Feb. 22, 1949. G. W. RATHERT 2,462,283

ELECTRICAL SWITCH

Filed July 20, 1945

2 Sheets-Sheet 1

FIG. 1.

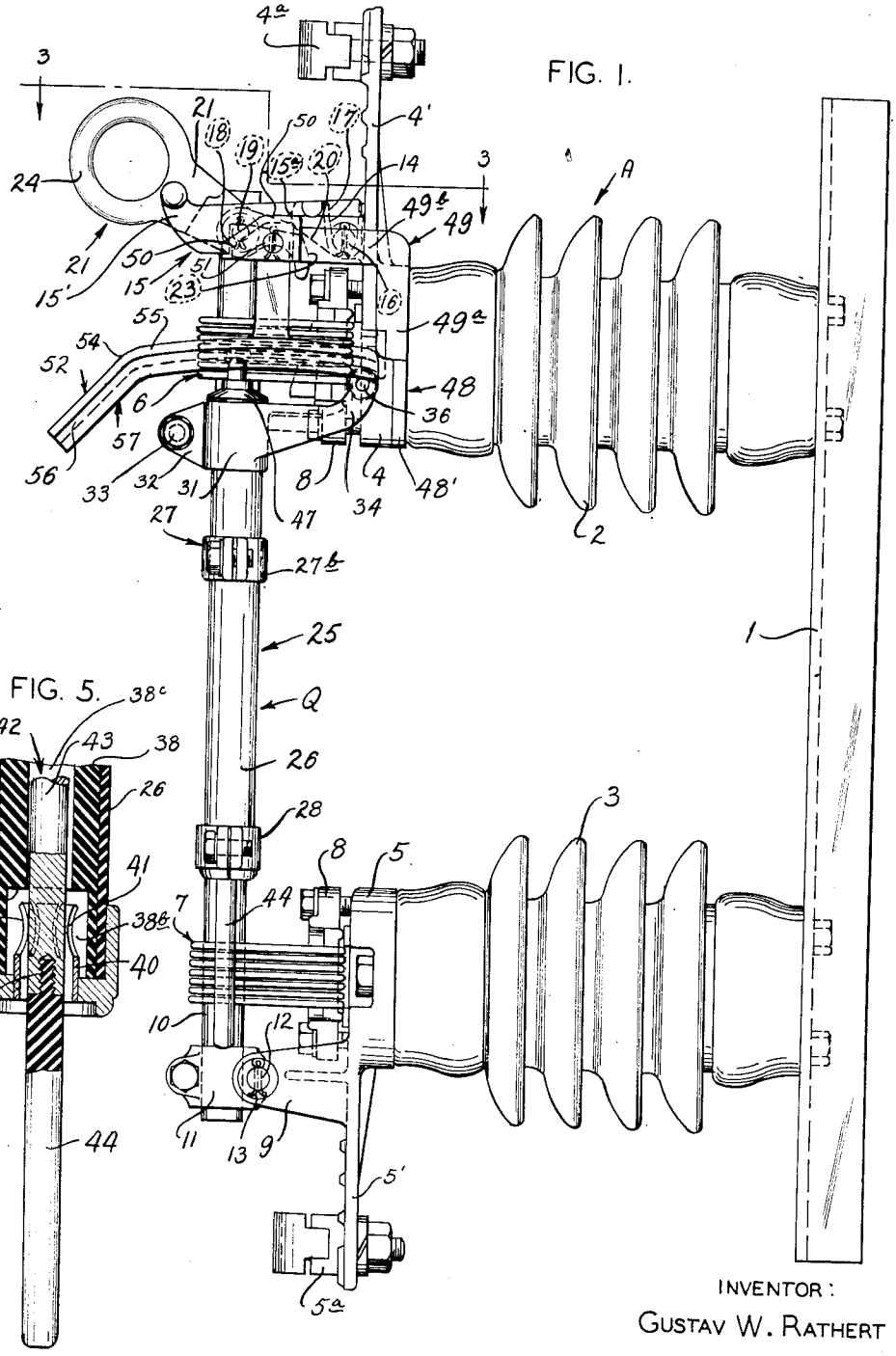


FIG. 5.

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2 Sheets-Sheet 2

FIG. 2.

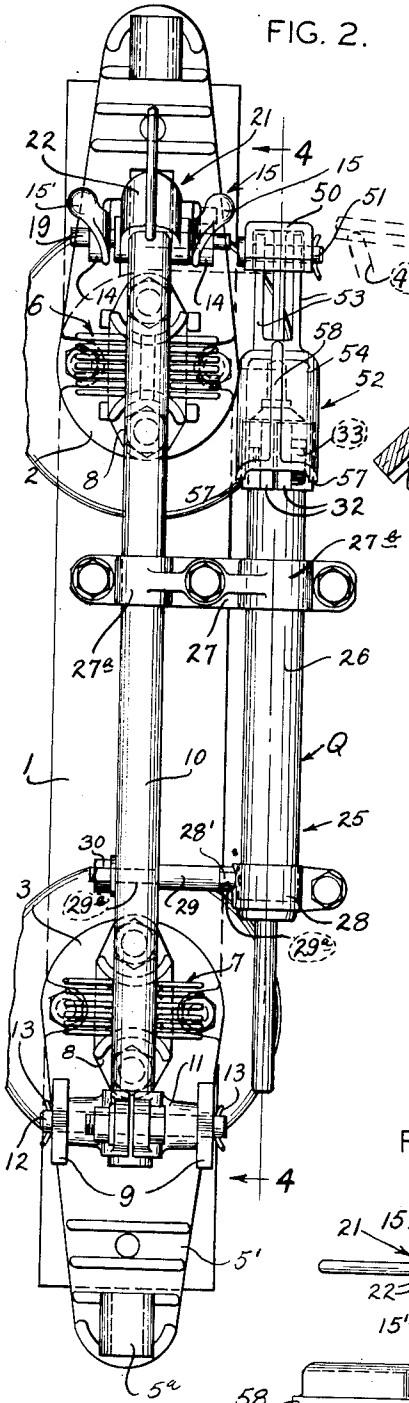


FIG. 4.

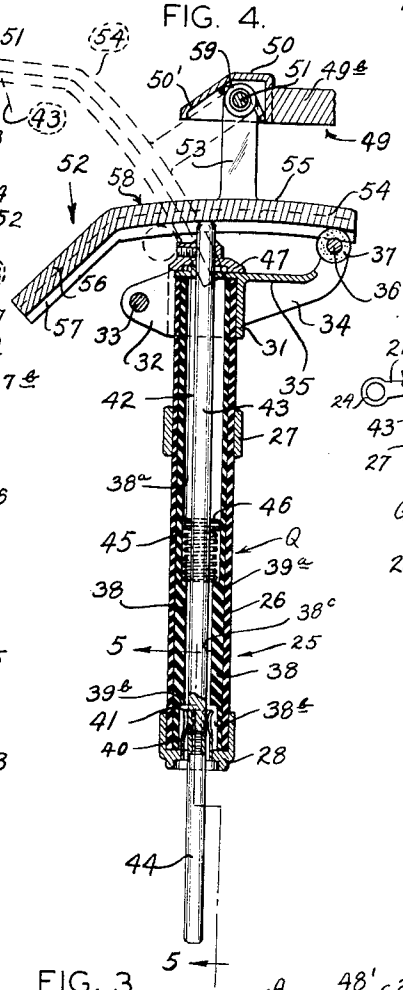


FIG. 7.

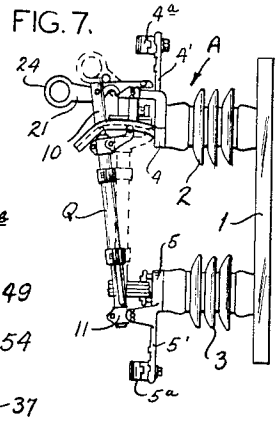


FIG. 8.

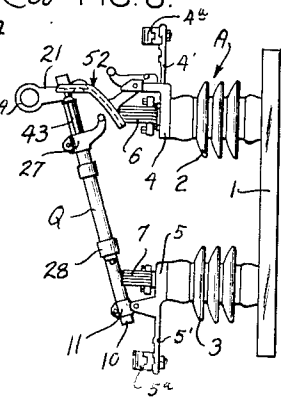


FIG. 6.

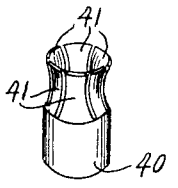
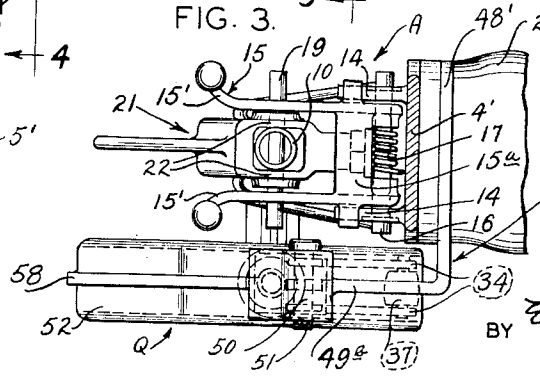


FIG. 3.



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ELECTRICAL SWITCH

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Application July 20, 1945, Serial No. 606,086

4 Claims. (Cl. 200—146)

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This invention relates generally to electrical switches, and more specifically to electrical switches of the type comprising movably supported switch blades movable into and out of electrical contact with contact means so as to complete or interrupt electrical circuits in which the switches are interposed, the predominant object of the invention being to provide such an electrical switch with improved, rapid operating means for quickly interrupting or breaking the circuit at a point remote from the contacts of the switch, with which the switch blade makes electrical contact, so as to protect said contacts and the switch blade from the injurious effects which would otherwise result from arcing when the switch blade would be drawn from the closed-switch position to the open-switch position.

Fig. 1 is a side elevation of the improved switch of the present invention.

Fig. 2 is a front elevation of the switch shown in Fig. 1.

Fig. 3 is a top plan view of the switch shown in Figs. 1 and 2, the upper terminal of the switch being shown in section.

Fig. 4 is a fragmentary section taken on line 4—4 of Fig. 2.

Fig. 5 is an enlarged fragmentary section taken on line 5—5 of Fig. 4.

Fig. 6 is a perspective view of a part of the structure illustrated in Fig. 5.

Fig. 7 is a side elevation of the improved switch, on a reduced scale, showing the switch blade by dotted lines in the closed-switch position, and illustrating said switch blade by solid lines as it appears at an early stage of the switch-opening operation.

Fig. 8 is a view similar to Fig. 7 but showing the switch blade as it appears when same approaches the completion of the switch-opening operation.

In the drawings, wherein is shown for purposes of illustration, merely, one embodiment of the invention A designates the improved switch generally. The switch A comprises a suitable supporting member 1 on which is mounted a pair of insulators 2 and 3. The insulator 2 has fixed thereto a terminal member 4 which is provided with an upwardly projected extension 4' to which an incoming conductor (not shown) may be connected mechanically and electrically by a suitable connector 4a. Also, the insulator 3 has fixed thereto a terminal member 5 having a downwardly projected extension 5' to which an outgoing electrical conductor (not shown) may be connected mechanically and electrically by a suitable connector 5a. The terminal 4 supports a contact structure 6 and the terminal 5 supports a similar contact structure 7, said contact structures being each made up of a plurality of resilient rod or wire elements, and said contact structures 6 and 7 being secured to the terminals 4 and 5 by suitable attaching means 8.

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The terminal member 5 is provided with spaced, forwardly projected extensions 9 which support a switch blade 10 for pivotal movement into and out of electrical contact with the contact structures 6 and 7. The switch blade 10 has clamped thereto at its lower end a member 11 which is provided with a portion through which an opening is formed, a pivot pin 12 being extended through said opening and having opposed, outwardly extended end portions which are disposed in openings formed in the spaced extensions 9 of the terminal member 5. The pivot pin 12 is retained in position by cotter pins 13 and said pivot pin supports the switch blade 10 for the pivotal movement described above.

The terminal member 4 at the upper end of the switch A is provided with spaced extensions 14 (Figs. 1 and 3) between which the rear portion of a switch blade latch 15 is disposed, said latch being pivotally attached to said spaced extensions 14 by a pivot pin 16, and a torsional coil spring 17 being provided which embraces the pivot pin 16 and has its opposite ends in engagement with portions of the terminal 4 and the latch so that the forward portion of said latch is urged downwardly by said torsional coil spring. The forward portion of the switch blade latch 15 is bifurcated, being provided with a pair of spaced arms 15' shaped, as shown by dotted lines at 18 in Fig. 1, to engage opposed, outwardly extended end portions of a pin 19 which is fixedly carried by the upper portion of the switch blade 10. The spaced arms 15' of the latch 15 are joined at their rear ends by a bridge portion 15a, through which the pivot pin 16 extends, said bridge portion being cut away to provide a space in which the torsional coil spring 17 is disposed. Also, the bridge portion 15a of the switch blade latch 15 is provided with an inclined cam face 20 which serves a purpose to be hereinafter set forth.

The pin 19, previously mentioned herein as the element whose outer extended portions are engaged by the switch blade latch 15 for latching the switch blade in the closed switch position, serves to pivotally attach to the switch blade a latch operating member 21. The latch operating member 21 includes a portion having spaced portions

22, as is shown to good advantage in Fig. 3, said spaced portions being disposed at opposite sides of the switch blade and the pin 19 being extended through openings formed through said spaced portions. The inner end of the latch operating member 21 is shaped as shown in Fig. 1; that is to say, said inner portion of said latch operating member is provided with a curved cam face 23 which is adapted to engage the cam face 20 of the bridge portion of the switch blade latch 15. The latch operating member 21 includes an eye 24 at its outer end, and when it is desired to operate the latch, the finger of a suitable switch stick is introduced into this eye and the outer end of the latch operating member is drawn downwardly. This causes the curved cam face 23 of the inner end portion of the latch operating member 21 to engage the cam face 20 of the latch with the result that the outer portion of the latch is moved upwardly so that the spaced arms thereof are disengaged from the outwardly extended end portions of the pin 19. After such disengagement of the latch from the pin 19, downward and outward pull on the eye of the latch operating member with the aid of the switch stick will swing the switch blade on its pivot 12 to the open-switch position where said switch blade is disengaged from and is spaced with respect to the contact structures 6 and 7.

The switch A is provided with a quick-break mechanism which is designated generally by the reference character Q, said quick-break mechanism including a tubular structure 25 which is secured to the blade 10 of the switch A. The tubular structure 25 comprises an outer tube 26 which is attached rigidly to the switch blade 10 by means of a clamping structure 27 that includes portions 27*a* and 27*b* that embrace and clampingly engage the switch blade and the outer tube 26 of the tubular structure 25, respectively, as is shown in Fig. 2. Also, the outer tube 26 of the tubular structure 25 which is formed of suitable electrical insulating material, has fixed to its lower end portion a metallic cap 28 that embraces said lower portion of said outer tube 26. The cap 28 has formed thereon at one side thereof a boss 28' which is provided with a screwthreaded opening, said screwthreaded opening receiving a reduced, screwthreaded extension 29*a* of a metallic stud 29. At the end of the stud 29 opposite to the end thereof at which the extension 29*a* is located, another extension of reduced diameter is provided and this latter extension, which is designated by the reference character 29*b*, extends through the switch blade 10 and has a nut and washer assembly 30 applied thereto so as to mechanically secure the stud 29 and the cap 28 to the switch blade. The stud 29 serves not only to mechanically attach the cap 28 to the switch blade 10 but it also serves as means for electrically connecting the cap 28 and the contact 40 to said switch blade.

Secured to the outer tube 26 of the tubular structure 25 at the upper end thereof is a member that includes a split sleeve 31, said sleeve being provided with outstanding, spaced apart ears 32 at opposite sides of the split thereof which are drawn toward each other by a bolt 33 so as to clampingly secure the sleeve 31 to the upper portion of said outer tube 26 in embracing relation with respect thereto. The sleeve 31 is provided with a top wall through which an opening is formed centrally thereof, and extended outwardly from said sleeve is a pair of spaced arms 34, the outer end portions of said arms being extended vertically, as is shown to the best advantage in Fig. 4. The spaced arms 34 are preferably formed integral with the sleeve 31 and are strengthened by an extension 35 thereof, said arms supporting at their outer ends the opposite ends of a rod 36 on which means, such, for instance, as a roller 37 is mounted for rotation.

The outer tube 26 of the tubular structure 25 has arranged therein an inner tubular member 38 which preferably is formed of horn fiber, or other suitable insulating material, which in the presence of an electrical arc gives off gas that tends to extinguish the arc. The inner diameter of the inner tubular member 38 varies, as is shown in Fig. 4, said inner diameter being relatively large throughout the upper portion of the inner tubular member, as indicated at 38*a*, and at the lower end of said tubular member, as indicated at 38*b*, and these larger inner diameter portions are joined by a smaller inner diameter portion, as indicated at 38*c*, shoulders 39*a* and 39*b* being present at the junctions of the larger inner diameter portions and the smaller inner diameter portion.

The cap 28 at the lower end of the tubular structure 25 is provided with a bottom wall through which an opening is formed centrally thereof (Figs. 4 and 5) and set into this opening and rigidly fixed therein is a metallic contact 40. The contact 40 is of solid tubular formation throughout its lower portion, and extended upwardly from said lower contact portion is a plurality of inwardly curved, resilient contact fingers 41. The tubular structure 25 has extended longitudinally therethrough, and beyond the opposite ends thereof, a rod structure 42 which extends through the contact 40. The rod structure 42 comprises a metallic rod 43, which normally contacts with the contact 40, and attached to the lower end of said metallic rod 43 is a rod section 44 which is formed of suitable electrical insulating material, the attachment of the insulating rod section 44 to the metallic rod 43 being effected by a screwthreaded extension 44' on said insulating rod section which is screwed into a screwthreaded opening formed in the lower end portion of the metallic rod 43 (see Fig. 5). The metallic rod has a coil spring 45 (Fig. 4) arranged in embracing relation with respect thereto, this coil spring contacting at its lower end with the shoulder 39*a* of the inner tubular member 38 and at its upper end with a spring seat 46 which is fixed to the metallic rod 43. The coil spring 45 tends to urge the rod structure longitudinally of the tubular structure 25 in an upward direction, and adjacent to the upper end of said rod structure the metallic rod 43 has fixed thereto an abutment member 47 which serves to limit downward movement of the rod structure 42 by abutting against the top wall of the split sleeve 31.

Supported by the insulator 2 is a member 48 that includes a disk portion 48' which is arranged in contact with a correspondingly shaped portion of the upper terminal 4, as is shown in Fig. 1. The member 48 is formed of metal and extended from the disk portion 48' thereof is an arm 49, said arm including a vertical portion 49*a* and a horizontal portion 49*b*. The horizontal portion 49*b* of the arm 49 has arranged at its forward end a housing 50 which is shaped in section as is shown in Fig. 4. The housing 50 is open at its bottom and its opposite side walls support

a headed pivot pin 51 which extends laterally through said housing.

Disposed beneath the housing 50 is an element 52 which is supported by said pivot pin 51 for pivotal movement, said element 52 including a pair of vertically extended, spaced arms 53 which are provided with openings formed therethrough through which the pivot pin extends. The element 52 includes, also, a shoe 54 which is shaped in longitudinal section as shown in Fig. 4; that is to say, said shoe includes an arcuate portion 55 and an inclined portion 56. The opposite edges of the shoe 54 are turned downwardly to provide flanges 57 (Fig. 2) and also said shoe is provided with a rib 58 which is extended from end to end thereof at the approximate transverse center of the shoe. Arranged within the housing 50 and about the pivot pin 51 is a torsional coil spring 59, the ends of said torsional coil spring contacting with the inner face of the inclined wall 50' and with one of the arms 53 of the element 52 so that said torsional coil spring tends to swing the entire element 52 to the position in which it is shown by dotted lines in Fig. 4 and by full lines in Fig. 8.

In describing the operation of the improved switch disclosed herein, attention is directed to the fact that when the switch blade 10 of the switch A is in the closed-switch position the roller 37, which is supported by the spaced arms 34 of the split sleeve 31, contacts with the lower face of the shoe 54 at a point adjacent to the rear end of said shoe, as is shown in Figs. 1 and 4. Because of such contact of the roller 37 with the rear end portion of the shoe the torsional coil spring 59 is prevented from swinging the element 52 about the pivot pin 51. Also, it is to be noted that when the switch blade 10 is in the closed-switch position the upper end of the rod structure 42 of the tubular structure 25 is in contact with the lower face of the shoe of the element 52 whereby said rod structure is held in a depressed position against the force exerted by the coil spring 45 so as to retain said rod structure 42 in contact with the contact 40.

Assume, now, that the switch blade 10 of the switch is in the closed-switch position and that it is desired to move said switch blade to the open-switch position. To accomplish this the finger of a suitable switch stick is introduced into the eye 24 of the latch operating member 21, and the outer end portion of said latch operating member is drawn downwardly so as to elevate the forward portion of the switch blade latch and disengage its spaced arms 15' from the pin 19 of the switch blade. The switch blade is then drawn downwardly and outwardly about its pivot element 12. During its initial outward and downward movement the switch blade is being moved outwardly with respect to the upper contact structure 6 of the switch, and during such initial movement the upper end of the rod structure 42 of the tubular structure 25, and the roller 37 of said tubular structure travel along the lower face of the shoe 54 of the element 52. In this connection it is pointed out that during this initial movement of the switch blade the coil spring 45 does not elevate the rod structure 42 of the tubular structure 25 because the center of the radius of the curved portion 55 of the shoe 54 is the pivot point about which the switch blade swings.

As outward movement of the switch blade continues the roller 37 of the tubular structure 25 will pass forwardly beyond the vertical plane of the pivot pin 51 which supports the element 52, and such condition will be brought about just

prior to disengagement of the switch blade from the upper contact structure 6. As a result of this situation there will be no arcing at the upper contact structure 6 when the switch blade is separated therefrom, because at the time the switch blade separates from the contact structure 6 a conductive path for the current is established through the quick-break mechanism, the current passing by way of the top terminal 4, the member 48, the element 52, the rod 43, the contact 40, the stud 29, and the switch blade 10 to the lower terminal 5.

As the roller 37 moves forwardly beyond the vertical plane of the pivot pin 51 which supports the element 52, the torsional coil spring 59 will swing said element 52 rapidly on the pivot pin 51 to the position in which said element 52 is shown by dotted lines in Fig. 4. This will permit the coil spring 45 to move the rod structure 42 of the tubular structure 25 of the quick-break mechanism Q rapidly, longitudinally of said tubular structure 25, as is shown in Fig. 8, thereby quickly withdrawing the metallic rod 43 from contact with the contact 40. When the metallic rod 43 moves out of contact with the contact 40 the arc produced by such separation is elongated within the portion 38c of the inner tube 38 that is of reduced diameter, and the insulating rod portion 44, which acts as a follower, moves into said portion 38c of the inner tube of the tubular structure 25 so as to confine the arc between the outer face of the insulating rod portion 44 and the inner face of the portion 38c of the inner tube. Thus the arc is forced into close contact with the horn fiber of which the inner tube 38 is formed and a gas is produced by the arc acting on the horn fiber of the inner tube which extinguishes the arc.

When the switch blade 10 of the switch A is in the open-switch position and it is desired to move said switch blade to the closed-switch position in contact with the contact structures 6 and 7, the finger of a switch stick is introduced into the eye 24 of the latch-operating member 21 and the switch blade is moved upwardly and rearwardly about its pivot 12. At this time the element 52 is in the position in which it is shown by dotted lines in Fig. 4, and therefore the roller 37 of the tubular structure 25, which moves with the switch blade, will contact with the lower face of the shoe 54 and will swing said element about its pivot to the position in which said element 52 is shown by full lines in Fig. 4. Also, the lower face of the shoe 54 of the element 52, during such swinging movement thereof, will engage the top end of the rod structure 42 of the tubular structure 25 and move said rod structure downwardly against the force of the coil spring 45, thus re-establishing contact between the metallic rod 43 and the contact 40. The final switch-closing movement of the switch blade moves the switch blade in contact with the contact structures 6 and 7 to establish the closed-switch position of the switch A, where the latch 15 will again engage the pin 19 to lock the switch blade in such closed-switch position.

I claim:

1. An electrical switch assembly comprising an upper structure, a switch blade supported for movement into and out of contact engagement with respect to said contact structure, a quick-break mechanism comprising a tubular structure supported by and movable with said switch blade, a contact arranged within said tubular structure, a rod structure movable within said tubular structure into and out of contact engagement

with said contact, means for electrically connecting said contact to said switch blade, an element engaging said rod structure at an end thereof so as to retain same in contact engagement with said contact when said switch blade is in the closed-switch position and during initial opening movement of said switch blade, a pivot for supporting said movable element for pivotal movement, a spring for subjecting said element to pivotal movement, a coil spring associated with said rod structure for moving said rod structure out of contact engagement with said contact, and means carried by said tubular structure which engages and retains said element in a position where said rod structure is maintained in contact engagement with said contact and which is movable with said tubular structure and said switch blade to permit said element to move to a position where said coil spring of said rod structure may move said rod structure out of contact engagement with said contact.

2. An electrical switch assembly comprising an upper contact structure, a switch blade supported for movement into and out of contact engagement with respect to said contact structure, a quick-break mechanism comprising a tubular structure supported by and movable with said switch blade, a contact arranged within said tubular structure, a rod structure movable within said tubular structure into and out of contact engagement with said contact, means for electrically connecting said contact to said switch blade, an element engaging said rod structure at an end thereof so as to retain same in contact engagement with said contact when said switch blade is in the closed-switch position and during initial opening movement of said switch blade, a pivot for supporting said movable element for pivotal movement, a torsional coil spring for subjecting said movable element to pivotal movement, a coil spring associated with said rod structure for moving said rod structure out of contact engagement with said contact, and means carried by said tubular structure which engages and retains said element in a position where said rod structure is maintained in contact engagement with said contact and which is movable with said tubular structure and said switch blade to permit said element to move to a position where said coil spring of said rod structure may move said rod structure out of contact engagement with said contact.

3. An electrical switch assembly comprising an upper contact structure, a switch blade supported for movement into and out of contact engagement with respect to said contact structure, a quick-break mechanism comprising a tubular structure supported by and movable with said switch blade, a contact arranged within said tubular structure, a rod structure movable within said tubular structure into and out of contact engagement with said contact, means for electrically connecting said contact to said switch blade, an element engaging said rod structure at an end thereof so as to retain same in contact engagement with said contact when said switch blade is in the closed-switch position and during initial opening movement of said switch blade, a pivot for supporting said movable element for pivotal movement, a torsional coil spring for subjecting said movable element to pivotal movement, a coil spring associated with said rod structure for moving said rod structure out of contact engagement with said contact, and means carried by said tubular structure that includes an independently movable element which engages and retains said element in a position where said rod structure is maintained in contact engagement with said contact and which is movable with said tubular structure and said switch blade to permit said element to move to a position where said coil spring of said rod structure may move said rod structure out of contact engagement with said contact.

4. An electrical switch assembly comprising an upper contact structure, a switch blade supported for movement into and out of contact engagement with respect to said contact structure, a quick-break mechanism comprising a tubular structure supported by and movable with said switch blade, a contact arranged within said tubular structure, a rod structure movable within said tubular structure into and out of contact engagement with said contact, means for electrically connecting said contact to said switch blade, an element engaging said rod structure at an end thereof so as to retain same in contact engagement with said contact when said switch blade is in the closed switch position and during initial opening movement of said switch blade, a pivot for supporting said movable element for pivotal movement, a torsional coil spring for subjecting said movable element to pivotal movement, a coil spring associated with said rod structure for moving said rod structure out of contact engagement with said contact, and means carried by said tubular structure that includes a rotatable roller which engages and retains said element in a position where said rod structure is maintained in contact engagement with said contact and which is movable with said tubular structure and said switch blade to permit said element to move to a position where said coil spring of said rod structure may move said rod structure out of contact engagement with said contact.

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