are engaged beneath the terminal screws 16 and 18a and whose midportion is bent in conventional form for heaters used in switches of the type to which this invention relates. The plane of this central portion is parallel to and adjacent to a bimetallic thermal strip 60 which is capable of warping to cause automatic switch operation as will hereinafter be more fully described.

The parts of the switch mechanism which cause movement of the contact strip 30 are mounted upon a switch frame 40 stamped into U-shape from sheet metal. The side portions of the frame are substantially triangular as shown best in Figure 1. The bridge portion 40a of the frame lies adjacent the inside of the upper wall of the switch casing and one (40b) of the side plates lies against and is secured to the rear wall of the casing. Each of the side walls 40b and 40c have their end portions or apexes offset toward each other and have pivotally mounted upon a pin 41 passing through said offset portions a switch handle 42 comprising a sheet metal stamping which extends through a slot 40s in the bridge portion of the switch frame. The pivoted end of the switch handle is offset and lies against the inner face of the offset apex of the side 40c of the switch frame. This pivoted end is enlarged and has riveted to it a cam 44 of fibrous or composition insulating material, which cam has a curved surface 44s adapted to slide upon the cam surface 31 of the movable contact 30 to cause disengagement of the switch contacts as illustrated in Figure 1, when the switch lever is moved to its right hand position.

In order to provide positive action for the switch lever 42 and manually operable cam 44 I have provided a spring-stressed, long narrow lever plate 48 located between the side plates 40b and 40c of the frame and pivoted adjacent the upper left hand corner (referring to Figure 1) of the switch frame by laterally extending aligned lugs 48g at the left end of the lever plate, which lugs are seated in aligned recesses or notches 40n in the left hand corners of the side plates of the switch frame. The lever plate 48 has a longitudinal slot in its central portion to afford a passage for the lever 42. In order to stress the lever plate a coil tension spring 50 has one end anchored to the right end of the lever plate 48. The lower end of the spring 50 is anchored to the tripping lever 64 whose form of construction will be hereinafter more particularly described. Thus this coil spring serves a dual purpose of stressing the lever plate 48 and stressing a tripping lever 64 for automatic switch opening as will hereinafter more fully appear.

In order that the stress of the spring 50 may be transmitted through the lever plate 48 to the switch handle 42, there is provided a transverse pin 52 located in the bottom of a slot 54 in the central portion of the hand lever, the slot 54 being so located that when the pin 52 is located in its lower end the spring will be stressed when the hand lever is in both open-circuit position, as shown in Figure 1, and in closed-circuit position, as shown in Figure 2. The lever plate 48 is narrower than the spacing of the side plates of

the frame 40 and is shorter than the frame so that as the handle 42 is moved between closed and open position, there is sufficient room for movement of the right end of the lever plate up and down without engaging with the bridge portion 40a of the switch frame. It may now be observed that as the switch handle 42 moves between closed and open circuit positions it passes through a dead-center position when the hand lever 42 is substantially vertical (referring to Figures 1, 2 and 3). Thus when the hand lever is in either open or closed circuit position, the tension of the spring acting upon lever 48 and pin 52 tends to keep the hand lever in those extreme positions. At the same time, it will be observed that the tension of the spring also provides a snap action for the switch mechanism.

The means for causing automatic operation of the switch comprise a bimetallic strip 60, one end of which is anchored to a lug bent out from and at right angles to the plane of the bridge portion 40a of the switch frame. The other end of this bimetallic strip has on it a tooth or catch 62 for holding a pivoted tripping lever 64 against movement under the stress of the spring 50. This tripping lever may be a sheet metal stamping having a nose 64n engaging with the catch 62. The lever also has an aperture 64a in which is anchored or looped the lower end of the spring 50. The lever is pivoted upon the pin 41 which, it will be recalled, is also the pivot of the handle 42. The opposite end of the lever from the nose 64n may be reversely bent and have secured by a rivet between the reversely bent portions a cam 66 with a curved cam surface 66s which is positioned for a sliding engagement with the cam surface 31 on the contact strip 30 as the cam 66 moves from its restrained position, as shown in Figure 2, to its tripped or released position as shown in Figure 3.

It will now be observed that the tripping lever 64 is held in its restrained position, as illustrated in Figures 1 and 2, by engagement of the latch 62 with the nose 64n although the spring 50 normally urges its tripping lever toward its released or tripped position, as shown in Figure 3. While the tripping lever is held in its restrained position, the tripping cam 66 is out of engagement with the cam surface 31 and exerts no control over the movable contact strip 30. Thus the control of the movement of the contact strip 30 is in the handle and cam 44 operated thereby so that when the handle is moved to the left as shown in Figure 2, the cam 44 is removed from engagement with cam surface 31 and the normal bias of the movable contact strip 30 is given full effect to cause engagement of the fixed and movable contact buttons 32 and 34, thus completing the circuit through the switch. If now an overload occurs the heat generated in the heater element 17 will heat the bimetallic strip 60 which upon becoming heated will warp toward the heater 17 thus removing the catch 62 from engagement with the nose 64n of the tripping lever and permitting the spring 50 to move the cam 66 into engagement with the cam surface 31 as shown in Figure 3 and thereby cause separation of the contact buttons 32 and 34. Under this movement of the tripping lever the cam 66 is brought in abutment with the cam 44 so that as the handle 42 is moved to open-circuit position (Figure 1) the cam 44 pressing against the cam 64 will cause the clockwise rotation of the tripping lever 64 to accomplish reengagement of the nose 64n with the catch 62 and thus reseal

the automatic tripping mechanism. I prefer to make the cam surfaces 66s and 44s with curvatures complementing one another so that the joint movement of the cam surfaces 44s and 66s over cam 31, as the switch is moved from tripped position to manually open position, (from the position of Figure 3 to the position of Figure 1) will be smooth and continuous.

From the foregoing it will be apparent that I have provided a simple and effective mechanism for manually controlling a pair of switch contacts and for automatically separating the switch contacts upon the occurrence of a predetermined overload. This switch is particularly adaptable for use in alternating current circuits where the problem of arcing is not so acute and troublesome as in direct current circuits. It will also be observed that my automatic tripping mechanism is independent of the handle and therefore the switch is what is commonly known in the art as "tripped free".

Many changes in the construction of my invention will occur to those skilled in the art, therefore I do not limit it to the specific embodiment shown.

I claim:

1. In a circuit breaker, fixed and movable contacts, means biasing said movable contact toward closed-circuit position, a manually operable cam adapted to be set in one position to hold said movable contact in open-circuit position and adapted to be set in another position to permit movement of said movable contact into closed-circuit position, and a cam operable automatically for moving said movable contact to open-circuit position on the occurrence of a predetermined overload, said manually operable cam means being incapable of operation to cause said movable contact to remain in closed-circuit position during the occurrence of an overload.

2. In a circuit breaker, fixed and movable contacts, means biasing said movable contact toward closed-circuit position, a manually operable cam adapted to be set in one position to hold said movable contact in open-circuit position and adapted to be set in another position to permit movement of said movable contact into closed-circuit position, and a cam operable automatically for moving said movable contact to open-circuit position on the occurrence of a predetermined overload, said manually operable cam and said automatically operable cam being independently operable whereby said contacts may not be held closed on overload.

3. In a circuit breaker, fixed and movable contacts, means biasing said movable contact toward closed-circuit position, a manually operable cam adapted to be set in one position to hold said movable contact in open-circuit position and adapted to be set in another position to permit movement of said movable contact into closed-circuit position, and a cam operable automatically for moving said movable contact to open-circuit position on the occurrence of a predetermined overload, said movable contact being uncontrolled by said manually operable cam while in closed-circuit position whereby said contacts may not be held closed during continuance of an overload.

4. In a circuit breaker, fixed and movable contacts, means biasing said movable contact toward closed-circuit position, a manually operable cam adapted to be set in one position to hold said movable contact in open-circuit position and adapted to be set in another position to permit movement of said movable contact into

closed-circuit position, and a cam operable automatically for moving said movable contact to open-circuit position on the occurrence of a predetermined overload, said movable contact being uncontrolled by said manually operable cam while in closed-circuit position whereby said automatically operable cam has sole control of the movement of said movable contact to open-circuit position during the time that said manually controlled cam is in closed circuit position.

5. In a circuit breaker, fixed and movable contacts, means biasing said movable contact toward closed-circuit position, a manually operable cam adapted to be set in one position to hold said movable contact in open-circuit position and adapted to be set in another position to permit movement of said movable contact into closed-circuit position, and a cam operable automatically for moving said movable contact to open-circuit position, thermally responsive means releasing said last-named cam for operation upon the occurrence of a predetermined overload, said manually operable cam being incapable of operation to cause said movable contact to remain in closed-circuit position during the continuance of an overload.

6. In a circuit breaker, fixed and movable contacts, means biasing said movable contact toward closed-circuit position, a manually operable cam adapted to be set in one position to hold said movable contact in open-circuit position and adapted to be set in another position to permit movement of said movable contact into closed-circuit position, and a cam operable automatically for moving said movable contact to open-circuit position, thermally responsive means releasing said last-named cam for operation upon the occurrence of a predetermined overload, said manually operable cam and said automatically operable cam being independently operable whereby said contacts may not be held closed on overload.

7. In a circuit breaker, fixed and movable contacts, means biasing said movable contact toward closed-circuit position, a manually operable cam adapted to be set in one position to hold said movable contact in open-circuit position and adapted to be set in another position to permit movement of said movable contact into closed-circuit position, and a cam operable automatically for moving said movable contact to open-circuit position, thermally responsive means releasing said last-named cam for operation upon the occurrence of a predetermined overload, said movable contact being uncontrolled by said manually operable cam while in closed-circuit position whereby said contacts may not be held closed during continuance of an overload.

8. In a circuit breaker, fixed and movable contacts, means biasing said movable contact toward closed-circuit position, a manually operable cam adapted to be set in one position to hold said movable contact in open-circuit position and adapted to be set in another position to permit movement of said movable contact into closed-circuit position, and a cam operable automatically for moving said movable contact to open-circuit position, thermally responsive means releasing said last-named cam for operation upon the occurrence of a predetermined overload, said movable contact being uncontrolled by said manually operable cam while in closed-circuit position whereby said automatically operable cam has sole control of the movement of said movable contact to open-circuit position while said manually controlled cam is in closed-circuit position.

9. In an electric switch, fixed and movable contacts, means to operate the switch, cam means movable by said manual means to cause engagement and disengagement of said fixed and movable contacts, automatically operable cam means for causing disengagement of said contacts on occurrence of an overload, and spring means biasing said automatic cam means for contact separation, and biasing said manually operable means so as to cause engagement and disengagement of said contacts to be accomplished with a snap motion.

10. In an electric switch, fixed and movable contacts, means to manually operate the switch, cam means movable by said manual means to cause engagement and disengagement of said fixed and movable contacts, automatically operable cam means for causing disengagement of said contacts on occurrence of an overload, and spring means biasing said automatic cam means for contact separation and biasing said manually operable means so as to cause engagement and disengagement of said contacts to be accomplished with a snap motion, and thermally responsive means controlling the operation of said automatic cam means.

11. In an electric switch, fixed and movable contacts, means to manually operate the switch, cam means movable by said manual means to cause engagement and disengagement of said fixed and movable contacts, automatically operable cam means for causing disengagement of said contacts on occurrence of an overload, and spring means biasing said automatic cam means for contact separation and biasing said manually operable means so as to cause engagement and disengagement of said contacts to be accomplished with a snap motion, and a bimetallic member controlling the operation of said automatic cam means.

12. In an electric switch, fixed and movable contacts, means to manually operate the switch, cam means movable by said manual means to cause engagement and disengagement of said fixed and movable contacts, automatically operable cam means for causing disengagement of said contacts on occurrence of an overload, and spring means biasing said automatic cam means for contact separation and biasing said manually operable means so as to cause engagement and disengagement of said contacts to be accomplished with a snap motion, said manually controlled cam engaging with said automatically controlled cam for resetting of the switch after overload operation.

13. In an electric switch, contact means biased when in normal open circuit position to move to closed circuit position, a cam occupying one or another of two positions of rest for causing engagement and disengagement of said contact means, and manually operable means for operating said cam between said positions at will, in combination with thermally responsive means operable by an overload current to cause separation of said contact means, said cam means being ineffective to maintain the circuit closed during the continuance of an overload.

14. In an electric switch, fixed and movable contacts, manually operable means occupying one or another of two positions of rest for engaging and disengaging said contacts, and cam means engageable with said movable contact upon the occurrence of an overload to cause separation of said contacts, said cam means being independent of said manual operating means.

15. In an electric switch, fixed and movable contacts, manually operable means occupying one or another of two positions of rest for engaging and disengaging said contacts, and cam means engageable with said movable contact upon the occurrence of an overload to cause separation of said contacts, said cam means being independent of said manual operating means and bimetallic means controlling the movement of said cam means.

16. In an electric switch, fixed and movable contacts, manually operable means occupying one or another of two positions of rest for engaging and disengaging said contacts, and cam means engageable with said movable contact upon the occurrence of an overload to cause separation of said contacts, said cam means being independent of said manual operating means, and bimetallic means controlling the movement of said cam means, said bimetallic means being resettable by circuit opening movement of said manual means.

17. In an electric switch, fixed and movable contacts, manually operable means for engaging and disengaging said contacts, a pivoted lever having cam means thereon for engaging with said movable contact upon the occurrence of an overload to cause separation of said contacts.

18. In an electric switch, fixed and movable contacts, manually operable means for engaging and disengaging said contacts, a pivoted lever having cam means thereon for engaging with said movable contact upon the occurrence of an overload to cause separation of said contacts, and bimetallic means controlling the movement of said lever.

19. In an electric switch, fixed and movable contacts, manually operable means for engaging and disengaging said contacts, a pivoted lever having cam means thereon for engaging with said movable contact upon the occurrence of an overload to cause separation of said contacts, and bimetallic means for controlling the movement of said lever, said bimetallic means being resettable by circuit opening movement of said manual means.

20. In a circuit breaker, fixed and movable contacts, manually operable cam means for moving said movable contact to open-circuit position, and automatically operable cam means for moving said movable contact to open-circuit position on the occurrence of a predetermined overload, said manually operable cam means being incapable of operation to cause said movable contact to remain in closed-circuit position during the occurrence of an overload, said manually operable cam means and said automatically operable cam means being pivotally mounted for rotation about a common axis.

21. In a circuit breaker, fixed and movable contacts, manually operable cam means for moving said movable contact to open-circuit position, and automatically operable cam means for moving said movable contact to open-circuit position on the occurrence of a predetermined overload, said manually operable cam means being incapable of operation to cause said movable contact to remain in closed-circuit position during the occurrence of an overload, and a common pivot for said manually operable cam means and said automatically operable cam means.

22. In an electric switch, fixed and movable contacts, a pivotally mounted handle, cam means on said handle for operating said movable contact, in combination with a pivotally mounted

tripping lever, cam means on said lever for operating said movable contact, thermally responsive means operable upon the occurrence of an overload for controlling said lever.

23. In an electric switch, fixed and movable contacts, a pivotally mounted handle, cam means on said handle for operating said movable contact, in combination with a pivotally mounted tripping lever, cam means on said lever for operating said movable contact, thermally responsive means operable upon the occurrence of an overload for controlling said lever, and a common pivot for both of said cam means.

24. In an electric switch, fixed and movable contacts, a pivotally mounted handle, cam means on said handle for operating said movable contact, in combination with a pivotally mounted tripping lever, cam means on said lever for operating said movable contact, thermally responsive means operable upon the occurrence of an overload for controlling said lever, and a single spring means biasing both said cam means.

25. In an electric switch, fixed and movable contacts, a pivotally mounted handle, cam means on said handle for operating said movable contact, in combination with a pivotally mounted tripping lever, cam means on said lever, for operating said movable contact, thermally responsive means operable upon the occurrence of an overload for controlling said lever, and a single spring means biasing both said cam means, said spring means serving to bias said first-named cam means in both circuit-open and circuit-closed positions, alternatively.

26. In an electric switch, fixed and movable contacts, a pivotally mounted handle, cam means on said handle for operating said movable contact, in combination a pivotally mounted tripping lever, cam means on said lever for operating said movable contact, thermally responsive means operable upon the occurrence of an overload for controlling said lever, and a common pivot for both of said cam means, and a single spring means biasing both said cam means.

27. In an electric switch, fixed and movable contacts, a pivotally mounted handle, cam means on said handle for operating said movable contact, in combination a pivotally mounted tripping lever, cam means on said lever for operating said movable contact, thermally responsive means operable upon the occurrence of an overload for controlling said lever, and a common pivot for both of said cam means, and a single spring means biasing both said cam means, said spring means serving to bias said first-named cam means in both circuit-open and circuit-closed positions, alternatively.

28. In an electric switch, fixed and movable contacts, manual means to operate the switch, means connected to and movable upon each movement of said manual means for accomplishing engagement and disengagement of said fixed and movable contacts, automatically operable means movable without movement of said means connected to said manual means for causing disengagement of said contacts on occurrence of an overload, and spring means biasing said automatic means for contact separation and biasing said manually operable means so as to cause engagement and disengagement of said contacts to be accomplished with a snap motion.

29. In an electric switch, fixed and movable contacts, said movable contact when in open circuit position being biased to move into engagement with the fixed contact, manual means

to operate the switch, means movable by said manual means for causing disengagement of said fixed and movable contacts when moved to one position and for permitting the bias of said movable contact to move it into engagement with said fixed contact when moved to another position, automatically operable means for causing disengagement of said contacts on occurrence of an overload, and spring means biasing said automatic means for contact separation and biasing said manually operable means so as to cause engagement and disengagement of said contacts to be accomplished with a snap motion and current responsive means actuated by an overload current for controlling the operation of said automatic means.

30. In a circuit breaker, fixed and movable contacts, means biasing said movable contact when in normal open circuit position to move to closed circuit position, a member adapted to be set in one position to hold said movable contact in open-circuit position and adapted to be set in another position to permit movement of said movable contact into closed circuit position, manually operable means to control said member and having two stable positions corresponding to said positions of said member, and an automatically operable current responsive means for causing movement of said movable contact to open-circuit position on occurrence of a predetermined overload, said manually operable means being incapable of operation to cause said movable contact to remain in closed-circuit position during occurrence of an overload.

31. In a circuit breaker, fixed and movable contacts, means biasing said movable contact toward closed circuit position, an insulated member adapted to be set in one position to hold said movable contact in open-circuit position and adapted to be set in another position to permit movement of said movable contact into closed-circuit position, manually operable means to control said member, and an automatically operable member for moving said movable contact to open-circuit position, thermally responsive means releasing said automatically operable member upon occurrence of a predetermined overload, said manually operable means being incapable of operation to cause said movable contact to remain in closed circuit position during occurrence of an overload.

32. In an electric switch, fixed and movable contacts, an insulating member occupying one or another of two positions of rest for permitting engagement of said contacts when in one position and causing disengagement of said contacts when in the other position, and manually operable means movable between two positions for operating said member between its positions at will, said manually operable means being biased to remain in either of said two positions to which it is moved in combination with thermally responsive means operable by an overload current to cause separation of said contacts, said insulating member being ineffective to maintain the circuit closed during the continuance of an overload.

33. In an electric switch, fixed and movable contacts biased when in open position to move to closed position, a pivotally mounted operating handle, a pivotally mounted tripping lever, insulating means operable by said handle and lever for operating said movable contact to open position against its bias, thermally responsive means operable upon occurrence of an overload for controlling said tripping lever.

34. In a circuit breaker, a pair of contacts, at least one of which is movable to open and close the circuit through the circuit breaker, means for biasing said movable contact when in open-circuit position to move to closed-circuit position, an operating member for the circuit breaker movable to one position to cause said movable contact to move to open-circuit position against its bias and movable to another position wherein said movable contact may be moved by its biasing means to closed-circuit position, means biasing said operating member toward said one position when moved to that position and toward said other position when moved to said other position, a tripping member biased to move said movable contact member to open-circuit position against said bias, and releasable means for restraining said tripping member from movement due to its bias until the occurrence of a predetermined current condition.

35. In a circuit breaker, a pair of contacts, at least one of which is movable to open and close the circuit through the circuit breaker, means for biasing said movable contact when in open-circuit position to move to closed-circuit position, an operating member for the circuit breaker movable to one position to cause said movable contact to move to open-circuit position against its bias and movable to another position wherein said movable contact may be moved by its biasing means to closed-circuit position, means biasing said operating member toward said one position when moved to that position and toward said other position when moved to said other position, a tripping member biased to move said movable contact member to open-circuit position against said bias, and releasable means for restraining said tripping member from movement due to its bias until the occurrence of a predetermined current condition, said tripping member when released causing said movable contact to move to open-circuit position irrespective of the position in which said operating member may be held.

36. In a circuit breaker, a pair of contacts, at least one of which is movable to open and close the circuit through the circuit breaker, means for biasing said movable contact when in open-circuit position to move to closed-circuit position, an operating member for the circuit breaker movable to one position to cause said movable contact to move to open-circuit position against its bias and movable to another position wherein said movable contact may be moved by its biasing means to closed-circuit position, means biasing said operating member toward said one position when moved to that position and toward said other position when moved to said other position, a tripping member biased to move said movable contact member to open-circuit position against said bias, releasable means for restraining said tripping member from movement until the occurrence of a predetermined current condition, and means operable upon movement of said operating member to return said tripping member to the position wherein it is restrained by said releasable means.

37. In a circuit breaker, a fixed contact and a movable contact cooperating therewith to open and close the circuit through the circuit breaker, spring means biasing said movable contact toward closed-circuit position at all times, a pivoted operating handle movable to "off" position to cause said movable contact to move against its spring means to open-circuit position and movable to "on" position where said movable contact

may be moved by its spring means to closed-circuit position, said operating handle being biased to move about its pivot and the direction of said bias being reversed as the operating handle moves through a point intermediate "on" and "off" positions, whereby the operating handle is always biased to the position to which it has been moved, a tripping member biased to move and apply the force of its biasing means to move said movable contact to open-circuit position against the bias of the spring means biasing it to closed-circuit position, a thermally responsive catch normally holding said tripping member from said movement and releasing it upon the flow of a predetermined current in the circuit, said tripping member when released causing said movement of the movable contact to open-circuit position even though said operating member may be held in "on" position, and means operated by movement of said operating handle from "on" to "off" position for returning said tripping member against its biasing means to position where it is retained by said thermally responsive catch.

38. In a circuit breaker, a fixed contact and a movable contact cooperating therewith to open and close the circuit through the circuit breaker, spring means biasing the movable contact toward closed-circuit position at all times, a pivoted operating handle movable to "off" position to cause said movable contact to move to open-circuit position and movable to "on" position wherein said movable contact is freed for movement by its spring means to closed-circuit position, biasing means for said operating handle, the direction of said bias being reversed as the operating handle moves through a point intermediate "on" and "off" positions, whereby the operating handle is always biased to the position to which it has last been moved, a tripping member biased to move said movable contact to open-circuit position against the movable contact biasing means, a thermally responsive catch normally holding said tripping member from said movement and releasing it upon the flow of a predetermined current in the circuit, said tripping member when released causing said movable contact to move to open-circuit position irrespective of the position in which said operating member may be held and means operated by movement of said operating handle from "on" to "off" position for returning said tripping member against its biasing means to position wherein it is held by said thermally responsive catch.

39. In a circuit interrupter, a pair of contacts one of which is movable to open and close the circuit, means for normally actuating said movable contact including a manually engageable portion and a contact actuating portion, said manually engageable portion having two positions and being biased to remain in whichever of said positions it is placed, and said contact actuating portion having two positions between which it is movable upon movement of said manually engageable portion, said contact actuating portion when in one position holding said movable contact in open-circuit position and when in the other position permitting said movable contact to be in closed-circuit position, a tripping member biased to move and cause said movable contact to move to open-circuit position without any movement of said contact actuating portion of the means for normally actuating the movable contact, and current responsive means normally holding said tripping member from movement

but being releasable upon the occurrence of a predetermined condition.

40. In a circuit interrupter, a pair of contacts one of which is movable to open and close the circuit, means biasing said movable contact to move from open-circuit position to closed-circuit position, means for normally actuating said movable contact including a manually engageable portion and a contact actuating portion, said manually engageable portion having two positions and being biased to remain in whichever of said positions it is placed, and said contact actuating portion having two positions between which it is movable upon movement of said manually engageable portion, said contact actuating portion when in one position holding said movable contact in open-circuit position against its biasing means and when in the other position permitting said movable contact to be moved to closed-circuit position by its biasing means, a tripping member biased to move and cause said movable contact to move to open-circuit position against its biasing means and without any movement of said contact actuating portion of the means for normally actuating the movable contact, and current responsive means normally holding said tripping member from movement but being releasable upon the occurrence of a predetermined condition.

41. In a circuit interrupter, a pair of contacts one of which is movable to open and close the circuit, means for normally actuating said movable contact including a manually engageable portion and a contact actuating portion, said manually engageable portion having two positions and being biased to remain in whichever of said positions it is placed, and said contact actuating portion having two positions between which it is movable upon movement of said manually engageable portion, said contact actuating portion when in one position holding said movable contact in open-circuit position and when in the other position permitting said movable contact to be in closed-circuit position, a tripping member biased to move and cause said movable contact to move to open-circuit position without any movement of said contact actuating portion of the means for normally actuating the movable contact, current responsive means normally holding said tripping member from movement but being releasable upon the occurrence of a predetermined condition, and said tripping member being returnable into position where it is held by said current responsive means by movement of said manually engageable portion of the means for normally actuating the movable contact.

42. In a circuit interrupter, a pair of contacts one of which is movable to open and close the circuit, a member movable for normally operating the circuit interrupter, means connected to and movable upon each movement of said movable operating member for causing movement of said movable contact to open and close the circuit, automatically operable means movable without movement of said means connected to the operating member for causing said movable contact to move to open the circuit upon the occurrence of a predetermined condition in the circuit, and a spring connected at one end to bias said automatic means to open the circuit and connected at its other end to bias said operating member.

43. In a circuit interrupter, a pair of contacts one of which is movable to open and close the circuit, a member movable between two posi-

tions for normally operating the circuit interrupter, means connected to and movable upon each movement of said movable operating member for causing movement of said movable contact to open and close the circuit, automatically operable means movable without movement of said means connected to the operating member for causing said movable contact to move to open the circuit, a spring connected at one end to bias said automatic means to open the circuit and connected at its other end to bias said operating member to whichever of said two positions it has been moved last, and means connected in the circuit through the circuit interrupter for normally retaining said automatic means against its bias and for releasing said automatic means upon the occurrence of an abnormal condition in the circuit.

44. In a circuit interrupter, a pair of contacts one of which is movable to open and close the circuit, means for biasing said movable contact when in open position to move to closed position, a member movable for normally operating the circuit interrupter, means connected to and movable upon each movement of said movable operating member for causing movement of said movable contact to open and close the circuit, automatically operable means movable without movement of said means connected to the operating member for causing said movable contact to move to open the circuit against its bias upon the occurrence of a predetermined condition in the circuit, and a spring connected at one end to bias said automatic means to open the circuit and connected at its other end to bias said operating member.

45. In an electric switch, movable contact means, biasing means tending at all times to move said contact means to close the circuit through the switch, a cam occupying one or another of two positions of rest for causing said contact means to close the circuit by said biasing means and for causing said contact means to maintain the circuit open against said biasing means, manually operable means for operating said cam from one of said positions to the other, thermally responsive means operable by an overload current to cause separation of said contact means against said biasing means even though said cam may be held from movement, whereby said cam is ineffective to maintain the circuit closed during the continuance of an overload.

46. In an electric switch, movable contact means having biasing means tending to close the circuit when in normal open circuit position, a cam occupying one or another of two positions of rest for causing engagement and separation of said contact means, and manually operable means positively connected with said cam at all times for operating said cam between said positions at will, in combination with thermally responsive means operable by an overload current to cause separation of said contact means even though said cam is held by said manually operable means in position to maintain the circuit closed, and means actuated by movement of said manually operable means for causing resetting of the switch after its opening by said thermally responsive means.

47. In an electric switch, movable contact means, biasing means tending at all times to move said contact means to close the circuit through the switch, a movable part occupying one or another of two positions of rest for caus-

ing closing of the circuit through said contact means by said biasing means and for causing opening of said contact means against said biasing means, manually operable means for operating said movable part between said positions at will, thermally responsive means operable by an overload current to cause separation of said contact means against said biasing means irrespective of the retention of said movable part in position to maintain the circuit closed during the continuance of an overload, and means actuated by movement of said manually operable means for resetting said thermally responsive means after its operation.

48. In an electric switch, movable contact means having biasing means tending to close the circuit when in normal open circuit position, a cam occupying one or another of two positions of rest for causing engagement and separation of said contact means, and manually operable means positively connected with said cam at all times for operating said cam between said positions at will, in combination with thermally responsive means operable by an overload current to cause separation of said contact means even though said cam is held by said manually operable means in position to maintain the circuit closed.

49. In an electric switch, movable contact means, biasing means tending at all times to move said contact means to close the circuit through the switch, a current responsive element and a member movable in response to movement of the current responsive element to cause said movable contact means to open the circuit, a movable part occupying one or another of two positions of rest for causing closing of the circuit through said contact means by said biasing means and for causing opening of said contact means against said biasing means, and manually operable means for operating said movable part between said positions at will, and said movable part being normally operable by said manually operable means to cause opening of said contact means independently of any movement of said member movable in response to movement of the current responsive element.

50. In an electric switch, contact means for opening and closing the circuit, a contact arm normally supported adjacent one end and movable at its other end to actuate said contact means to open and close the circuit, said contact arm when in normal open circuit position being biased to move the closed circuit position, an operating member mounted for normal pivotal movement about a point intermediate its ends and having a cam surface adjacent one end and a portion by which it may be engaged and operated adjacent its other end, said operating member having two stable positions in each of which it will normally remain set and when moved to one of said positions causing its cam surface to exert a force moving said contact arm to open circuit position against the bias thereon and when moved to the other of said positions permitting said contact arm to be moved to closed circuit position due to the bias thereon, current

responsive means operable upon the occurrence of a predetermined abnormal condition to cause movement of said contact arm to open circuit position, and said contact arm being movable to open circuit position upon operation of said current responsive means even though the cam surface on said operating member may be held in closed circuit position.

51. In a circuit breaker, a substantially fixed contact, a movable contact, and actuating mechanism including a contact arm normally supported adjacent one end and having said movable contact adjacent its other end and movable into and out of engagement with said fixed contact to open and close the circuit, said contact arm when in normal open circuit position being biased to move to closed circuit position, and an operating member having a cam surface adjacent one end and a portion by which it may be manually engaged and operated adjacent its other end, said operating member having two stable positions in each of which it will normally remain set and said operating member when moved to one of said positions causing its cam surface to exert a force to be applied to the mid-portion of said contact arm to move it to open circuit position against its bias and when moved to the other of its positions permitting said contact arm to be moved to closed circuit position by the bias thereon, a current responsive element normally having latching engagement with a part of said actuating mechanism and being movable to unlatched position upon the occurrence of an abnormal condition to initiate movement of said contact arm to open the circuit even though said operating member may be held with its cam surface in its normal closed circuit position, and said operating member being movable to cause relatching of said current responsive element and the actuating mechanism.

52. In an electric switch, a contact member, a contact arm carrying a contact surface movable into and out of engagement with said contact member to open and close the circuit through the switch, said contact arm being permanently biased to move to engage said contact member, a first contact operating means having a manually engageable part and another part positively connected to move with the manually engageable part at all times and operatively engageable with said contact arm, said first contact operating means having two positions and when in one of said positions holding said contact arm in open circuit position against its bias and when in the other of said positions permitting said contact arm to be moved to closed circuit position by its biasing means, and a second contact operating means including a current responsive element operable to cause movement of said contact arm to open circuit position against its bias, said second contact operating means being operable to cause said contact arm to move to open circuit position even though said first contact operating means may be held in its closed circuit position.

EDWARD E. FORSTROM

CERTIFICATE OF CORRECTION.

Patent No. 2,137,134.

November 15, 1938.

EDWARD E. FORSTROM.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, first column, line 56, claim 13, after the word and comma "switch," insert the words relatively movable; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 13th day of December, A. D. 1938.

Henry Van Arsdale

(Seal)

Acting Commissioner of Patents.

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