Sept. 7, 1954 E. BESAG ET AL 2,688,674

ELECTRIC SWITCH

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FIG. 1.

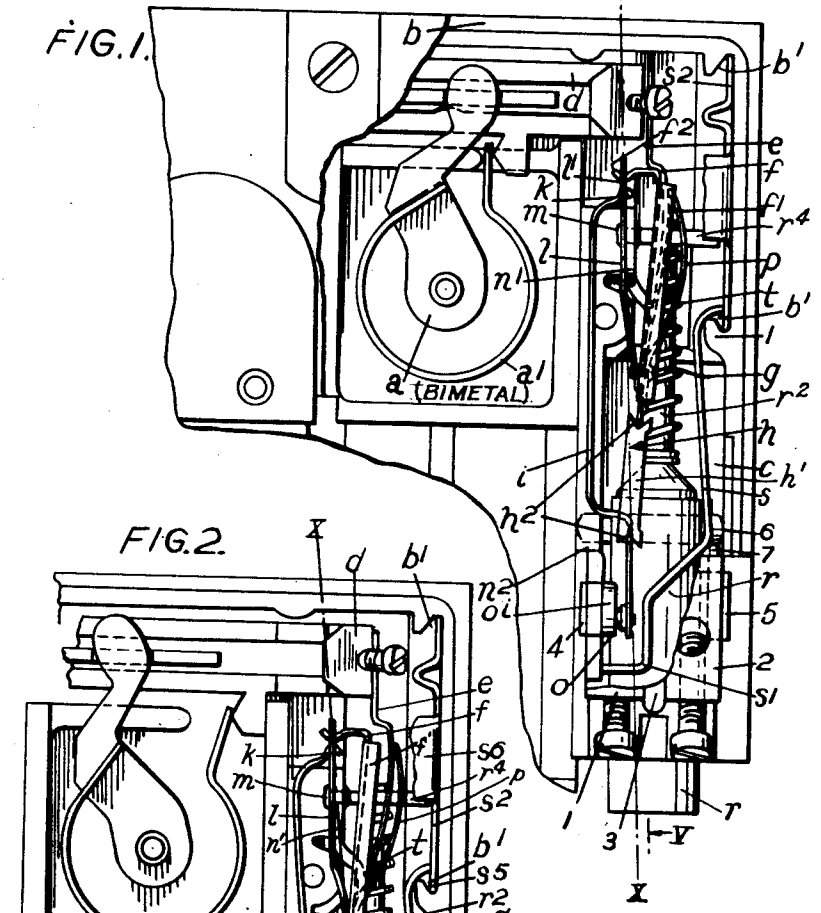
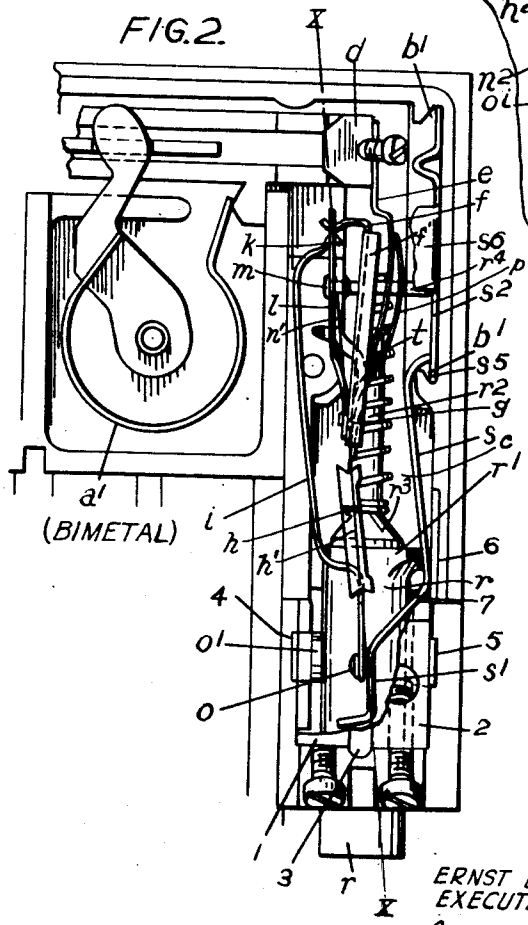


FIG. 2.



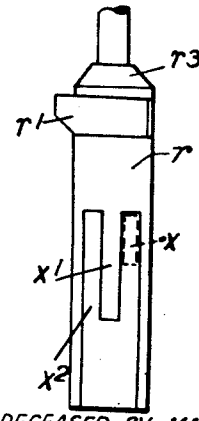


FIG. 11.

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ELECTRIC SWITCH

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FIG. 3.

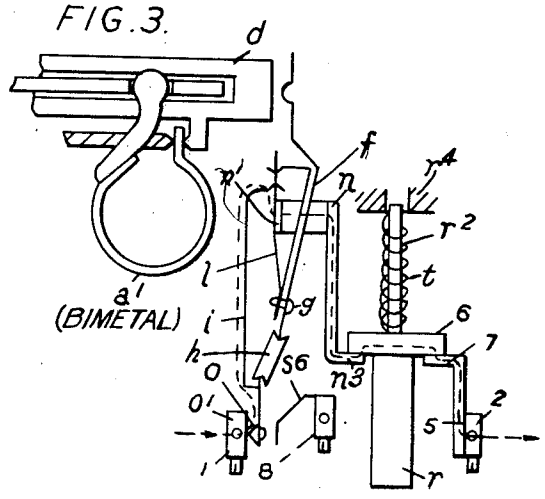
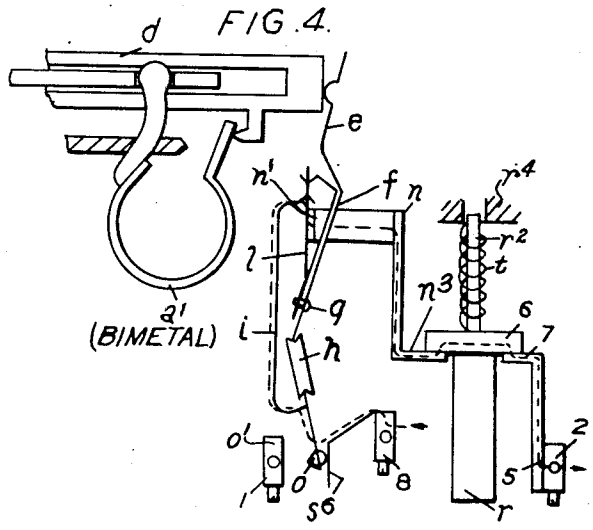


FIG. 4.



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FIG. 5.

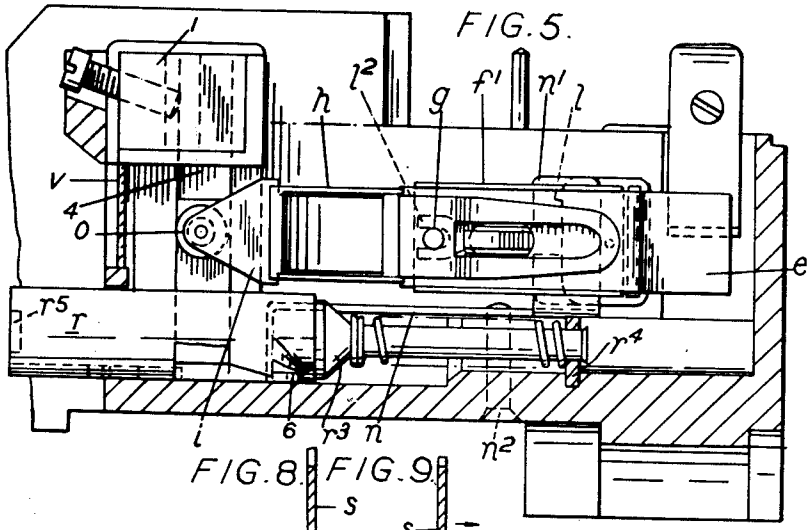


FIG. 8.

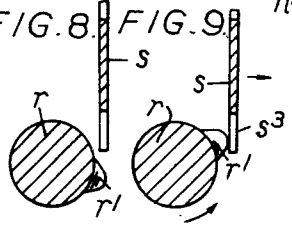


FIG. 9.

FIG. 7.

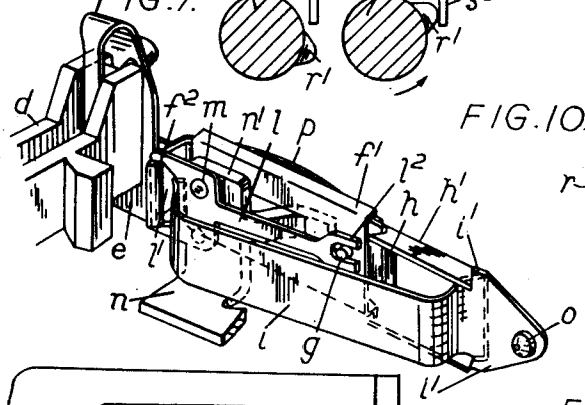


FIG. 10.

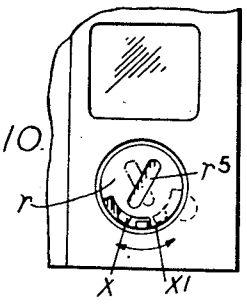
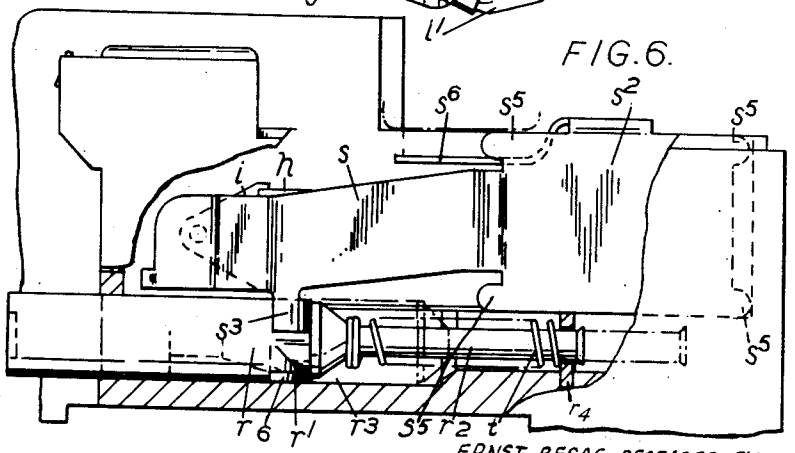


FIG. 6.



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UNITED STATES PATENT OFFICE

2,688,674

ELECTRIC SWITCH

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Continuation of application Serial No. 173,102, July 11, 1950. This application March 12, 1954, Serial No. 415,932

Claims priority, application Great Britain July 21, 1949

12 Claims. (Cl. 200—113)

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The present application is a continuation of our abandoned application Serial No. 173,102, filed July 11, 1950, and entitled "Electric Switches."

This invention relates to improvements in electric switches, and is particularly concerned with switches adapted, by adjustment, to enable the contacts to be re-set after a switching operation, either automatically or by hand. For example, the invention is applicable for use in connection with switches employed with automatic circuit breakers or contactors in which thermally operated elements are adapted to trip the circuit breaker when an overload occurs, the improved switch including mechanism enabling the contacts thereof to be re-set either automatically or by hand, for re-establishing the interrupted circuit when normal current conditions are restored.

According to this invention, an electric switch is provided which comprises a spring-holder which tends to compress the members of a toggle, this holder, which is formed with an extension carrying the moving contact, being pivoted in a re-set spring blade which is adapted also for pivotally supporting the end of the toggle remote from the contact. An adjustable stop device is provided which is adapted to be disposed in the path of the moving contact so that in one position it limits the movement of the toggle to such an extent that the re-set blade is enabled to cause re-engagement of the contacts, while in the other position the stop device is displaced with respect to the spring-holder and contact so as to permit the toggle to move to a greater distance and to necessitate manual re-setting of the switch.

The toggle employed in the switch of the present invention, may comprise a channelled member and a notched plate. The former carries a flexible blade, which may be laminated, so that any overrun of the trip bar of the associated automatic circuit breaker or contactor which impinges on it at one end, does not cause damage to the switch parts or to the bimetal elements of the associated thermal release device. The other end of the flexible blade is pivoted in the notched plate forming one element of the toggle, the other end of which plate is carried by the spring holder, which spring holder may be in the form of a bent resilient blade pivoted in an aperture in the re-set blade. The improvements provided by the present invention enable a small movement of the trip bar of the associated automatic circuit breaker or contactor to result in an increased movement of the switch parts.

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In order to enable the invention to be readily understood, reference will now be made to the accompanying drawings, illustrating, by way of example, a motor starter having thermal overload release devices operative on the trip switch in accordance with the present invention, in which drawings:

Figure 1 is a plan view of part of the overload box of a motor starter fitted with the trip switch which is shown in the closed position and with the adjustment means effective for automatic re-setting for re-establishing the interrupted circuit when normal current conditions are restored.

Figure 2 is a view similar to Figure 1 showing the switch in the tripped position and with the adjustment means effective for requiring hand re-setting for re-establishing the interrupted circuit when normal current conditions are restored.

Figure 3 is a diagrammatic view showing the parts in the position illustrated in Figure 1 and showing the current circuit.

Figure 4 is a diagrammatic view similar to Figure 3 and illustrating the path of the current after a switching operation to open-circuit position with the adjustment means in the position shown in Figure 2.

Figure 5 is a vertical sectional view on the line V—V of Figure 1.

Figure 6 is a fragmentary side elevation of Figure 1 with a portion of the wall of the overload removed, the chain lines in this figure indicating the position of the plunger when the same is pushed inwards to a position for re-setting.

Figure 7 is a perspective view of the trip mechanism.

Figures 8 and 9 are detailed sectional views showing respective positions of adjustment of the rotatable reset plunger.

Figure 10 is an end view of the reset plunger, and

Figure 11 is an inverted plan view of the front end of the reset plunger.

According to one example of construction, the thermal release devices *a* of an associated automatic circuit breaker or contactor, are housed in an overload box *b* formed at one end with a long, narrow compartment *c* in which the trip switch

mechanism of the present invention is mounted. The bimetal elements a^1 of the associated thermal devices a are operative on a trip bar d of the construction described and claimed in the U. S. Patent No. 2,527,907 of October 31, 1950 one end of the bar being adapted, on the occurrence of overload conditions, to impinge on the free end of a flexible blade e of extended length, the major portion of which blade is disposed within the channel f^1 of a long plate f, to which the blade e is secured by means of a rivet g. The ends of the blade e protrude beyond the plate f, one end of said blade being bent for engagement by the trip bar d, and the other end of said blade being pivotally engaged with a short rectangular plate h, the other end of which rectangular plate is pivotally engaged by a spring contact holder i. This contact holder i is of elongated "C" form, one end being hooked at k into engagement with an aperture l^1 (see Figure 7) in a resilient re-set blade l, which blade is secured midway of its length by a pair of rivets m to the upstanding arm n^1 of a fixed bracket n secured by a screw n^2 to the box. This upstanding arm n^1 acts as an abutment for the channelled plate f for limiting the turning movement of the toggle constituted by this plate f and the rectangular plate h. The other end of the blade l which presses on the channel f^1, is bifurcated at l^2 so that the rivet g can slide therein. The other end of the aperture l^1 has hooked engagement with the bent end f^2 of the channel plate f. Thus the re-set blade l has provision therein for two pivots, one for the spring contact holder i, and the other for the channelled plate f. The rectangular plate h which constitutes one element of the toggle, has side flanges h^1, and it is in the ends of these side flanges that V-shaped notches h^2 are formed for pivotally seating the flexible blade e and lateral shoulders i^1 (see Figure 7) of the C-shaped holder i. Extending forwardly from the end of the C-shaped holder i is an arm which carries a silver button o constituting the moving contact.

The rivet g which attaches the flexible blade e to the channel plate f, may also secure a reinforcing bowed blade p to produce a structure with enhanced flexibility. The bowed formation enables only the end of the blade p to bear on the flexible blade e, thereby reducing friction. Alternatively, the blade p may be flat, its end remote from the rivet g being formed with a protuberance to separate it from the flexible blade e and thereby reduce friction.

The inherent resiliency of the C-shaped holder i tends to compress the toggle, the set of the re-set plate l disposed between the holder and the toggle, serving to move the mid-joint of said toggle toward the right and away from the holder i as viewed in Figure 1. Impingement of the trip bar d on the upper end of the flexible blade e moves it, together with the channel plate f to which it is secured, in a clockwise direction as viewed in Figure 1, and thereby the toggle joint is moved toward the left as viewed in Figure 1, so that the toggle moves over its dead-centre line X—X. As a result, the moving contact o on the lower end of thet C-shaped holder i flies away, and is disengaged from, its fixed contacts o^1, and, dependent on the position of an adjustment means to be hereinafter described, the contacts are momentarily or permanently broken, that is, the contacts are either automatically re-set or, hand resetting is necessary for effecting their re-engagement.

The adjustment means above referred to, comprises a rotatable plunger r which also acts as a stop button for the motor starting switch, and which plunger is formed with a lobe or cam r^1 engageable with a downturned arm s^3 (see Figure 6) of the resilient blade s of a bracket s^2. This blade s has a bent end s^1 disposed in the path of the moving contact o. The resiliency of the blade s causes it to assume the position shown in Figures 1 and 8, its movement being limited by the abutment of the bent end s^1 with the box. When, however, the button or plunger r is turned to the position shown in Figures 2 and 9, the cam r^1 causes the blade s to be pressed toward the right as viewed in Figure 1, so that its bent end s^1 permits additional movement of the contact o toward the right and away from the contact o^1. In the position for automatic re-setting, the stop s^1 is disposed in the path of the moving contact o so that movement of the latter away from the fixed contact o^1 is restricted, as illustrated in Figures 1 and 3.

The plunger r can be pressed inwardly as seen in chain lines in Figure 6, against the action of a helical compression spring t which is coiled around a reduced stem r^2 of the plunger r and which spring is operative between a shoulder r^3 and a fixed stop r^4 through which the stem guidingly extends. Adjustment is effected by pressing the plunger r inwardly to its maximum extent so that a rib x thereon is disengaged from a complementary lug formation x^1 on the case as best seen in chain lines Figures 10 and 11, to enable the plunger r to be turned, which turning may be effected, for example, by the engagement of a screw driver with its grooved end r^5, Figure 10. Slots x^2 move over the lug x^1 during the inward movement of the plunger r, the lug x^1 being disposed in one or other of the slots according to position of adjustment. The rib x prevents rotation of the plunger when in its normal position. In operation, and assuming the adjustment to be set as seen in Figure 2, it will be apparent that upon tripping, the toggle is enabled to move so far over the dead-centre line X—X, that the pressure toward the left, due to the toggle, is much in excess of the re-setting pressure of the re-set blade l. In this condition, therefore, re-setting is effected manually by pressing the stop button r inwardly so that the lobe r^1 thereon is disengaged from abutment with the arm s^3 of the blade s, the resiliency of said blade causing it to return to the position shown in Figure 1. As a result, the blade s urges the contact o to the position shown in Figure 2, when, if the fault which caused the switch to trip has disappeared, the contacts are enabled to re-engage.

If the plunger r has been adjusted to the position shown in Figure 1, i. e. to the position for antomatic re-setting, tripping of the switch causes disengagement of the contacts o and o^1, but in view of the limited movement of the contact o, due to the position of the stop s^3, the contact o re-engages with o^1 as soon as the overload disappears and normal conditions are reestablished.

The greater part of the effort of the trip bar d during a tripping operation is utilised in further stressing or increasing the set of the re-set blade l, and only a small part of this effort is expended in stressing the spring holder i. After tripping of the switch has occurred, these parts act in opposite senses, the blade l tending to re-set the mechanism. This permits an extended outward movement of the arms of the bimetal

elements a^1 due to their inherent resiliency. The improvements provided by the present invention thereby ensure that the minimum time is occupied in re-setting, and undesirable irregular action or jumping of the bimetals a^1 is avoided.

Any excessive movement of the trip bar d due to abnormal overheating of the bimetals a^1 merely causes flexing of the flexible blade e and its back-up blade p, thereby avoiding damage or undesirable distortion of the switch parts and the bimetals.

The stop plate s which is disposed in the side of the strip compartment of the overload box, has a rectangular portion, the corners s^5 of which fit into grooves b^1 of the box.

Terminal blocks **1**, **2** are disposed on each side of an insulating partition **3**, their outer exposed surfaces being engaged by upright metal strips **4**, **5**, disposed in grooves at the upper front corner of the trip chamber of the box. The fixed contact o^1 is secured to the strip **4** and a contact block **7**, is rivetted to the lower end of the blade **5**. A traverse contact blade **6** on the plunger r is engageable at one end with the block **7** and at the other end with a downturned arm n^3 of the bracket n.

In the normal closed position shown in Figure 3, current flows from the terminal **2**, strip **5**, block **7**, plate **6**, bracket n, spring holder i, fixed and moving contacts oo^1, respectively, strip **4**, and terminal l. In the normal open position shown in Figure 4, the moving contact o engages the stop plate s, so that current flows to the latter (instead of to the fixed contact o^1) and thence to a horizontal extension s^6 of the latter which is connected with a terminal **8** for a pilot light or the like which indicates that the circuit is broken.

As will be evident from Figure 3, pressing the plunger r inwardly enables it to act as a stop button by breaking the circuit between the plate **6** and its co-operating contacts n^3 and **7**. In Figure 5, v is a transparent window through which the position and condition of the contacts can be observed.

Having thus described our invention, we claim:

1. An electric switch having adjustment means to enable the contacts thereof to be reset either automatically or manually after a switching operation to open contact position, comprising a pair of alined levers constituting a toggle the levers of which are movable from one side to the other of the dead center position of said toggle to effect opening and closing of said switch, a fixed contact, a movable contact controlled by said toggle and movable thereby into and out of engagement with said fixed contact as said toggle is moved from one side to the other of its dead center position, a resilient adjustable stop plate in the path of movement of and engaged by said movable contact as it moves away from said fixed contact, said stop plate normally occupying a first position relatively close to said fixed contact and being movable to a second position at a greater distance from said fixed contact than said first position, resilient resetting means acting on said toggle for urging said movable contact from said first position into engagement with said fixed contact but being ineffective to urge said movable contact into engagement with said fixed contact from said second position, said resilient resetting means effecting automatic resetting of said contact from said first position, and manually operable means for moving said stop plate from said first position to said second position and for permitting return of said resilient stop plate from said second position to said first position from which first position said movable contact is moved into engagement with said fixed contact by said resilient resetting means, said manually operable means permitting manual resetting of said contacts.

2. An electric switch as defined in claim 1 in which the manually operable means comprises a rotatable plunger having a peripheral cam thereon, movement of said plunger to one position causing engagement of said cam with said resilient stop member to move said stop member from said first position to said second position, and movement of said plunger to another position removing said cam from engagement with said resilient stop member and permitting said stop member to return to said first position from said second position.

3. An electric switch as defined in claim 1 and including a third contact within a circuit including an indicator, said third contact being positioned within the path of movement of said movable contact and being engageable thereby when said movable contact moves away from said fixed contact, said indicator informing the operator of the open position of said fixed and movable contacts when said movable contact engages said third contact.

4. An electric switch adapted for actuation to open position by the trip lever of an automatic circuit breaker and having adjustment means to enable the contacts of said switch to be reset either automatically or manually after being opened by said trip lever, said switch comprising a pair of alined levers constituting a toggle, the levers of which are movable from one side to the other of the dead center position of said toggle to effect opening and closing of said switch, a fixed contact, a spring contact holder contacting one lever of said toggle and tending to move the toggle to one side of the dead center position of said toggle, said spring contact holder having an end extension on which is mounted the movable contact of said switch, said fixed and movable contacts being in open-circuit relation when said toggle is moved by said spring contact holder to said one side of said dead center position of said toggle, a resilient reset blade contacting the other lever of said toggle and tending to move the toggle to the other side of the dead center position of said toggle to reset the contacts to circuit closing position, said reset blade pivotally supporting the end portion of said spring contact holder that is opposite said end on which said movable contact is mounted, and said reset blades pivotally supporting that end of the toggle lever that is remote from the movable contact, a flexible blade connected at one end to the toggle lever remote from the movable contact and having its other end positioned within the path of movement of and engageable by the trip lever of the automatic circuit breaker with which said switch is associated, engagement of said trip lever with said other end of said flexible blade moving said toggle to said one side of its dead center position to permit said spring contact holder and the contact carried thereby to move away from said fixed contact to open circuit position, said reset blade moving said toggle to said other side of the dead center position of said toggle to automatically reset the contacts to circuit-closing position when said trip lever is moved from engagement with said flexi-

ble blade, and means to render said reset blade ineffective to automatically reset said contacts and to require manual setting of said contacts to circuit closing position.

5. An electric switch as defined in claim 4 and including a resilient adjustable stop disposed in the path of movement of and engaged by said movable contact as it moves away from said fixed contact, said stop normally occupying a first position relatively close to said fixed contact and being movable to a second position at a greater distance from said fixed contact than said first position, said stop when in said first position arresting movement of said toggle and movable contact in a position from which said reset blade will move said toggle and movable contact to effect engagement of said contacts, and said stop when in said second position arresting movement of said toggle and movable contact in a position from which said reset blade will not move said toggle and movable contact to effect engagement of said contacts, and manually operated means acting on said stop to move the same from said second to said first positions of said stop to permit said reset blade to effect engagement of said contacts.

6. An electric switch as defined in claim 4 wherein the toggle comprises one lever of channel-shaped formation and a second lever having notched end portions, said spring contact holder engaging one end of the lever having the notched end portions, and said flexible blade having a portion thereof connected to said lever of channel-shaped formation.

7. An electric switch as defined in claim 4 wherein a resilient back up blade exerts pressure on said flexible blade to resiliently oppose movement of said flexible blade by said trip lever.

8. An electric switch having adjustment means to enable the contacts thereof to be reset automatically or manually to circuit closing position after a switching operation to open circuit position, comprising a fixed contact, a movable contact adapted for movement to engage said fixed contact in circuit closing position and to first and second positions away from said fixed contact in open circuit position, a spring-pressed toggle mechanism effective in one direction to move said movable contact away from said fixed contact to said first and second positions and effective in an opposite direction to move said movable contact from said first position into engagement with said fixed contact but ineffective to move said movable contact from said second position into engagement with said fixed contact, a stop plate in the path of movement of and engaged by said movable contact as it is moved away from said fixed contact by said spring-pressed toggle mechanism, and manually operable means to position said stop plate to selectively control movement of said movable contact away from said fixed contact to said first or second positions.

9. An electric switch as defined in claim 8 in which said stop plate is resilient and tends to occupy a normal position wherein movement of said movable contact away from said fixed contact is restricted to said first position, and in which said manually operable means comprises a rotatable member having a cam thereon for engagement with said resilient stop plate, rotation of said member to one position causing said cam to move said stop plate from its normal position to a position wherein movement of said movable contact away from said fixed contact is restricted to said second position, rotation of said member to another position removing said cam from engagement with said stop plate and permitting said resilient stop plate to return to its normal position.

10. An electric switch as defined in claim 8 in which said stop plate is in a circuit including said movable contact and an indicator, which circuit is open when said movable contact is in engagement with said fixed contact and out of engagement with said stop plate, and which circuit is closed when said movable contact is out of engagement with said fixed contact and in engagement with said stop plate, whereby said indicator is energized to inform the operator of the open position of said movable and fixed contacts when said movable contact engages said stop plate in circuit closing position.

11. An electric switch having adjustment means to enable the contacts thereof, to be reset automatically or manually to circuit closing position after a switching operation to open circuit position, comprising a fixed contact, a movable contact adapted for movement to engage said fixed contact in circuit closing position and to first and second positions away from said fixed contact in open circuit position, a resilient toggle mechanism movable from one side to the other of its dead-center position and carrying said movable contact, first means acting on said toggle mechanism in one direction to move said mechanism to one side of its dead-center position to move said movable contact away from said fixed contact to said first or second positions, a resilient reset blade acting on said toggle mechanism in a direction opposite that of said first means and effective to move said toggle mechanism to the opposite side of its dead-center position to move said movable contact from said first position into engagement with said fixed contact but ineffective to move said movable contact from said second position into engagement with said fixed contact, and adjustable stop means to selectively control movement of said movable contact away from said fixed contact to said first or second positions, said reset blade effecting automatic resetting of said movable contact from said first position, and said adjustable stop means being movable to permit movement of said movable contact from said second position to said first position to permit said reset blade to effect automatic resetting of said movable contact following movement of said adjustable stop means.

12. An electric switch adapted for actuation to open circuit position by the trip lever of an automatic circuit breaker and having adjustment means to enable the contacts of said switch to be reset automatically or manually to circuit closing position after actuation thereof by said trip lever, comprising a fixed contact, a movable contact adapted for movement to engage said fixed contact in circuit closing position and to first and second positions away from said fixed contact in open circuit position, a resilient toggle mechanism movable from one side to the other of its dead-center position, first means acting on said toggle mechanism and movable by said trip mechanism in one direction to move said mechanism to one side of its dead-center position to move said movable contact away from said fixed contact to said first or second positions, a resilient reset blade acting on said toggle mechanism in a direction opposite that of said first means and effective to move said toggle mechanism to the opposite side of its dead-center position to move

said movable contact from said first position into engagement with said fixed contact but ineffective to move said movable contact from said second position into engagement with said fixed contact, a spring contact holder having its lower end engaging one member of said resilient toggle mechanism and mounting at said lower end said movable contact, said reset blade pivotally supporting the end of said spring contact holder that is opposite the end thereof which mounts said movable contact, and said reset blade pivotally supporting that end of the toggle mechanism that is remote from said movable contact, and manually operable means to selectively control movement of said movable contact away from said fixed contact to said first or second positions.

No references cited.