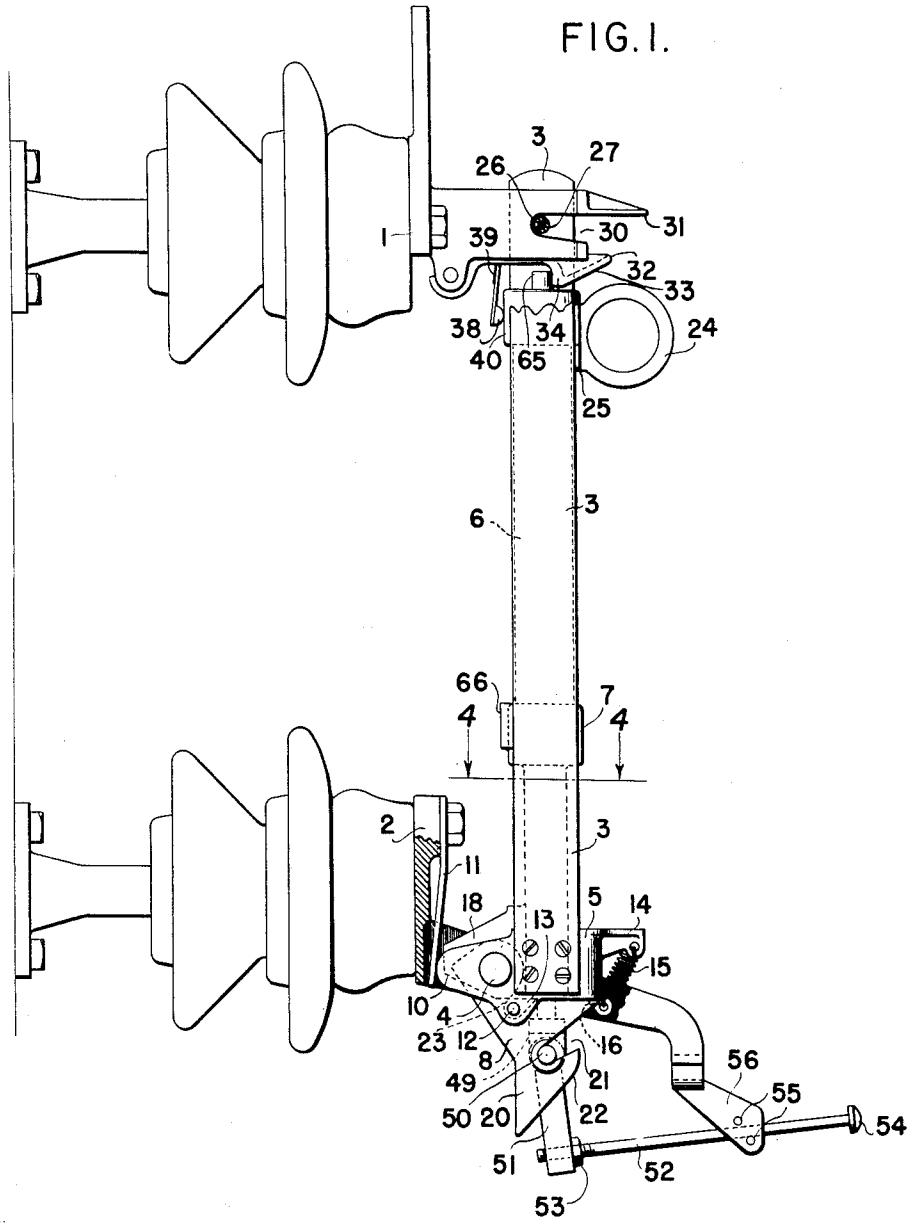
Jan. 20, 1953 R. H. EARLE ET AL 2,626,332

ELECTRICAL SWITCH

Filed July 27, 1950 4 Sheets-Sheet 1

FIG. 1.



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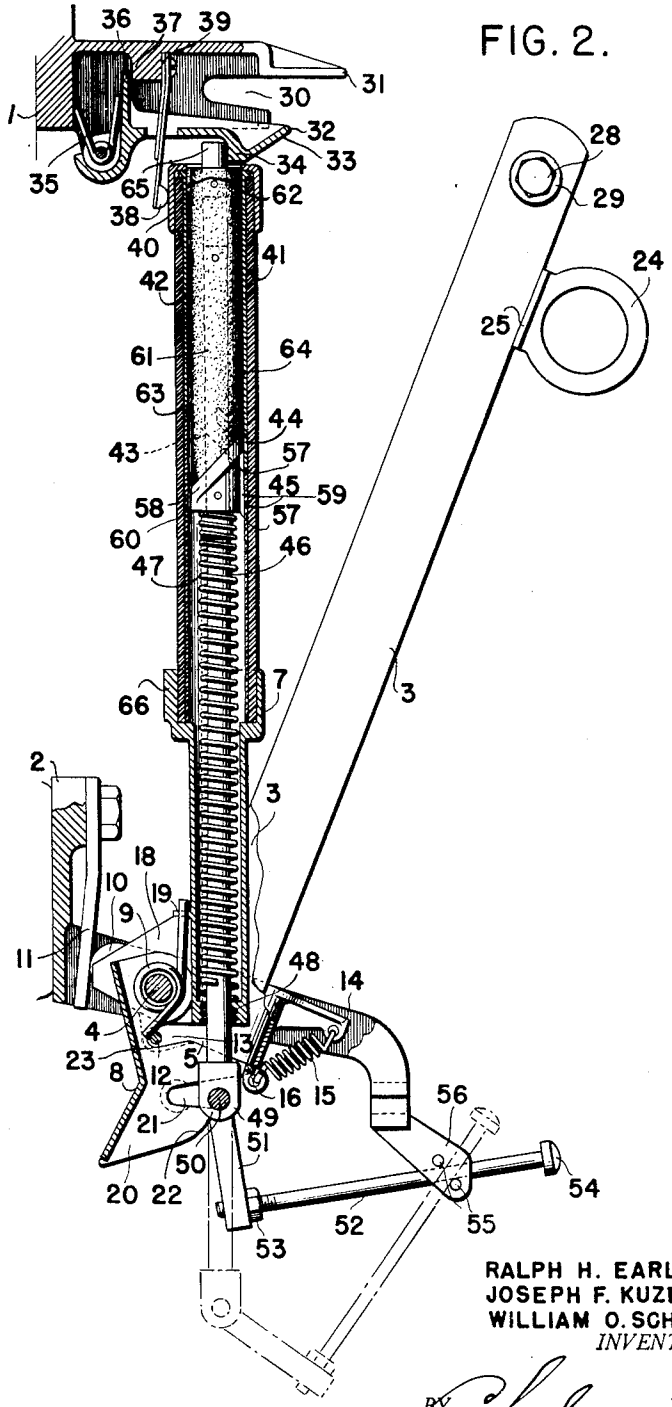
BY Charles A. Crandell.

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ELECTRICAL SWITCH

Filed July 27, 1950 4 Sheets-Sheet 2

FIG. 2.



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ELECTRICAL SWITCH

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FIG. 3.

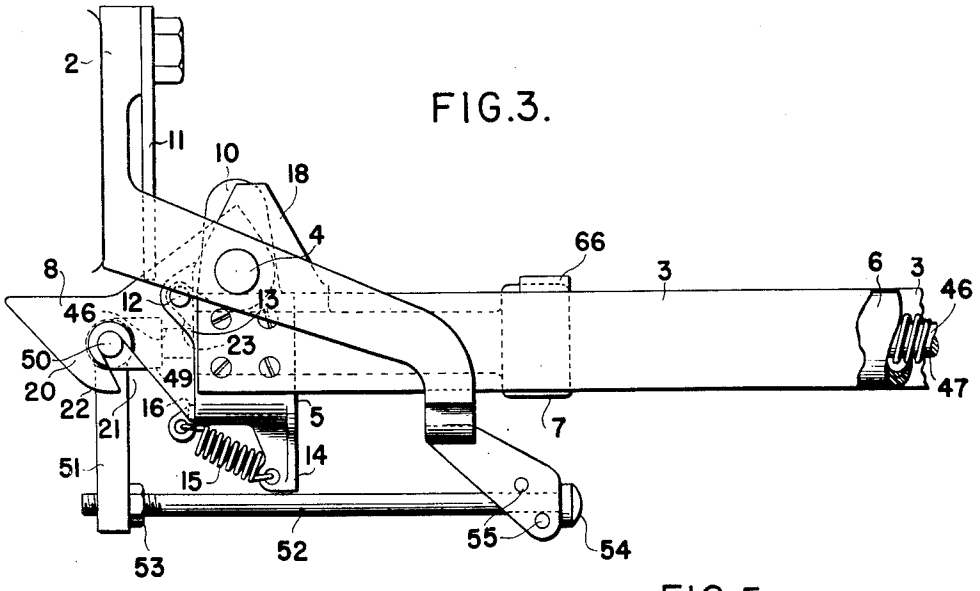


FIG. 4.

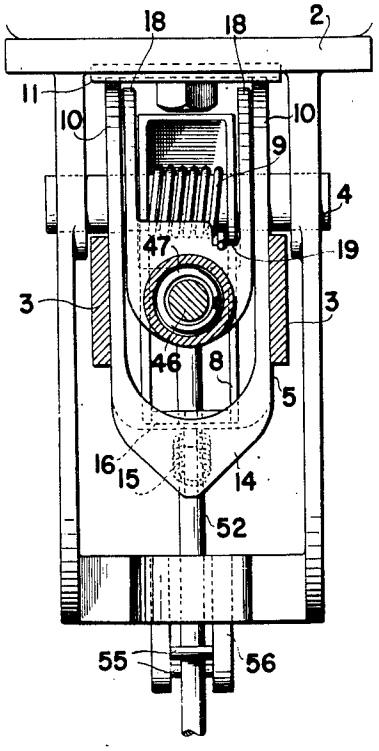


FIG. 5.

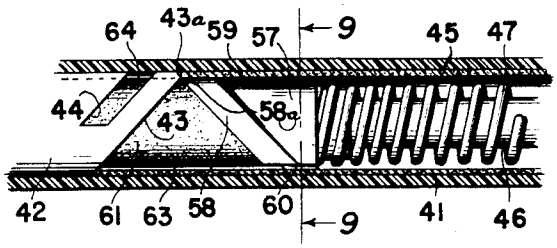
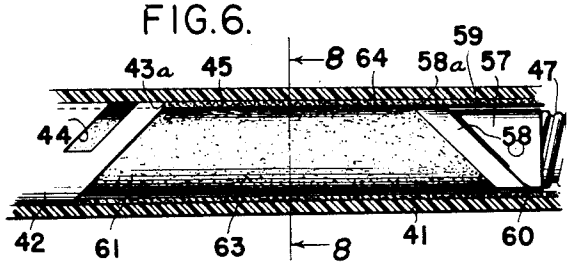


FIG. 6.



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ELECTRICAL SWITCH

Filed July 27, 1950 4 Sheets-Sheet 4

FIG. 7.

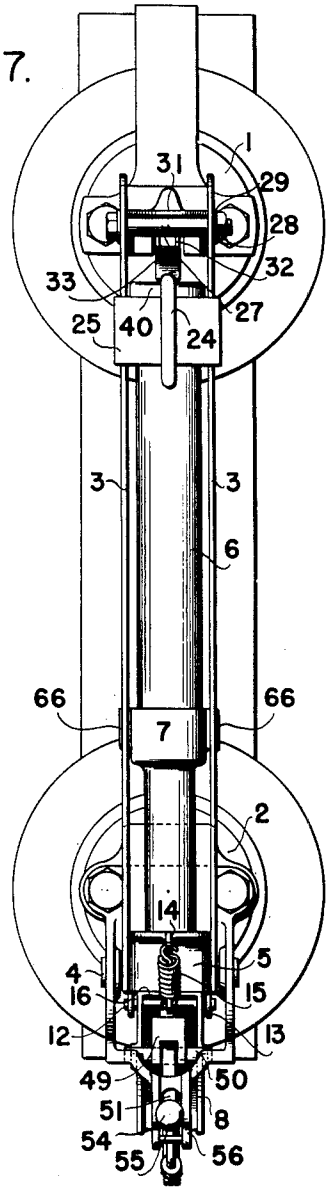


FIG. 8.

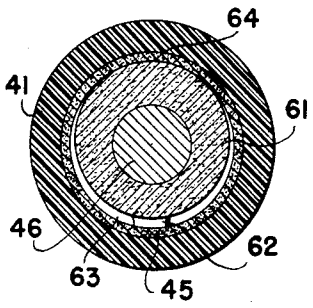
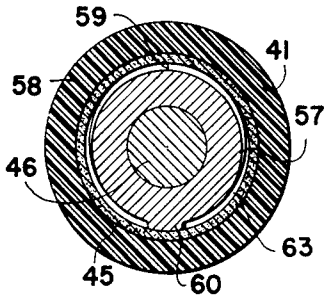


FIG. 9.



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Patented Jan. 20, 1953

2,626,332

UNITED STATES PATENT OFFICE

2,626,332

ELECTRICAL SWITCH

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Application July 27, 1950, Serial No. 176,196

13 Claims. (Cl. 200—146)

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This invention relates to switches, and particularly to switches that may be used on high tension lines, and adapted to be opened under load without damaging the switch parts or associated apparatus.

Sectionalizing of power lines is usually accomplished with the use of disconnect switches, or oil circuit breakers. The former are intended to open primarily when there is no load on the line and the latter are used for opening lines under heavy load. Oil circuit breakers are comparatively more expensive than disconnect switches. At times it becomes necessary to open lines under load at points located at an inconvenient distance from the circuit breaker. When the ordinary type disconnect switch is opened under load the contacts are usually damaged by arcing and burning, and there is the possibility of producing a surge in the line accompanied by a flashover to ground.

The invention hereinafter disclosed is designed to overcome the above disadvantages, and objects of this invention are to provide a switch which is adapted to be opened under load without damage to switch parts, and which will quickly extinguish any arc that is formed by confining it within an insulating chamber that is novelly constructed in a manner that will quickly snuff out the arc and expel the gases formed therein.

In alternating current lines the current and voltage pass through zero amplitude every half cycle, and the efficient operation of a load break switch is dependent upon the arc path being rendered incapable of supporting re-establishment of the arc after the power current has passed zero following the breaking of the contacts under load. To be effective, gas or vapor must be evolved very rapidly and the arc snuffed out to de-ionize the arc path, or at least, to so disperse the ions or break up the continuity or density of ionization that the arc will not restrike when the power current again becomes ascendant.

To achieve a rapid de-ionization of the arc created under load breaking conditions, a switch has herein been devised operating in a similar fashion to the switch illustrated in U. S. Letters Patent No. 2,344,113, granted to William O. Schultz, March 14, 1944, and assigned to the assignee of the present application. However, an entirely novel means has been provided for extinguishing and expelling the arc formed. The present invention contemplates an entire confinement of the arcing contacts within a specially designed expulsion chamber, whereas the switch disclosed

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in the above referred to patent embodies external arcing contacts which may be rapidly burned away after relatively few operations. Also, a modification of the withdrawal and resetting mechanism is provided to achieve rapid arc extinction.

Objects of this invention are generally similar to those of the above mentioned patent, viz: to provide a switch that is adapted to be opened under load and which is provided with a means for readily opening and closing by an operation through the medium of an ordinary switch stick is so desired, with the assurance that no damage will be occasioned to the switch mechanism or to any associated apparatus, and that no objectionable surges or flashovers will be produced; to provide a switch which may be used in place of ordinary disconnect switches and which is of relatively simple and inexpensive construction and does not require the use of an oil switch in connection with the disconnect switch, but which of itself, provides both for the sectionalizing of the line and also for the quick and safe extinguishing of any arc that is formed, thereby preventing flashovers or other damages incident to the opening of the ordinary disconnect switches under load.

In addition, the present invention discloses a switch adapted to be conveniently opened under load, said switch incorporating an auxiliary, or parallel current carrying path contained within a novel arc-extinguishing expulsion chamber. On separation of the main contact switch blades from the contact terminals, the current will be momentarily transferred to arcing contacts within the arc-extinguishing expulsion chamber, said arcing contacts being arranged in a manner that when separated, the arc is established in a restricted area in the chamber between the contacts and will be quickly lengthened to a more spacious portion of the chamber between the same contacts where it will be extinguished and expelled by a combination of the throttling action of the tube and gas pressure created therein.

Embodiments of the invention are shown in the accompanying drawings, in which:

Fig. 1 is a view in side elevation with portions broken away showing the switch in closed position.

Fig. 2 is a sectional view in elevation showing the switch with the main contact blades fully separated from the main terminal contact, but with the auxiliary, or parallel, circuit remaining in closed position immediately prior to release of the arcing contact plunger rod.

Fig. 3 is a fragmentary view of the switch in fully opened position with the auxiliary circuit assembly in reset position.

Fig. 4 is a sectional view taken on line 4—4 of Fig. 1.

Fig. 5 is a fragmentary detail view, partially in section, showing a portion of the auxiliary arcing contact assembly with the contacts shown just prior to separation.

Fig. 6 is a fragmentary detail view, partially in section and similar to Fig. 5, showing the arcing contacts in fully open position.

Fig. 7 is a front elevational view of the switch in closed position.

Fig. 8 is an enlarged sectional view taken on the line 8—8 of Fig. 6.

Fig. 9 is an enlarged sectional view taken on the line 9—9 of Fig. 5.

Referring to the drawings, and particularly to Figs. 1, 2 and 7, it will be seen that the novel switch comprises a pair of terminals 1 and 2 with an accompanying pair of relatively spaced main contact blades 3. Although it is usual to mount the switch in a vertical position as shown, with the terminal 1 at the top and the terminal 2 as the lower terminal, it is obvious that the switch assembly may be mounted in any desirable position, operating with equal efficiency. The lower terminal 2 also acts as a hinge support, carrying the main pintle pin 4.

The main contact blades 3 are fastened to a U-shaped casting 5 which is pivoted on the pintle pin 4. The pin also supports the parallel or auxiliary current carrying circuit, or arcing contact assembly 6, hereinafter described, which is independently pivoted thereon through the supporting casting 7. Also pivoted on pin 4 is the latch casting 8 and the relatively heavy spring 9 which serves to bias the supporting casting 7 in a clock-wise direction as viewed in Figs. 1 and 2.

The U-shaped casting 5, supporting the blades 3, is provided with a cam-shaped portion 10 which bears against a relatively heavy contact spring 11. A stop pin 12 is supported by the side walls 13 of the casting 5. This pin 12 serves as a bearing member for one end of the bias spring 9. A projecting tongue 14 on the casting 5 supports one end of a latch spring 15, the opposite end of which is supported by a bridge-like member 16 on the latch casting 8. Both the bridge 16 of latch 8 and the end wall of casting 5 are positioned from the pintle pin 4 far enough to permit clearance of parts during the outward motion of the contact blades 3 as described hereinafter.

The supporting casting 7 includes a trapezoidal-shaped portion 18 which acts to provide a trigger-like action to the assembly 6 as will be apparent in a subsequent description of operation. The biasing spring 9 bears against the supporting casting 7 and is retained by the slot 19 shown in Fig. 4.

The lower portion of each of the side walls 20 of latch casting 8 is provided with a latching slot 21, the inner end of which is adapted to act as a bearing surface for retaining the novel arcing assembly 6 in a closed switch position as hereinafter described. The shoulders 22 are adapted to aid in the re-setting operation as will be described. Another slot-like surface 23 is provided in each of the side walls 20 in order to provide clearance around the stop pin 12 of casting 5. The bridge 16 of latch casting 8 supports one end of latch spring 15, and is adapted to act as a bearing surface for casting 5 during outward motion of the main switch blades 3. The bridge is designed to be positioned far enough from pin 4 to provide clearance for moving parts.

The main contact blades 3 are provided with a manipulating member or eyelet 24 adapted to be engaged with a switch stick. The eyelet 24 is integral with a brace or bridge 25 which is located between, and fastened to, each of the contact blades 3. The outer ends of the blades 3 are joined by a member 26 adapted to concurrently act as a contact with the upper terminal 1, and as a means of retaining the contact blades 3 in a manner that will assure firm and adequate contact. In order to further insure firm contact, the contact member 26 may be in the form of a bolt, or stud, passing through a spacer sleeve 27, and projecting through both contact blades. The bolt or stud 26 is provided with a head and nut 28, or two nuts (not shown), and spring washers or spring members 29 which serve to yieldingly force the contact blades 3 towards one another, thus insuring adequate contact with the upper terminal member 1.

The contact blades 3 bear against the outer surfaces of the upper terminal when the switch is in a closed position. The blades 3 are guided into position within slot 30 by means of the tapered tongue 31 integral with the terminal 1. The upper terminal is also provided with a latching member 32 which has an outer cam face 33 and an inner latching shoulder 34. This latching member 32, although operating as a part of the upper terminal, is not intended to conduct current or in any way act as a contact means to the parallel or auxiliary current carrying arcing assembly 6. Referring to Fig. 2, the member 32 operates as a latch in the following manner: the spring 35 urges the latch member downwardly with the inner shoulder 34 acting as a stop, preventing a clockwise movement of auxiliary assembly 6. The latch 32 is prevented from traveling beyond a predetermined point by the contacting on the lip 36 with the stopping web 37 on the upper terminal.

The upper terminal is also provided with a contact member 38 at the end of a current carrying spring 39 fastened to the web portion 37, which spring urges the contact in a counter-clockwise direction so that it may contact and supply current to the novel auxiliary current carrying arcing contact assembly 6 as hereinafter described.

Although the switch may be used as a disconnect switch, or for any other desired purpose, the primary object of this invention is to provide a switch that will open a high voltage circuit under load conditions without damage to the switch parts or surrounding equipment.

To accomplish this object, a novel parallel or auxiliary current carrying circuit assembly 6 is provided between the upper and lower terminals. During the period that the switch blades are in contact with the upper terminal this circuit acts merely as a shunt circuit, but as the contact blades 3 leave the upper terminal 1, the full load is momentarily transferred to the auxiliary circuit. As the switch blades are moved to a predetermined position, the auxiliary arcing contacts of the novel parallel circuit assembly are opened with the accompanying arc quickly suppressed and extinguished in a novel manner contemplated by the invention.

The novel auxiliary circuit assembly 6 is provided with a metal ferrule 40, which ferrule serves

as a companion contact member with the terminal contact member 38. The ferrule 40 is fitted to the end of a hollow insulating expulsion tube 41 which may be formed of fiber liner. The lower end of the expulsion tube is carried by a cradle-like member or supporting casting 7 which is pivoted on the main pintle pin 4. Bearing against this supporting casting is a relatively heavy spring 9, also mounted on pintle pin 4, which spring serves to bias the casting and supported assembly 6 in a clockwise direction.

The parallel circuit is continued within the tube 41 through a fixed contact in the form of an inner metal sleeve 42 flanged at the upper end to make permanent electrical contact with the ferrule 40. This metal sleeve is pressed to the tube 41, and is provided with a slanted end 43 and a slot 44 as is clearly shown in Figs. 5 and 6. It is clearly understood that though the fixed contact is preferably shown as metal sleeve 42 for adding additional strength to said auxiliary circuit assembly 6, it may be any of many forms including a single rod-like electrode (not shown) pressed to tube 41 connecting with ferrule 40 at the upper end and extending substantially the same length as the preferred sleeve 42. A fiber sleeve or liner 45 serves as an inner liner for the other end of the insulating tube 41.

Slidably held within the tube 41 and the supporting casting 7 is the movable contact assembly comprising a metal current carrying plunger rod 46 surrounded by a coil spring 47 which is normally held in tension. The lower end of the spring is threaded into the stop member 48 which may be separate from, but bearing against the lower portion of support casting 7. The stop member may also be made integral with said support casting, as disclosed in Fig. 2.

The lower end of the metal rod 46 supports a clevis 49 which may be pinned to this rod. The clevis 49 supports the latch pin 50 which also serves as a hinge pin for the member 51. A restoring arm 52 is screw threaded into the member 51, and locked in adjusted position by means of a nut 53, the arm or rod 52 being provided with an outer headed portion 54. This restoring arm 52 is loosely guided between a pair of pins 55 carried by a projecting structure 56 integral with the lower terminal member 2.

As disclosed in Figs. 2, 5, and 6, the upper end of the coil spring 47 is threaded into the novel metal arcing contact plug 57. The preferred method of attaching the spring to the plug 57 is to provide the plug with internal threads to accommodate the spring 47. This contact plug is fastened permanently, as shown, to the plunger rod 46, said plug 57 provided with a raised slanting shoulder 58. This shoulder provides electrical contact with the internal surface of the metal current carrying sleeve 42. A recessed portion 59 is provided on the plug 57 directly below the shoulder 58. The surface 60 opposite the recessed portion 59 is adapted to slide on the inner surface of the fiber liner 45. Also permanently attached to the metal rod 46 is a novel follower 61 of arc-extinguishing material, slanted at the lower end to fit flush with the slanted shoulder 58 of the contact plug 57. This novel follower 61 is of substantially the same diameter as that of the shoulder 58, and both are, as indicated in Figs. 5 and 6, in eccentric relation to one another. The upper end of the fiber follower is provided with a foot portion 62 which is similar to surface 60 of the plug 57 and adapted to provide a sliding surface for the eccentric follower within the sleeve 42. It will be apparent from Figs. 5 and 6 that the relationship of shoulder 58 and follower 61 to the contact 42 and fiber liner 45 provides an arcing space which is crescent-shaped in transverse section, its widest dimension being on the side 63 and its narrowest dimension being on the side 64 of the tube 41.

Permanently attached to the upper end of the fiber follower 61 is a latch pin or tip 65. This tip may be of any suitable material, preferably insulating, as no electrical contact with the upper terminal latch 32 is necessary, nor desired. The pin 65 is provided only as a latching stop for the auxiliary assembly 6, preventing clockwise movement thereof until at such time as desired and hereinafter described. The metal plunger rod 46 extends well into the fiber follower to provide strength, but care is taken to insulate this rod from the tip 65 if the preferred material for the tip is of a metal, as will be apparent in the following description of operation.

The operation of the apparatus is as follows: The novel switch herein disclosed is operated in a manner similar to that of the switch of the aforementioned Schultz Patent No. 2,344,113, with the additional advantage of having the entire arc confined within the arc-extinguishing tube where it may be efficiently suppressed and snuffed out without damage to the switch parts or associated equipment.

The switch may be opened under load conditions, requiring no particular care on the part of the operator. He merely engages a switch stick with the manipulating member or eyelet 24 and pulls the switch blades 3 to the full open position shown in Fig. 3. The auxiliary or parallel current carrying assembly 6 is urged by spring 9 to rock outwardly, but is prevented from doing so by the engagement of the latching shoulder 34 of latching member 32 and the tip 65. Therefore, the full load current is momentarily carried by the auxiliary assembly 6 and the contact member 38 as the blades 3 break contact with the upper contact terminal 1. Thus, no arcing will occur between the outwardly moving blades 3 and the terminal 1 while current is still flowing from the terminal contact 38, through the various parts of the assembly 6 to the plunger rod 46, and thus to the lower contact terminal 2.

As the switch blades continue their outward movement, this motion is transferred by the casting 5 to the latch casting 8 at the bridge portion 16. As the plunger rod 46 is constantly forced downward by the tension spring 47, this force is opposed by, and transferred to, the latch casting 8 through the clevis pin 50. Therefore, when the blades 3 move a predetermined distance to a position measured by the length of travel of the pin 50 in the latch slot 21, as shown in Figs. 1 and 2, the movable contact assembly will be released. When this happens the spring 47 is permitted to suddenly force the plunger rod 46 downwardly drawing with it the arcing contact plug 57, the fiber follower 61, and the latching tip 65. Fig. 2 clearly shows the switch immediately prior to release of the clevis pin 50.

To assure continued electrical contact exteriorly of the tube as the assembly 6 is urged outward on disengagement of the latch tip 65 with the latch 32, the terminal contact 38 follows the assembly for a predetermined distance assuring electrical contact with the ferrule 40 long enough to permit the load break to occur across the contact tips 43a and 58a of the metal sleeve 42 and the contact shoulder 58 respectively. It is again emphasized that no electrical contact is desired

between the latching tip 65 and the upper terminal 1. The tip 65 may be pinned to the upper end portion of the fiber follower 61 as shown in Fig. 2, or may be made integral with this follower, but must be made separate from the plunger rod 46.

The auxiliary arcing contact assembly 6 is urged outwardly by the relatively heavy spring 9 bearing against the support casting 7. This bias spring may take any of various forms, but is preferably as disclosed in Figs. 2 and 4. This motion is aided by the trigger-type action of the terminal spring 11 engaging with the lower slanted edge of the trapezoidal-like projection 18 of the support casting 7. The cam-shaped surface 10 of the casting 5 aids in holding the blades 3 in an upright position. Pressure exerted by the terminal spring 11 on the upper shoulder surface of the cam through the casting 5 urges the blades 3 in a counter-clockwise direction about the main pintle pin 4 assuring firm electrical contact with terminal 1. As the blades 3 are pulled outwardly, the cam-shaped surface 10 is moved past its center line permitting the spring 11 to then act as a biasing force urging the casting 5 in a clockwise direction aiding in moving the blades 3 to the full open position. By the time that the blades 3 have been pulled outwardly far enough to permit the spring 11 to retract, the latching tip 65 of the auxiliary assembly 6 will have been disengaged, thus permitting clockwise movement of the assembly 6 as urged by bias spring 9. This retraction will permit the heavy terminal spring 11 to engage with the trapezoidal-like projection 18 of the support casting 7, thus offering a trigger-type action to the outward movement of the assembly 6, which will aid in expediting quick opening of the switch.

The auxiliary arcing contact assembly 6 is forced outward until it is arrested by the engagement of the ears 66 on the casting 7 with the switch blades 3 as shown in Fig. 3. The ears 66 take up the force of the blow, but may be aided by adapting the bridge-like portion 25 of the eyelet 24 to concurrently assist in arresting the motion of the assembly 6 engaging with the upper ferrule 40, saddle-fashion. However, the primary purpose of the member 25 is to assist in centering the tube with reference to the switch blades 3.

The operation of the novel auxiliary arcing contact assembly 6 is as follows: As latch casting 8 is moved clockwise to withdraw the clevis latching pin 50 from the latching slot 21, the spring 47 urges the plunger rod 46 downwardly. This downward movement permits disengagement of the arcing contact tips 43*a* and 53*a*, which are shown in full electrical contact, but immediately prior to disengagement in Fig. 2.

The arc created by breaking the load is confined entirely to the novel arcing contact assembly where it is properly suppressed, extinguished, and expelled. As the contacts are withdrawn by the downward movement of the arcing contact plug 57 any arc that is created will be formed between the nearest contact points, i. e., tips 43*a* and 53*a*. These point surfaces have been especially located in a very confined space on the side of the tube 41 located between the periphery of the follower plug 61 and 64, the internal diameter of the sleeve 42, or liner 45. In actual practice the follower 61 and shoulder 58 make a frictional sliding contact with the sleeve 41, leaving little or no space at 64. Thus, the arc will try to find an easier path. Since the shoulder 58 is adapted to have a relatively loose space at the opposite side from the tip 58*a*, the arc will tend to follow along the shoulder 58 to this relatively large space on the side 63. Since the shoulder 58 slants in an opposite direction from the end 43 of the metal sleeve 42, the arc will be additionally stretched and located in an area where it may be suppressed and expelled. Referring to Fig. 5, which shows the contact tips 43*a* and 58*a* at the last point of electrical contact, it will be apparent that as the contacts are separated to the position indicated in Fig. 6, the arc will be distended. As it is distended in the relatively confined portion 64 of the chamber, it will tend to follow the path of least resistance, towards the unconfined portion 63.

As the fiber liner 45 and the fiber follower 61 are of arc-extinguishing material, the arc formed will act on these materials to form hot gases and water vapor. The downward motion of the arcing contact plug 57 and the follower 61 will also tend to pull all of the gases formed into the relatively unconfined portion 63—the path of least resistance, where they may be expelled to the atmosphere through the upper end of the space 63, past the foot portion 62 to the atmosphere. These gases will act to snuff out any of the arc remaining and, also act to prevent subsequent arcs forming from follow current. Subsequent arcing is also prevented by the quick and relatively lengthened withdrawal of the contact tips.

The hot gases formed from the arc contain a considerable amount of vaporized metal from the contact materials. This metal vapor has a tendency to condense on the travel surface of the arcing chamber, making it quite inconvenient to reset the mechanism and also preventing rapid action on subsequent operations. This hindrance has been remedied by a novel means: A slot 44 is formed in the sleeve 42 substantially at the same angle as the slanted end 43. Also a recessed portion 59 is provided in the arcing contact plug 57. As the contacts are disengaged, and moved to the position shown in Fig. 6, any molten metal vapor formed by arcing is forced along with other gases created. These gases have a tendency to take the easiest path, which will be toward the unconfined portion 63, between the follower 61 and the sleeve 42 and through the slot 44. Thus, the molten metal will condense and collect on the lower wall of the slot 44. Also, metal vapors will condense and collect in the recessed portion 59 of the plug 57 rather than on the contact shoulder 58.

The resetting operation of the parts of the auxiliary arcing contact assembly 6 is as follows: After the pin 50 is released by the latch slot 21, the plunger rod 46 and clevis 49 are forced downward carrying along the hinge member 51 which is pivoted on the clevis latch pin 50. The combination of the downward motion and the outward motion of the blades 3 is transmitted to the restoring rod 52, as is shown in dotted lines in Fig. 2. The rod 52 is moved until the head 54 engages with the stop pins 55 of the projecting portion 56, which portion is rigid with the lower terminal 2, clearly shown in Fig. 4. As the rod 52 is stopped from further motion, the length of which may be adjusted by the unt 53, the plunger rod 46 is then forced back towards the closed position. As the operator continues to pull on the manipulating eyelet 24 the latch pin 50 will ride on the shoulder 22 of the latch casting 8 pulling the rod spring 47 into tension until the pin reaches

the highest portion of the shoulder when the latch casting 8 will separate from the casting 5 opposing the force of the spring 15. As the pin 59 rides past the high portion of the shoulder 22 the latch casting will be urged in a counter-clockwise direction, forcing the pin 59 into the latching slot 21 where said pin will ride into a latched rest position as is shown in Fig. 3.

When the switch is again closed, the main contact blades 3 move as a unit with the auxiliary assembly 6, the upper contact latching member 32 yielding and permitting the latch tip 65 to ride the outer cam face 33 and pass to a latched position behind the inner latching shoulder 34 to the original position shown in Fig. 1.

No particular delaying mechanism is necessary for efficient operation of the novel switch as all arcing is confined within the chamber of the auxiliary assembly 6. Extinguishment of the arc may be completed while the assembly is moving outwardly, without delaying outward motion until complete extinction of the arc is assured. Thus, more efficient and quicker switch operation is assured.

It will be seen that a novel switch has been shown which is adapted to be opened under load conditions and may be positioned in a high tension line. The switch may be operated effectively as a disconnecting switch, which ordinarily are not adapted to be opened under load conditions. In addition to this, the invented switch contemplates a complete confinement of any deleterious arcing conditions, which might prove damaging to the switch mechanism or surrounding equipment.

It is apparent that though a single switch has been shown, such switches may be adapted to operate as gang switches. The only modification necessary would be to add a means for connecting any number of switches together to act simultaneously.

We claim:

1. A load break switch including in combination a pair of stationary terminals, an expulsion tube open at each end and hingedly mounted on one terminal, a pair of arcing contacts therein, one of which is in fixed position and the other of which is movable in the tube, an insulating follower plug affixed to said movable arcing contact and of substantially identical cross-section as that of said movable arcing contact, the cross-sectional dimension of said follower plug and said moving arcing contact being less than and in eccentric relationship to the bore diameter of said expulsion tube providing a constricted portion located substantially where the arcing contacts are electrically connected and a relatively spacious arc expulsion passage oppositely positioned from said restricted portion, a plunger slidable in said tube and actuating said movable arcing contact, said movable contact being normally engaged with said fixed contact, an insulating latch member of said plunger normally extending from said tube and latched to the other of said terminals, a latch interposed between said hinge and said plunger, spring means biasing said plunger to separate said contacts and release said insulating latch member, a resilient contact on said other terminal electrically connected to said fixed contact, and means for manually releasing said plunger, said tube biased for swinging motion on said hinge.

2. A load break switch including in combination a pair of stationary terminals, an expulsion tube open at each end and hingedly mounted on one terminal, a pair of concentrically related arcing contacts, at least one of which is beveled to extend the arc created on disengagement of said contacts, said arcing contacts releasably held in engagement to provide an electrical circuit connecting said terminals, means including a spring biasing one of said contacts towards disengagement from the other of said arcing contacts, a plunger slidable in said tube and having an arcing contact movable therewith and normally engaged with said fixed contact, an insulating latch member on said plunger normally extending from said tube and latched to the other of said terminals, a latch interposed between said hinge and said plunger, said tube biased for swinging motion on said hinge, a resilient contact on said other terminal electrically connected to said fixed contact, and means for manually releasing said plunger.

3. A load break switch including in combination a pair of stationary terminals, an expulsion tube open at each end and hingedly mounted on one terminal, a pair of arcing contacts, at least one of which is beveled to extend the arc created on disengagement of said contacts, said arcing contacts releasably held in engagement to provide an electrical circuit connecting said terminals, means including a spring biasing one of said contacts towards disengagement from the other of said arcing contacts, a plunger slidable in said tube and having one of said arcing contacts movable therewith and normally engaged with the other of said contacts, an insulating latch member on said plunger normally extending from said tube and latched to the other of said terminals, a latch interposed between said hinge and said plunger, a resilient contact on said other terminal electrically connected to said fixed contact, means for manually releasing said plunger, said tube biased for swinging motion on said hinge, and a restoring means for resetting said plunger to its original position with reference to the expulsion tube after said tube has been swung outwardly.

4. A load break switch including in combination a pair of stationary terminals, an expulsion tube open at each end and hingedly mounted on one terminal, an arcing contact fixed in said tube, said fixed arcing contact comprising a metal sleeve inserted within the bore of said tube, said sleeve beveled at the end extending within said tube, a plunger slidable in said tube and having an arcing contact movable therewith and normally engaged with said fixed contact, an insulating latch member on said plunger normally extending from said tube and latched to the other of said terminals, a latch interposed between said hinge and said plunger, spring means biasing said plunger to separate said contacts and release said insulating latch member, a resilient contact on said other terminal electrically connected to said fixed contact, means for manually releasing said plunger, said tube biased for swinging motion on said hinge.

5. A load break switch including in combination a pair of stationary terminals, an expulsion tube open at each end and hingedly mounted on one terminal, an arcing contact fixed in said tube, said fixed arcing contact comprising a metal sleeve inserted within the bore of said tube, said sleeve beveled at the end extending within said tube, a plunger slidable in said tube and having an arcing contact movable therewith and normally engaged with said fixed contact, an insulating follower plug affixed to said movable

contact, an insulating latch member integral with said follower plug normally extending from said tube and latched to the other of said terminals, a latch interposed between said hinge and said plunger, spring means biasing said plunger to separate said contacts and release said insulating latch member, means for manually releasing said plunger, said tube biased for swinging motion on said hinge, and a restoring means for resetting said plunger to its original position with reference to the expulsion tube after said tube has been swung outwardly.

6. A load break switch including in combination a pair of stationary terminals, an expulsion tube open at each end and hingedly mounted on one terminal, an arcing contact fixed in said tube, said fixed arcing contact comprising a metal sleeve inserted within the bore of said tube, said sleeve beveled at the end extending within said tube, a plunger slidable in said tube and having an arcing contact movable therewith and normally engaged with said fixed contact, said movable contact beveled in opposed relation to the bevel of said fixed arcing contact, an insulating follower plug affixed to said movable arcing contact, an insulating latch member integral with said follower plug normally extending from said tube and latched to the other of said terminals, a latch interposed between said hinge and said plunger, spring means biasing said plunger to separate said contacts and release said insulating latch member, means for manually releasing said plunger, said tube biased for swinging motion on said hinge, and a restoring means for resetting said plunger to its original position with reference to the expulsion tube after said tube has been swung outwardly.

7. A load break switch including in combination a pair of stationary terminals, an expulsion tube open at each end and hingedly mounted on one terminal, an arcing contact fixed in said tube, said fixed arcing contact comprising a metal sleeve inserted within the bore of said tube, said sleeve beveled at the end extending within said tube, a plunger slidable in said tube and having an arcing contact movable therewith and normally engaged with said fixed contact, an insulating follower plug affixed to said movable arcing contact, the cross-sectional dimensions of said follower plug substantially identical to those of said movable arcing contact, said cross-sectional dimensions being less than and in eccentric relationship to the bore diameter of said expulsion tube providing a constricted portion substantially located where the arcing contacts are electrically connected and a relatively spacious arc expulsion passage oppositely positioned from said restricted portion, a latch interposed between said hinge and said plunger, spring means biasing said plunger to separate said contacts, and means for manually releasing said plunger, said tube being biased for swinging motion on said hinge, and a restoring means for resetting said plunger to its original position with reference to the expulsion tube after said tube has been swung outwardly.

8. A switch adapted to be opened under load comprising two terminals, a switch blade for connecting and disconnecting said terminals, an auxiliary circuit breaker including concentrically related arcing contacts, at least one of which is beveled to extend the arc created on disengagement of said contacts, said arcing contacts releasably held in engagement to provide an electrical circuit in parallel with said blade and connecting said terminals, means including a spring biasing one of said contacts towards disengagement from the other of said arcing contacts, a latch means operated in conjunction with said switch blade releaseably holding said means inactive until a given time following movement of said switch blade to open position thereby delaying disengagement of said arcing contacts for a time subsequent to opening of said switch blade.

9. In a switch adapted to be opened under load comprising two terminals, a switch blade for electrically connecting and disconnecting said terminals by movement to closed and open position respectively, and means for moving said switch blade; an auxiliary circuit breaker normally in parallel circuit relation to said switch blade and adapted to carry the entire load for an interval after the switch blade is moved to open position, said auxiliary circuit breaker comprising in combination an arc expulsion tube open at each end, a pair of arcing contacts therein, one of which is in fixed position and the other of which is movable in said tube longitudinally of the axis thereof, an insulating follower plug affixed to said movable arcing contact and of substantially identical cross-section as that of said movable arcing contact, the cross-sectional dimension of said follower plug and said movable arcing contact being less than and in eccentric relationship to the bore diameter of said expulsion tube providing a laterally constricted portion extending longitudinally of said tube and located substantially where the arcing contacts are electrically connected and a laterally relatively spacious arc expulsion passage extending longitudinally of said tube and positioned oppositely from said restricted portion, a slidably operated plunger means actuating said movable arcing contact to rapidly disengage said arcing contacts by movement thereof longitudinally of said tube after said switch blade has moved a given distance following movement to open position, causing the arc to be extended and extinguished within said expulsion tube and the resulting gases expelled therefrom, said plunger normally releasably held by a latch means operating in conjunction with said switch blade.

10. In a switch adapted to be opened under load comprising a terminal provided with a pivot support, a second terminal, a switch blade pivoted on said pivot support and adapted to engage said second terminal, and means for moving said switch to open and closed positions; an auxiliary circuit breaker comprising in combination an insulating tube, a fixed arcing contact within said tube comprising a hollow metal sleeve having its arcing end beveled relative to the axis of said tube and normally electrically connected with a movable contact affixed to said second terminal, a movable arcing contact in said tube having its arcing end beveled in opposition to the beveled surface of said sleeve, a fiber follower plug of a cross-section dimension substantially identical to said movable arcing contact and permanently attached thereto, said movable arcing contact and follower being eccentrically positioned relative to the axis of said tube, a plunger within said tube for actuating said movable arcing contact longitudinally of said tube, a spring means biasing said plunger towards disengagement of said arcing contacts, a latch means operated in conjunction with said switch blade for releasably holding said plunger

until a given time following movement of said switch from open position, biasing means for moving said auxiliary circuit breaker outwardly away from said second terminal after said plunger has operated, and latch means for releasably retaining said auxiliary circuit breaker in electrical connection with said second terminal until said switch blade has moved a given distance from open position, said latch means insulated from said arcing contacts and operated from said plunger.

11. A load break switch including in combination a pair of stationary terminals, an expulsion tube open at each end and hingedly mounted on one terminal, a pair of arcing contacts therein, one of which is in fixed position and the other of which is movable in the tube, an insulating follower plug affixed to said movable arcing contact, a crescent-shaped arcing passage defined by the outer surface of said follower plug and the bore of said tube, a plunger slidable in said tube and actuating said movable arcing contact, said movable contact being normally engaged with said fixed contact, a latch interposed between said hinge and said plunger, spring means biasing said plunger to separate said contacts, a resilient contact on the other of said terminals electrically connected to said fixed contact, and releasable latching means for normally restraining said plunger from actuating said movable contact, said tube biased for swinging motion on said hinge.

12. In a load break switch including a fixed sleeve-like member having an arcing contact portion thereon, and a movable contact concentrically related to said fixed contact, an expulsion tube about both of said contacts, said fixed sleeve-like contact member having a slotted portion rearwardly of its contact portion whereby eroded particles of metal attendant to arcing conditions are entrapped.

13. In a load break switch including a fixed sleeve-like arcing contact and a movable contact concentrically related to said fixed contact, an expulsion tube about both of said contacts, said contacts each beveled in opposed relationship with one another, said fixed sleeve-like contact having a slotted portion rearwardly of and on a plane parallel to its bevel, said slot adapted to entrap eroded particles of metal attendant to arcing conditions.

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