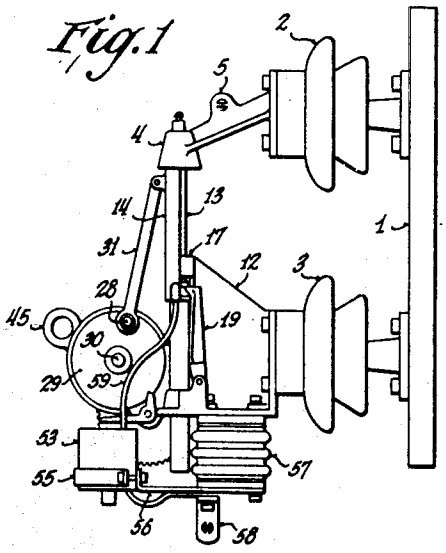
Jan. 11, 1949. W. O. SCHULTZ 2,458,800

AUTOMATIC SWITCH CONSTRUCTION

Original Filed Sept. 4, 1943 3 Sheets-Sheet 1

Fig. 1



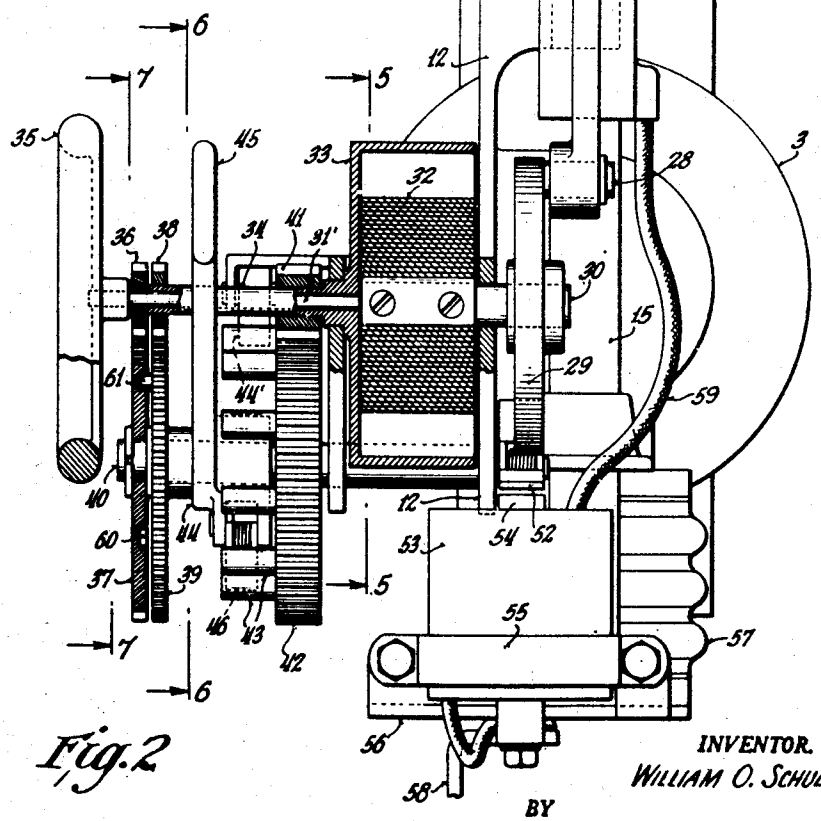


Fig. 2

INVENTOR.
WILLIAM O. SCHULTZ

BY

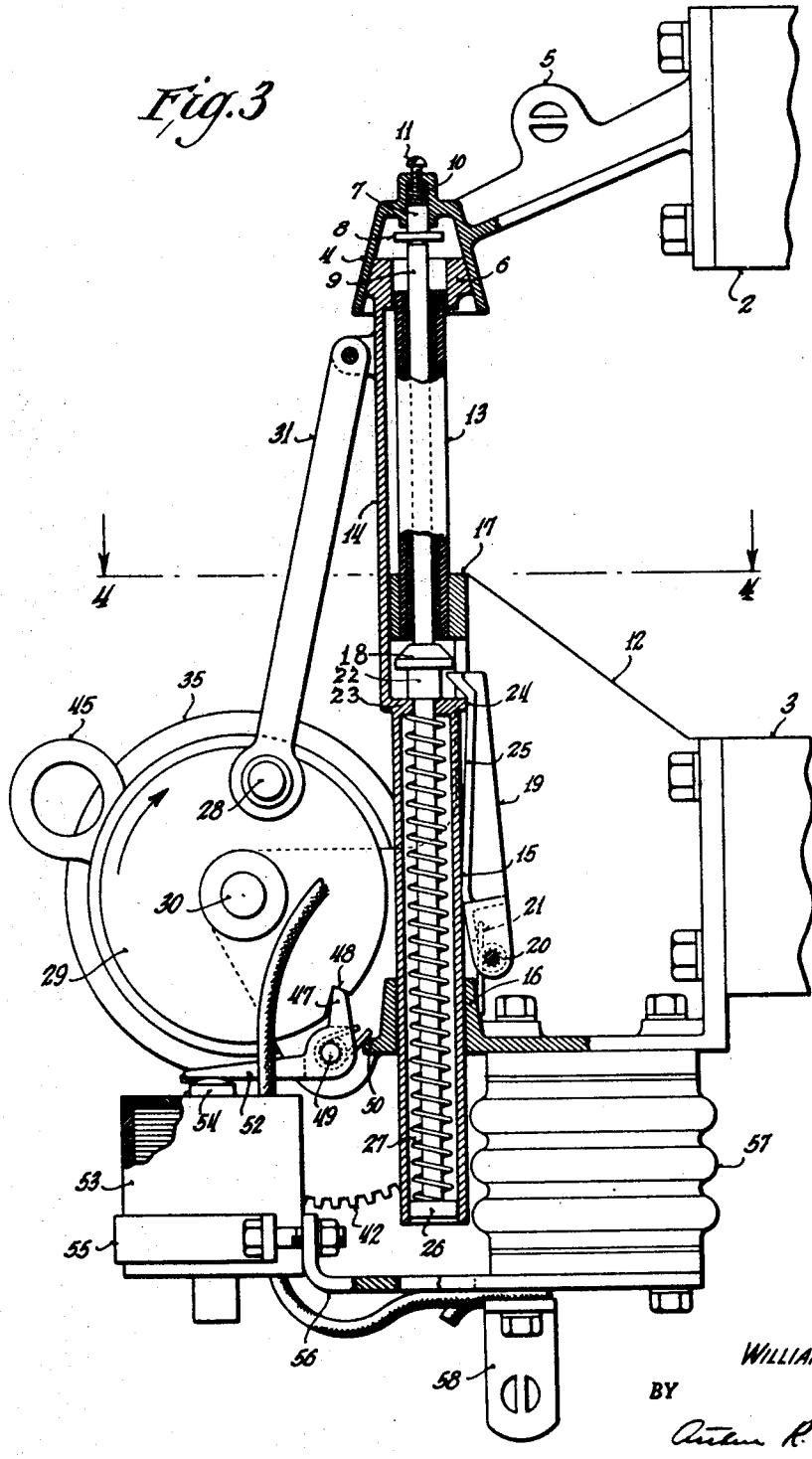
Arthur P. Woodford
ATTORNEY.

Jan. 11, 1949. W. O. SCHULTZ 2,458,800

AUTOMATIC SWITCH CONSTRUCTION

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Fig. 3



INVENTOR.
WILLIAM O. SCHULTZ

BY

Austen R. Woolfolk
ATTORNEY.

Jan. 11, 1949. W. O. SCHULTZ 2,458,800

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Fig. 4

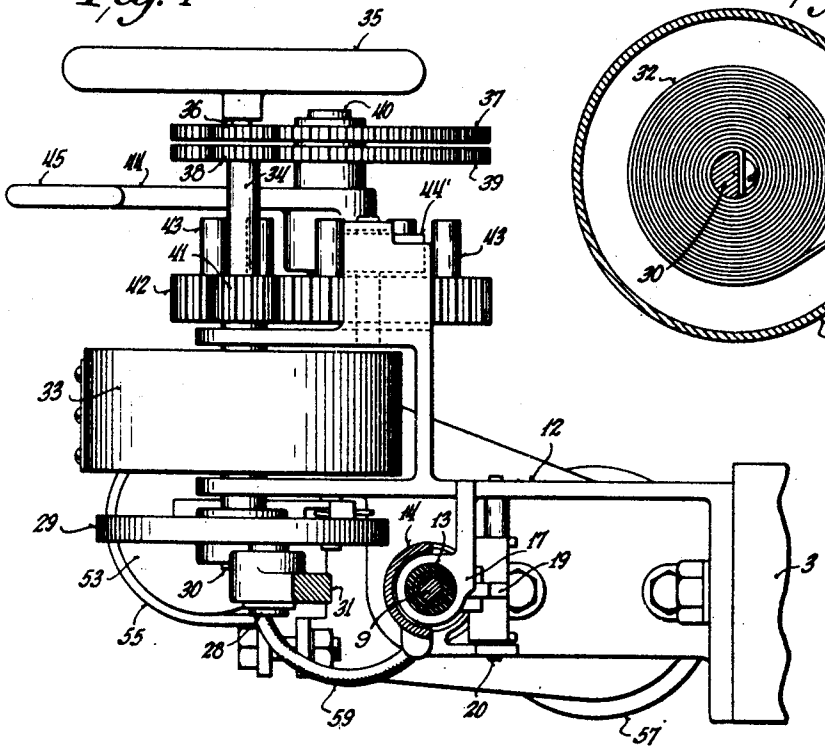


Fig. 5

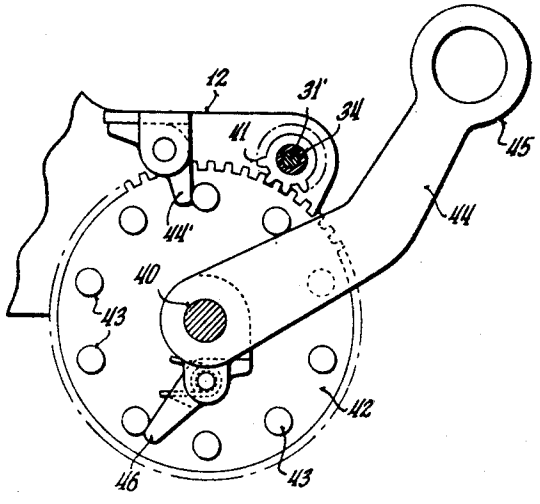
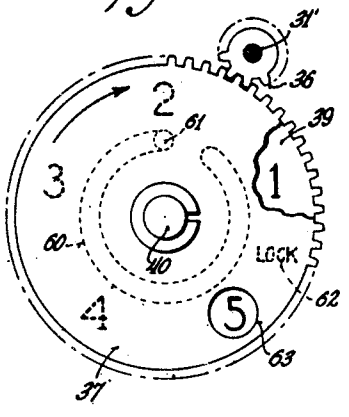


Fig. 6

Fig. 7



INVENTOR.
WILLIAM O. SCHULTZ
BY
Arthur R. Woodcock
ATTORNEY.

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2,458,800

UNITED STATES PATENT OFFICE

2,458,800

AUTOMATIC SWITCH CONSTRUCTION

William O. Schultz, South Milwaukee, Wis., assignor to Line Material Company, Milwaukee, Wis., a corporation of Delaware

Original application September 4, 1943, Serial No. 501,227. Divided and this application August 16, 1944, Serial No. 549,659

4 Claims. (Cl. 200—146)

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This invention relates to an automatic switch construction. This application is a division of my prior application Serial No. 501,227, filed September 4, 1943, for Automatic switch constructions.

Objects of this invention are to provide a switch construction of the repeating type which is adapted to open under load, which is spring operated and is adapted to execute a number of operations before the spring needs rewinding, and which is controlled by condition responsive means, such as overload trip means, and is provided with a time delay mechanism, the time delay mechanism causing a delay before the switch is automatically again closed so that if the fault has cleared during this interval, the switch will remain closed but if the fault has not cleared, the switch will again be automatically opened, the device being provided with lock-out means to lock the switch in open position after a predetermined number of operations.

Further objects are to provide a switch construction in which crank means are provided which always rotates in the same direction when the switch operates, such crank means being operatively connected to a main movable contact means, and in which quick motion auxiliary movable contact means is provided which is reciprocable into a stationary insulating tube after the main movable contact means has moved to open position to thereby cause the final arc to be drawn into the tube and extinguished.

In greater detail, further objects are to provide a switch construction in which main and auxiliary stationary and movable contacts are provided, in which the main stationary and movable contacts are so arranged that they have tapered surfaces adapted to contact when the switch is closed, in which spring means are provided to insure a firm contact between the auxiliary stationary and movable contacts, and in which a stationary insulating tube is provided into which the auxiliary movable contact is adapted to be drawn to insure final extinguishing of the arc within the tube, and in which the tube is arranged in spaced relation to the stationary contacts, the main stationary contact forming a hood or a shield for the adjacent end of the tube.

An embodiment of the invention is shown in the accompanying drawings, in which:

Figure 1 is a side elevation of the automatic switch.

Figure 2 is a front view of the automatic switch with parts broken away and parts in section.

Figure 3 is an enlarged view corresponding to Figure 1 with parts broken away and parts in section.

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Figure 4 is a sectional view on the line 4—4 of Figure 3.

Figure 5 is a detail sectional view on the line 5—5 of Figure 2.

Figure 6 is a detail sectional view on the line 6—6 of Figure 2.

Figure 7 is a detail sectional view, partly broken away, on the line 7—7 of Figure 2.

The automatic switch comprises a supporting portion 1 which has a pair of insulators 2 and 3 projecting therefrom. The insulator 2 carries the stationary contact 4 which is provided with a terminal portion 5. This stationary contact 4 consists of a downwardly flaring conical cap like member whose inner surface is the contact surface against which the conical main movable contact 6 is adapted to normally seat to thus provide good current carrying contact surfaces. The stationary contact also includes a movable auxiliary contact consisting of a cylindrical portion 7 terminating in a head 8 adapted to be engaged by the upper end of the rod or auxiliary movable contact 9 when the switch is closed. The auxiliary stationary contact 8 is movably carried by the main stationary contact 4 and is spring urged downwardly by means of the spring 10, its downward motion being limited by means of the screw 11 threaded in to the cylindrical portion 7.

The lower insulator 3 carries a bracket 12 which in turn rigidly supports an insulating tube 13 within which the plunger or auxiliary movable contact 9 is slidably mounted and into which the plunger 9 is adapted to be suddenly withdrawn after the main movable contact 6 has been withdrawn from the stationary contact 4, as will hereinafter appear, so that the final arc is established between the auxiliary stationary contact 8 and the rod 9 and is drawn into and extinguished within the insulating tube 13. This tube 13 is preferably formed of a phenolic condensation compound body portion with a fiber lining. It is well known that when the fiber lining is subjected to the heat of the arc, it evolves a deionizing gas which assists in quickly extinguishing the arc.

The main movable contact 6 is integral with a half shell like portion 14 which in turn is integral with a downwardly extending tubular portion 15. The tubular portion 15 is guided by means of the guiding portions 16 of the bracket 12 and is also guided against lateral thrust to the right of the member 14 by means of the collar like portion 17 which is integral with the bracket 12 and which

rigidly carries the stationary insulating tube 13. Any other suitable guiding means may be provided.

The plunger or rod 9 extends downwardly into the tube 15 and is provided with a latching collar 18 beneath which a latching member 19 is normally positioned, the latching member being pivoted on the bracket by means of the pivot pin 20 and being urged in a counterclockwise direction by means of the spring 21. The latching collar 18 is provided with a beveled upper portion and with a cylindrical lower portion 22 which seats on the intermediate transverse apertured web 23 located between the shell like portion 14 and the tubular portion 15.

It is to be noted that the slidable member composed of the parts 6, 14 and 15 is provided with a projecting shoulder 24 which rides on the inner cam or slanting surface 25 of the latching lever 19. The lower end of the rod 9 is provided with a head 26 against which a compression spring 27 bears. It is to be noted that when the main movable contact 6 is moved downwardly by means hereinafter to be described, the spring 27 is compressed and after the main movable contact 6 has moved away from the stationary contact 4, the shouldered portion 24 will move the latching lever 19 to the right and release the plunger 9. The plunger, under the influence of the spring 27 will quickly descend and withdraw its upper end into the insulating tube 13 and the final arc will be extinguished within the tube. It is preferable to have the spring 27 under initial compression when the switch is closed though it is to be understood that the spring 27 may be free from compression initially.

The means for reciprocating the movable contact consists of a crank formed of the crank pin 28 carried by the disk 29, such disk being rigidly mounted on the shaft 30. The crank pin 28 is connected to the reciprocating member 6, 14, 15 by means of the connecting link 31. The shaft 30 is provided with a flattened portion to which one end of a helical spring or power storing means 32 is secured. The other end of the spring 32 is secured to a drum 33 which is rigid with a sleeve 34.

The sleeve 34 is apertured and the shaft 30 has a reduced portion 31' which is revolubly carried by the sleeve 34. The shaft 31 carries a flywheel 35 at its outer end. This flywheel may have a heavy rim and may be provided with an open work inner portion such as spokes or similar structure. If desired any other suitable time delay means could be provided such as a paddle wheel for instance. The shaft 31 also carries a small gear 36 which meshes with a larger gear 37. The sleeve 34 carries a small gear 38 which meshes with a larger gear 39 mounted adjacent the gear 37. The gears 37 and 39 are loosely mounted on a supporting pin 40 which is rigidly carried by the bracket 12.

The sleeve 34 is provided with a small gear 41 which meshes with a large winding gear 42. The winding gear is also loosely mounted on the pin 40. The winding gear is provided with a plurality of outwardly projecting, regularly spaced pins 43 and a gravity or spring actuated pawl 44', see Figure 6, drops in position behind the successive pins as the winding gear 42 is rotated and thus prevents the winding gear 42 from reverse rotation and through the medium of the small gear 41 correspondingly prevents the drum 33 from reverse rotation. Winding means in the form of a winding lever 44 is loosely mounted on the pin 40 and is provided with an apertured or eyeleted outer end 45 adapted to receive the terminal of an insulating switch stick. It is also provided with a spring pressed pawl 46 for engaging the pins 43.

The crank or disk 29 is prevented from rotating by means of a spring pressed pawl 47, see Figure 3, which seats against the shouldered portion of a notch 48. The pawl is pivotally carried on the pivot pin 49 which in turn is carried by the bracket 12. The pawl is urged in a counterclockwise direction by means of the spring 50. It is provided with an outwardly extending arm 52 which is adapted to be pushed upwardly by a condition responsive device, such for example as the magnetically operated overload device shown.

This overload device comprises a solenoid indicated generally at 53 and a plunger 54 which is adapted to be moved upwardly upon the flow of excessive current through the solenoid to thus release the latching member 47 and allow the crank to rotate. If desired, the solenoid may be formed with insulating upper and lower portions and an insulating outer shell. It is held by means of a clamp 55 secured to a bracket 56 carried by the lower portion of an insulator 57 rigidly attached to the bracket 12. One end of the solenoid is secured to a terminal member 58 which is bolted to the lower portion of the insulator 57 and the same bolt may be employed as one of the bolts for holding the bracket 56 in place if desired.

The bracket 56 is provided with an opening or clearance so that the lower end of the tube 15 may freely reciprocate past the bracket without contacting the bracket. The other end of the solenoid 55 is connected by means of a flexible leader 59 with the main movable contact.

The operation of the apparatus is as follows: When an overload occurs, the latch 47 is moved to released position and the crank is rotated by means of the spring 32, thus first moving the main movable contact 6 downwardly and out of engagement with the stationary contact 4. After the movable contact has moved down a predetermined distance, the latching lever 19 is tripped and the plunger 9 is suddenly drawn downwardly into the tube 13, thus extinguishing the final arc within the tube. The crank continues to rotate and again closes the circuit, the parts arriving at the position shown in Figure 3. If the fault has cleared, the latching lever 47 will arrest further motion of the crank. Upon the closing stroke it is apparent that the shouldered cylindrical portion 22 of the latching collar 18 rests upon the transverse web 23 and the auxiliary contact or plunger 9 is restored to its initial position and the latch lever 19 moves back to its latching position as shown in Figure 3. It is to be noted that there is a slight compression of the spring 10 as the auxiliary stationary contact 8 is moved upwardly a slight distance by the rod 9. The spring 10 maintains a pressure contact between the upper end of the rod 9 and the auxiliary stationary contact.

The time delay means, such as the flywheel 35 or if desired a paddle wheel or any other time delay means, causes a certain delay between the opening of the automatic switch and the closing thereof. Frequently the fault on the line clears during this interval and the switch remains closed. However, if the fault persists, the switch executes a second cycle of operations and if the fault has not cleared during the second cycle of

operations, the switch continues opening and closing until the apparatus has executed all of the operations for which it is designed. After execution of the predetermined number of operations, the switch is locked in open position, as will appear hereinafter.

In order to both lock the switch in its final open position and also to provide indicating means to show the number of operations still remaining to be performed, the gear **37** is provided with an arcuate groove **60**, see Figures 2 and 7, and the gear **39** is provided with a pin **61** designed to travel within the slot **60**. In addition to this, the gear **39** is provided with a series of numerals 1 to 5 in the form chosen for illustration and with the indicia LOCK as indicated at **62** in Figure 7, and the gear **37** is provided with a window **63**. When the device is fully wound and has not executed any operations, the window **63** is opposite the numeral 5 as shown in Figure 7. When the crank executes one rotation, the gear **36** drives the gear **37** to the position where the window is opposite the numeral 4 and thus 4 indicates the number of remaining operations that the device can perform.

During the time the crank is rotating, the drum **33**, the sleeves **34** and the gear **38** are held stationary. Consequently the gear **39** is held stationary. The gear **37** travels in a clockwise direction as indicated by the arrow in Figure 7. The crank can execute five operations in the form shown and if it continues to rotate, the slot **60** will have moved so that the pin **61** engages the other end of the slot from the end it is shown in engagement with in Figure 7 and consequently arrests further rotation of the crank. This position is chosen so that the switch is locked in switch open position and the window **63** is opposite the indicia LOCK.

It is necessary for the device to be rewound before it will again be placed in operation. This is accomplished by the lineman engaging his insulated switch stick in the eyelet **45** of the winding lever **44** and rocking this lever back and forth downwardly and upwardly. As he rocks the lever, the pawl **46** successively engages the pins **43** and rotates the gear **42**, thus rotating the gear **41** and the drum **33** and winding the spring **32**. In view of the fact that the gear **38** is rigid with the sleeve **34**, such gear will rotate and will in turn cause the gear **39** to rotate. This winding continues until the gears **42** and **39**, which have the same ratios with respect to their pinions **41** and **38**, have made one complete revolution and the parts are in the position shown in Figures 2 and 7.

The parts are so proportioned that when the lever **44** is moved downwardly, it will move two of the pins **43** past the pawl **44'**. Two successive spaces between the pins **43** correspond to one complete revolution of the crank. Consequently at the first down stroke of the lever **44**, the crank will immediately close the switch and if there is no fault, the switch will remain closed. On the other hand, if there is a fault, the switch will immediately open.

Assuming that there is no fault, the winding handle **44** or winding lever is rocked back and forth and the spring **32** is completely rewound, the pin **61** traveling during this time within the slot **60** and arriving at the position shown in Figure 7 and stopping further winding operations, thus protecting the spring against over winding.

It is to be noted that in the form chosen for illustration the device is designed for five operations and ten pins **43** are provided.

Other condition responsive means could be employed in place of the overload solenoid if so desired, or other tripping means could be employed.

It is to be noted that the insulating tube **13** is held rigidly by the bracket **12** and is at all times spaced from the stationary contact **4**. It is also to be noted that the stationary contact **4** forms a hood or shield which always shields and protects the upper end of the tube **13** from the entrance of water or snow. In addition to this, the upper inverted conical stationary contact **4** acts as a shield for the normal position of the movable main and auxiliary contacts. It is to be noted further that the spring **27** is housed within the tubular portion **15** of the movable member.

It will be seen that a repeating automatic switch construction has been provided which is designed to open under load and to immediately extinguish the resulting arc to protect the parts against damage.

Although this invention has been described in considerable detail, it is to be understood that such description is intended as illustrative rather than limiting, as the invention may be variously embodied and is to be interpreted as claimed.

I claim:

1. A switch construction comprising switch means including stationary contact means and movable contact means, said movable contact means having a main portion and an auxiliary portion, means for moving the main portion of said movable contact means out of engagement with said stationary contact means, a stationary insulating tube into which the auxiliary portion of said movable contact means is reciprocable, locking means for locking the auxiliary portion of said movable contact means in closed position, means actuated directly by said main portion of said movable contact means for tripping said locking means, and means for quickly reciprocating the auxiliary portion of said movable contact means into said tube after the main portion of said movable contact means has moved away from said stationary contact means.

2. A stwitch construction comprising switch means including stationary contact means and movable contact means, said movable contact means having a main portion and an auxiliary portion, means for moving the main portion of said movable contact means out of engagement with said stationary contact means, a stationary insulating tube supported in spaced relation to said stationary contact means and into which the auxiliary portion of said movable contact means is reciprocable, locking means for locking the auxiliary portion of said movable contact means in closed position, means actuated directly by said main portion of said movable contact means for tripping said locking means, and means for quickly reciprocating the auxiliary portion of said movable contact means into said tube after the main portion of said movable contact means has moved away from said stationary contact means.

3. A switch construction adapted to open under load comprising a main and an auxiliary stationary contact, a main and an auxiliary movable contact, said main movable and stationary contacts having interengaging portions, said auxiliary stationary contact being spring urged with reference to said main stationary contact and having a portion adapted to have pressure engagement with said auxiliary movable contact,

a stationary insulating tube out of contact with said stationary contacts, said auxiliary movable contact projecting outwardly from said stationary tube when said switch is in closed position, means for moving said main movable contact away from said main stationary contact, and means for subsequently quickly moving said auxiliary movable contact away from said auxiliary stationary contact and into said tube.

4. A switch construction adapted to open under load comprising a main and an auxiliary stationary contact, a main and an auxiliary movable contact, said main movable and stationary contacts having interengaging portions, said auxiliary stationary contact being spring urged with reference to said main stationary contact and having a portion adapted to have pressure engagement with said auxiliary movable contact, a stationary insulating tube out of contact with said stationary contacts and having one end located closely adjacent said main stationary contact so that said main stationary contact forms a protecting shield for the adjacent end of said insulating tube, means for moving said main movable contact away from said main stationary contact, and means for subsequently quickly moving said auxiliary movable contact away from

said auxiliary stationary contact and into said tube.

WILLIAM O. SCHULTZ.

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