Nov. 21, 1944. C. H. BAYER 2,363,287

ELECTRIC SWITCH

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Fig. 2.

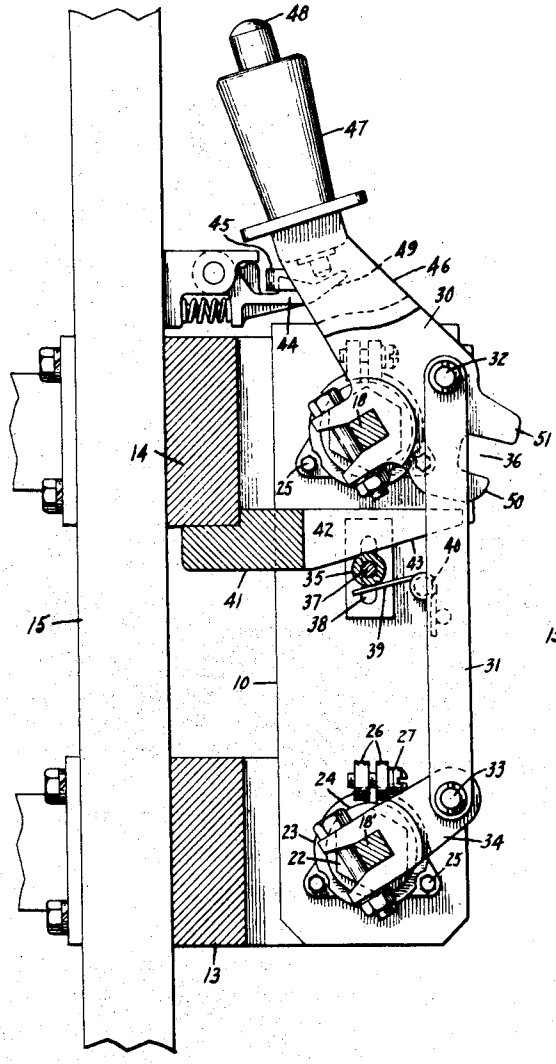
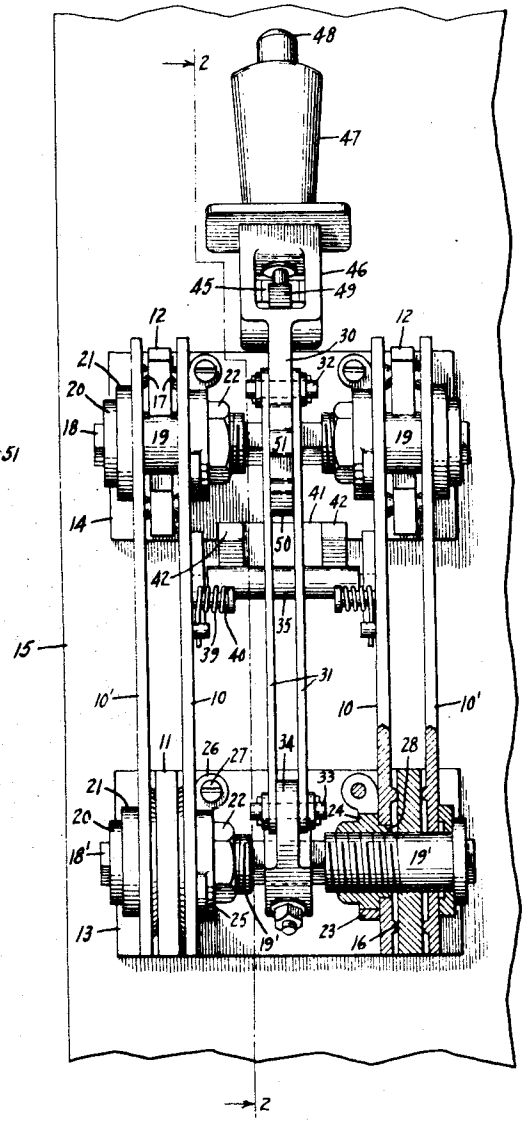


Fig. 1.



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Fig. 4.

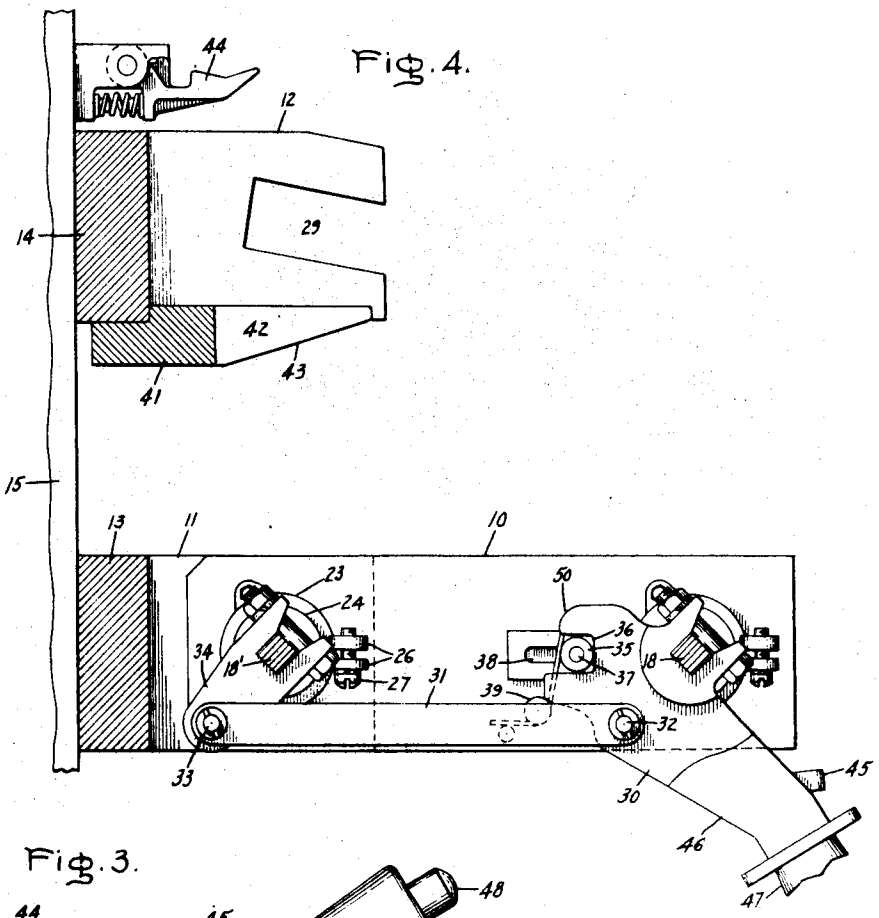


Fig. 3.

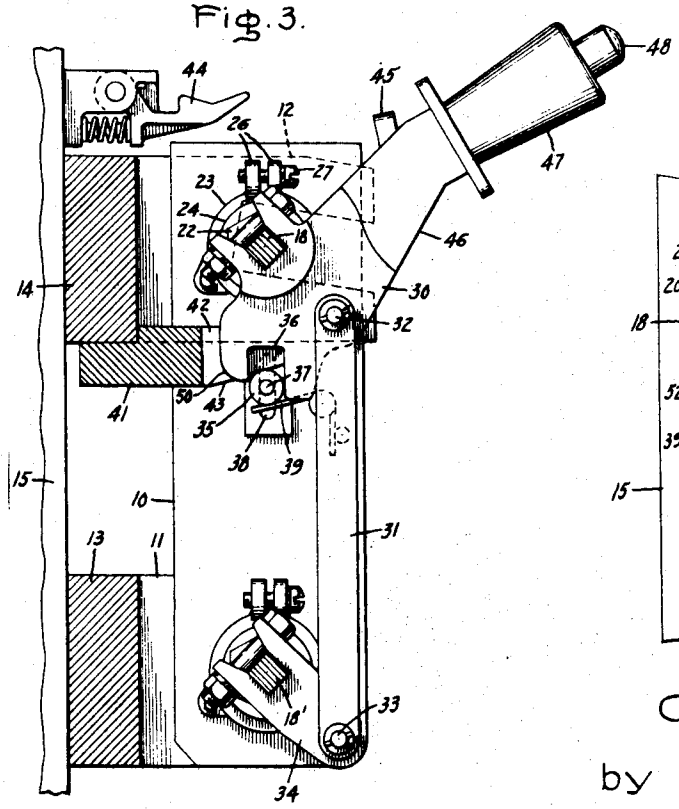
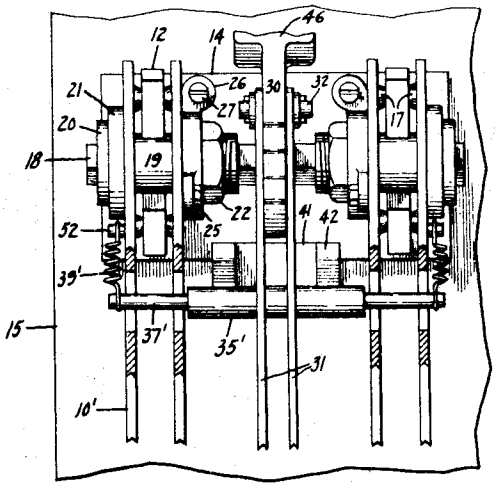


Fig. 5.



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UNITED STATES PATENT OFFICE

2,363,287

ELECTRIC SWITCH

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Application July 15, 1943, Serial No. 494,763

10 Claims. (Cl. 200—170)

My invention relates to improvements in electric switches and particularly to improvements in disconnecting switches for conducting large currents and especially disconnecting switches of the knife blade type.

The advantages of high contact pressure in electric switches are well recognized. Required current carrying capacities, however, are frequently such that in some types of switches it is is not feasible to obtain the contact pressure necessary to maximum conductivity by resiliency of contact structure because of the difficulty in opening and closing the switch. This is particularly troublesome in large multi-pole switches of the knife blade type because of the friction at each end of the blade contact during the contact closing and opening operations. In consequence of this, it is difficult to open and close the switch. Also, if the switch is not conveniently located, the operator may be unable to exert the effort necessary fully to close the switch which will then run hot. Moreover, without careful attention to adjustment of structure and to lubrication, material wear of the rubbing parts results from the friction between them.

Arrangements have been proposed for obtaining the desired contact pressure by suitable clamping means arranged to be actuated after the movable contact is in the switch closed position and to be released before moving this contact from the closed position. Some of these arrangements require two operating members, that is, one to open and close the switch and another to operate the clamping means. This involves a more or less expensive and complicated structure which requires thought and care on the part of the operator. Other arrangements have accomplished the opening and closing and pressure application and release with a single operating member, but arrangements with which I am familiar are complicated, likely to get out of order and more or less costly.

An object of my invention is to provide for a large current conducting capacity electric switch improved contact pressure producing and operating mechanism which requires the minimum of mental and physical effort on the part of the operator for functioning satisfactorily and which cannot be jarred out of its pressure applied position. Another object of my invention is to provide an improved relatively simple and rugged contact pressure producing and switch operating mechanism involving the use of only one operating member for both functions. A further object of my invention is to provide for a large current capacity knife blade switch a relatively economical and improved contact pressure producing and switch operating mechanism which is readily adaptable to standard switch construction. These and other objects of my invention will hereinafter appear in more detail.

In accordance with my invention, I provide for an electric switch a pressure applying mechanism and an operating member therefor which is movably positioned on the movable contact of the switch but held against movement relatively to such contact until substantially in the switch closed position by means mounted on the contact for translatory movement relatively thereto and arranged to be actuated substantially at the end of the switch closing movement to permit a predetermined movement of the operating member relatively to the contact for actuating the pressure applying mechanism. Also, in accordance with my invention, the operating member is held in the switch closed and pressure applying position against shocks and jars so as to prevent any possible loss of the contact pressure while the switch is conducting heavy currents. Further in accordance with my invention, the operating member and the mechanism for controlling its movement relatively to the switch contact are readily adaptable to the usual type of high current capacity knife blade switches without material change in the switch structure. Again in accordance with my invention as applied to switches of the knife blade type, the pressure applying mechanism is adapted to provide the necessary contact pressure at both the hinge and free ends of the blade.

My invention will be better understood from the following description when considered in connection with the accompanying two sheets of drawings, and its scope will be pointed out in the appended claims.

In the accompanying two sheets of drawings, Fig. 1 is a plan view, partly in section, of an electric switch of the knife blade type provided with pressure applying and operating means embodying my invention, the switch being shown in the closed position with the contact pressure applied; Fig. 2 is an elevation, partly in section, on the line 2—2 of Fig. 1; Fig. 3 is a view similar to Fig. 2 showing the parts in position with the contact pressure released; Fig. 4 is a view similar to Fig. 2 showing the switch in the full open position; and Fig. 5 is a plan view, partly in section, of a switch embodying a modification of my invention and showing the free end of the blade in engagement with its cooperating stationary contact and contact pressure applied.

For the purpose of illustrating my invention, I have shown embodiments thereof as applied to a relatively high current capacity knife switch of the multiple blade type, although it will be apparent to those skilled in the art that my invention is not limited to this particular type of electric switch. As shown, the switch comprises two blades, each having two spaced flat conducting

elements 10, 10' which are pivotally supported on stationary contacts such as hinge tongues 11 for movement into and out of engagement with stationary contact tongues 12. The hinge tongues 11 and the contact tongues 12 are conducting parts of terminals 13 and 14, respectively, which are suitably secured to a base 15 of insulating material. As illustrated, the blade elements 10, 10' are arranged for circular line contact with the hinge tongues 11 as appears at 16 in Fig. 1 and straight line contact with the contact tongues 12 as appears at 17 in Figs. 1 and 5.

For applying the necessary pressure between the blade elements 10, 10' and the hinge and contact tongues 11 and 12, I provide at each end of the blade elements in a switch of the type illustrated, a clamping means which is illustrated as of the screw type. As will appear most clearly in Fig. 1, this clamping means comprises at the ends of the switch blades cross shafts 18, 18' on which are respectively mounted threaded sleeves 19, 19' for each pair of blade elements. These sleeves 19, 19' are slidably positioned on their respective shafts and rotatable therewith. Between the head 20 of each sleeve 19, 19' and its adjacent blade element 10' is a washer 21. On the threaded end of each of the sleeves 19, 19' there is a nut 22 which can be adjustably positioned relatively to its adjacent blade element 10 to obtain the desired contact pressure for a predetermined angular movement of the shafts 18 and 18'.

For maintaining the nut 22 in any desired position relatively to its adjacent blade element 10, I provide a clamping member such as a split collar 23 which embraces a cylindrical portion 24 of the nut 22 and which is rigidly secured to the associated blade element 10 as by screws 25. For locking the nut in the desired position, the collar 23 is provided with lugs 26 and a clamping screw 27. In order to avoid rubbing between the threaded portion of the sleeve and the blade element embracing this portion, the adjusting nut 22 is provided with a cylindrical portion 28 which enters a corresponding opening in the adjacent blade element 10. With this structure, it will be clear that each of the sleeves 19' and the cylindrical portion 28 of the associated nut 22 provide the necessary pivotal support for the compound blade structure comprising two blade elements 10 and 10'. Each contact tongue 12 is provided with a notch 29 of such shape and size as to permit the entry of the sleeve 19 which seats in the bottom of the opening 29 to provide a blade stop.

For actuating the blade structure to and from the switch closed position and the clamping means to and from the pressure applied position when the switch is closed, I provide an operating member 30 which is bodily movable with the blade structure for the switch closing and opening operations and which is mounted on the blade structure for movement relatively thereto in one direction to effect the clamping action of the clamping means and in the opposite direction to release the clamping action when the switch is closed. Thus, as shown, the operating member 30 is rigidly secured to the cross shaft 18 at the free end of the blade structure. To effect the operation of the clamping means at the hinge end of the blade structure, I couple the operating member 30 to the cross shaft 18' by links 31 which are pivoted at 32 to the operating member and at 33 to a crank 34 suitably rigidly secured to the cross shaft 18'.

In order to prevent movement of the operating member 30 relatively to the blade structure during the switch closing and opening movements thereof, I provide, in accordance with my invention, means translatably supported on the blade structure and movable into interlocking engagement with the operating member 30 to prevent movement thereof relatively to the blade structure. As shown, this means comprises an element 35 which is rectilinearly movably mounted on the blade structure and biased for movement into an opening 36 in the operating member when a predetermined angular relation exists between the operating member and the blade structure. Thus, the element 35, which is preferably a roller for reduction of friction, may be mounted on a shaft 37 which is rollable or slidable or both in longitudinal slots 38 in the inner blade elements 10. Torsion springs 39 carried by the blade elements 10 on pins 40 serve to bias the roller 35 toward the free end of the blade structure, that is, into engagement with the notch 36 in the operating member as shown most clearly in Figs. 3 and 4.

In order to move the interlocking roller 35 out of the notch 36 to effect the clamping action when the switch is closed, I provide means for so displacing this roller as to move it toward the hinge end of the blade structure near the end of the closing movement thereof. As shown, this displacing means is of the cam type and comprises a generally U-shaped member 41 which, as shown, is secured to the terminal 14. The outstanding legs 42 of this member are provided with inclined plane surfaces 43 at such an angle to the longitudinal axis of the blade structure as to effect against the bias of the springs 39 near the end of the switch closing movement that displacement of the roller 35 necessary to release the operating member 30 for movement relatively to the blade structure. Following such release, the operating handle may be turned counterclockwise as viewed in Fig. 3 to tighten the nuts 22 on their respective sleeves 19, 19' and thereby apply the necessary contact pressure.

When this contact pressure is applied, it is important that it be maintained against the possibility of release by shocks and jars transmitted to the base 15 or otherwise. For preventing such release under shock, I provide means for positively holding the operating member 30 in the pressure applied position shown in Fig. 2. As illustrated, this means comprises a spring biased catch 44 which is mounted in the path of movement of a cooperating interlocking member 45 in the form of a stirrup secured to a bifurcated portion 46 of the operating member. For releasing the latch 44 to turn the operating member 30 clockwise relatively to the blade structure, I mount in the handle 47 of the operating lever a spring biased push rod 48, the inner end of which is, in the closed position of the switch, engageable with the tail 49 of the latch 44 to turn it clockwise out of the switch holding position.

Assuming the parts in the switch open position, as shown in Fig. 4, then the interlocking roller 35 under the bias of its springs 39 is seated in the notch 36 of the operating member 30, and movement of this member relatively to the blade structure cannot occur. Also, at this time, the clamping means is in the released position. The blade structure can now be turned counterclockwise about the axis of the shaft 18' at the hinge end by means of the operating member 30. Near the end of this counterclockwise rota-

tion, the roller 35 is engaged by the inclined plane surfaces 43 to cause translatory movement of the roller toward the hinged end of the blade structure and out of the notch 36 of the operating member with the parts positioned as shown in Fig. 3. At this time, the blade structure has come to rest with the sleeves seated on the bottom of the notches 29 in the contact tongues 12. Accordingly, movement of the blade structure in the counterclockwise direction is stopped. Continued pressure on the handle 47 of the operating member 30, however, will effect counterclockwise movement of the handle relatively to the blade structure with the curved portion on the tongue 50 of the operating member 30 riding over the roller 35 since the end of this portion is above the axis of the roller as viewed in Fig. 3. When this relative rotation of the operating member 30 occurs, both of the cross shafts 18 and 18' are rotated counterclockwise as viewed in Figs. 2 and 3 to apply the pressure action of the clamping means with the parts positioned as shown in Figs. 1 and 2 with the operating handle latched in the closed position by the latch 44.

When it is desired to open the switch, the push rod 48 is moved inwardly into the handle 47 to release the latch 44. The operating member 30 is then turned clockwise to effect the release of the clamping means thereby removing the applied contact pressure. When the operating member 30 is turned clockwise, its curved portion 50 engages the roller 35 on the side of its axis toward the contact tongue 12 to push the roller toward the cross-shaft 18' against the bias of the springs 39. As this occurs, the roller 35 rides over the curved portion of the tongue 50 and moves toward the front end of the blade slots 38. Further clockwise movement of the operating member 30 is stopped by the longer tongue portion 51 on the operating member coming to rest against the roller 35. The parts are then positioned as shown in Fig. 3. With the continuation of the effort applied to the operating handle to release the clamping means, the blade structure is moved to the full open position shown in Fig. 4. From the foregoing, it will be obvious that the operator merely has to clasp the handle 47 of the operating lever and apply a continuous effort in one direction to close the switch, apply the clamping action, and lock the switch in the closed position. To open the switch, it is only necessary to release the holding latch 44 and then apply continuous effort in the opposite direction to unclamp the pressure means and open the switch.

The embodiment of my invention shown in Fig. 5 is essentially the same as that heretofore described except for the mounting and biasing action on the roller 35. Thus, as shown in Fig. 5, the shaft 37' of the roller 35' extends through aligned slots in all of the blade elements, and the biasing springs 39' are simple helical tension springs connected between the shaft 37' and pins 52 carried by the outer blade elements 10'. The operation of this embodiment of my invention will be obvious from the description of the embodiment illustrated in Figs. 1 to 4, inclusive.

While I have shown and described my invention in considerable detail, I do not desire to be limited to the exact arrangements shown, but seek to cover in the appended claims all those modifications that fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In an electric switch comprising a stationary contact, a cooperating contact movable into and out of engagement with said stationary contact, clamping means for exerting pressure between said contacts in the switch closed position thereof and an operating member mounted on said movable contact for movement relatively thereto in one direction to effect the clamping action of said clamping means and in the opposite direction to release the clamping action, an element translatably supported on said movable contact and movable into interlocking engagement with the operating member to prevent movement thereof relatively to the movable contact during the switch closing and opening movements, and means for effecting translatory movement of said element relatively to said movable contact to permit movement of the operating member relatively to the movable contact after the movable contact has reached the end of its travel in the closing direction.

2. In an electric switch comprising a stationary contact, a cooperating contact movable into and out of engagement with said stationary contact, clamping means for exerting pressure between said contacts in the switch closed position thereof and an operating member pivotally supported on said movable contact for rotation in one direction to effect the clamping action of said clamping means and in the opposite direction to release the clamping action, an element rectilinearly movably mounted on said movable contact for preventing relative movement of the operating member and the movable contact during the switch closing and opening movements, and means for effecting rectilinear movement of said element relatively to said movable contact to permit rotation of the operating member relatively to the movable contact after the movable contact has reached the end of its travel in the closing direction.

3. In an electric switch comprising a stationary contact, a cooperating contact movable into and out of engagement with said stationary contact, clamping means for exerting pressure between said contacts in the switch closed position thereof and an operating member mounted on said movable contact for movement relatively thereto in one direction to effect the clamping action of said clamping means and in the opposite direction to release the clamping action, an element translatably supported on said movable contact and movable into interlocking engagement with the operating member to prevent movement thereof relatively to the movable contact during the switch closing and opening movements, means for effecting translatory movement of said element relatively to said movable contact to permit movement of the operating member relatively to the movable contact after the movable contact has reached the end of its travel in the closing direction, and means for positively holding the operating member in the pressure applied position.

4. In an electric switch comprising a stationary contact, a cooperating contact movable into and out of engagement with said stationary contact, clamping means for producing pressure between said contacts in the switch closed position thereof and an operating member supported on said movable contact for movement relatively thereto in one direction to effect the clamping action of said clamping means and in the opposite direction to release the clamping action, an interlocking ele-

ment rectilinearly movably mounted on said movable contact and biased for movement into interlocking engagement with said operating member when a predetermined angular relation exists between the movable contact and the operating member to prevent relative movement thereof during the switch closing and opening movements, and displacing means for moving said element out of interlocking engagement with said operating member near the end of the switch closing movement whereby to permit the clamping movement of the operating member, said displacing means being operative to permit the return of the element under the bias thereof into interlocking engagement with the operating member after the unclamping movement thereof.

5. In an electric switch comprising a stationary contact, a cooperating contact movable into and out of engagement with said stationary contact and clamping means for producing pressure between said contacts in the switch closed position thereof, an operating member provided with an opening and supported on said movable contact for movement relatively thereto in one direction to effect the clamping action of said clamping means and in the opposite direction to release the clamping action, an element rectilinearly movably mounted on said movable contact and biased for movement into the opening in said operating member when a predetermined angular relation exists between the movable contact and the operating member to prevent relative movement thereof during the switch closing and opening movements, and displacing means for moving said element out of the opening in said operating member near the end of the switch closing movement whereby to permit the clamping movement of the operating member, said displacing means being operative to permit the return of the element under the bias thereof into the opening in the operating member after the unclamping movement thereof.

6. In an electric switch comprising two spaced stationary contacts, a blade contact provided with a slot near the free end thereof and pivotally supported on one of said stationary contacts for movement into and out of engagement with the other of said stationary contacts and clamps for exerting pressure between each of said stationary contacts and said blade contact in the switch closed position thereof, an operating member provided with a notch and pivotally supported on the blade contact near the free end thereof for movement relatively thereto in one direction to effect the clamping action of said clamps and in the opposite direction to release the clamping action, an interlocking element movably supported in said blade contact slot, means biasing said interlocking element toward the free end of the blade contact into the notch in the operating member when a predetermined angular relation exists between the blade and the operating member whereby to prevent relative movement thereof during the switch closing and opening movements of the blade contact, and cam means adjacent said other stationary contact for moving said interlocking element out of the notch in said operating member near the end of the switch closing movement whereby to permit the clamping movement of the operating member effective to permit the return of the interlocking member under the bias thereon into said blade contact notch after the unclamping movement of the operating member.

7. In an electric switch comprising a stationary contact, a cooperating contact movable into and out of engagement with said stationary contact, clamping means for exerting pressure between said contacts in the switch closed position thereof and an operating member mounted on said movable contact for movement relatively thereto in one direction to effect the clamping action of said clamping means and in the opposite direction to release the clamping action, a rectilinearly movable element for locking said operating member and said movable contact against relative movement, and stationary means for effecting rectilinear movement of said element during the final switch closing movement of said operating member and said movable contact in a direction to allow relative movement thereof.

8. In an electric switch comprising a stationary contact, a cooperating contact movable into and out of engagement with said stationary contact, clamping means for exerting pressure between said contacts in the switch closed position thereof and an operating member mounted on said movable contact for movement relatively thereto in one direction to effect the clamping action of said clamping means and in the opposite direction to release the clamping action, a rectilinearly movable element for locking said operating member and said movable contact against relative movement, and stationary means for effecting rectilinear movement of said locking element during a predetermined portion of the movement of said movable contact.

9. In an electric switch comprising a stationary contact, a cooperating contact movable into and out of engagement with said stationary contact, clamping means for exerting pressure between said contacts in the switch closed position thereof and an operating member mounted on said movable contact for movement relatively thereto in one direction to effect the clamping action of said clamping means and in the opposite direction to release the clamping action, a locking element rectilinearly movably mounted on said movable contact for locking said operating member and the movable contact against relative movement, and means mounted adjacent said stationary contact for effecting during a predetermined portion of the switch closing movement rectilinear movement of said element in a direction to allow relative movement of said operating member and said movable contact.

10. In an electric switch comprising a stationary contact, a cooperating contact movable into and out of engagement with said stationary contact, clamping means for exerting pressure between said contacts in the switch closed position thereof and an operating member mounted on said movable contact for movement relatively thereto in one direction to effect the clamping action of said clamping means and in the opposite direction to release the clamping action, a locking element rectilinearly movably mounted on said movable contact for locking said operating member and the movable contact against relative movement, and stationary cam means for effecting rectilinear movement of said locking element relatively to the movable contact during a predetermined portion of the movement thereof.

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