June 5, 1951 W. A. GUSSOW 2,555,588

ELECTRIC SWITCH

Filed Aug. 26, 1948 3 Sheets-Sheet 1

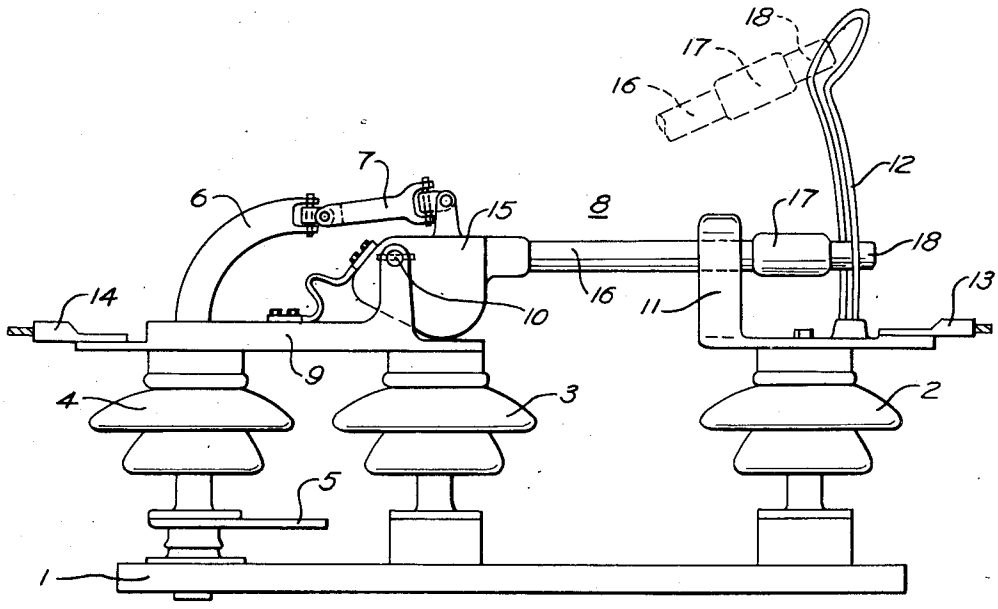


FIG. 1

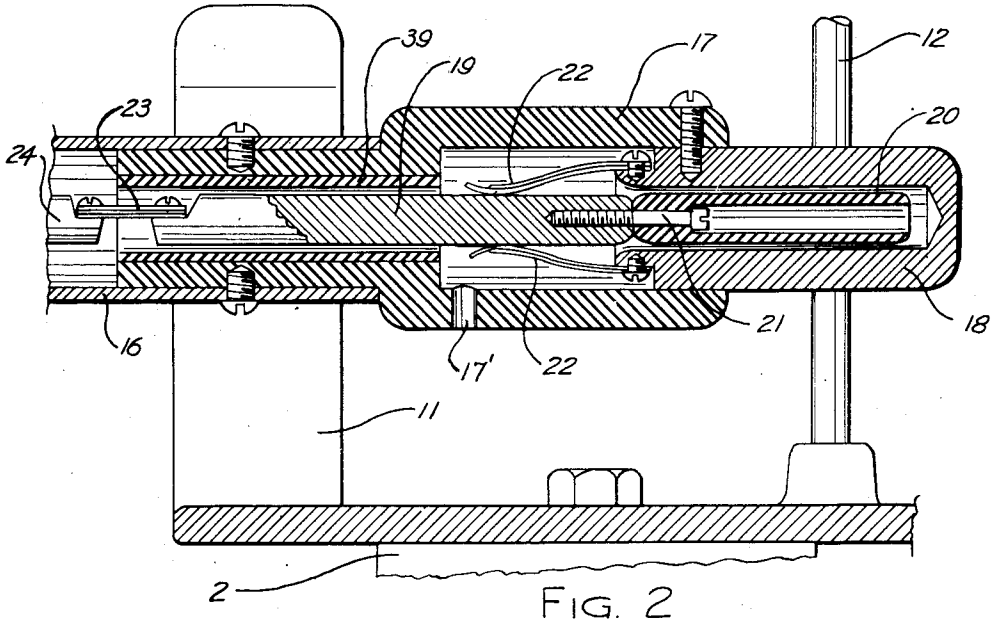


FIG. 2

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ELECTRIC SWITCH

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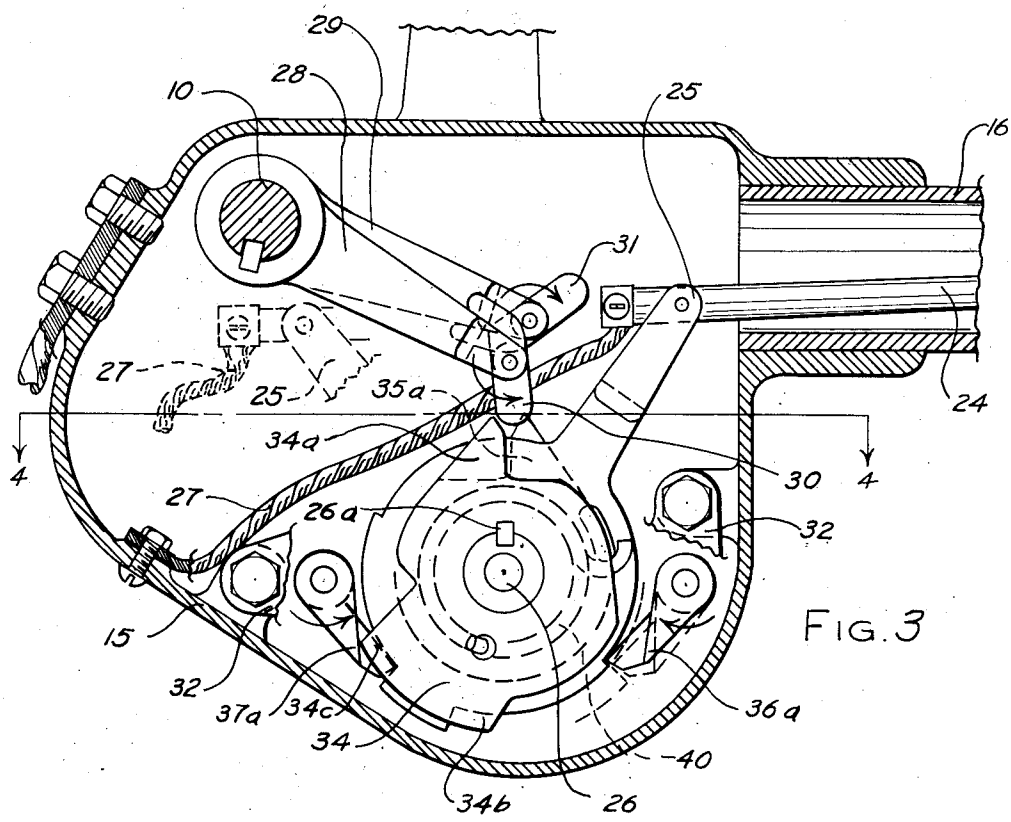


FIG. 3

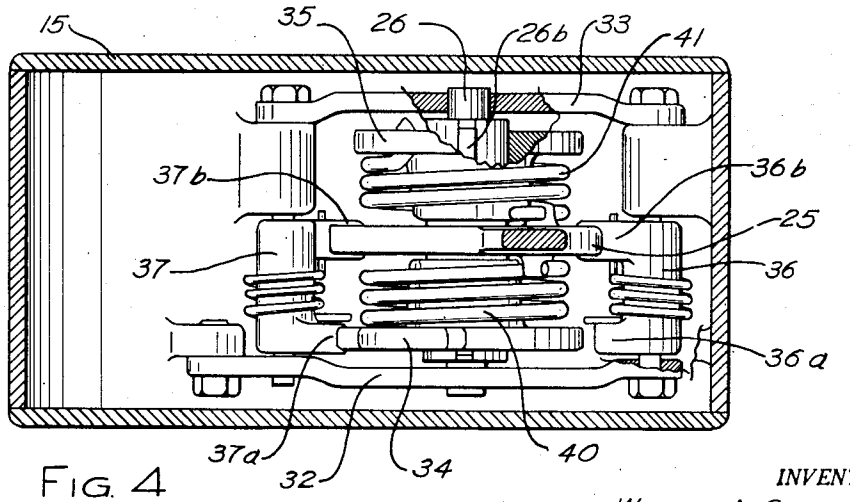


FIG. 4

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ELECTRIC SWITCH

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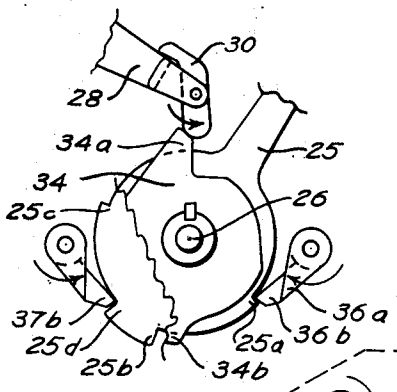


FIG. 5

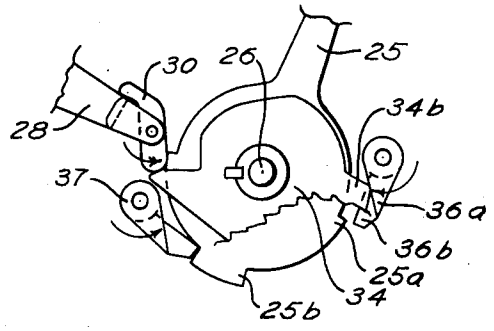


FIG. 6

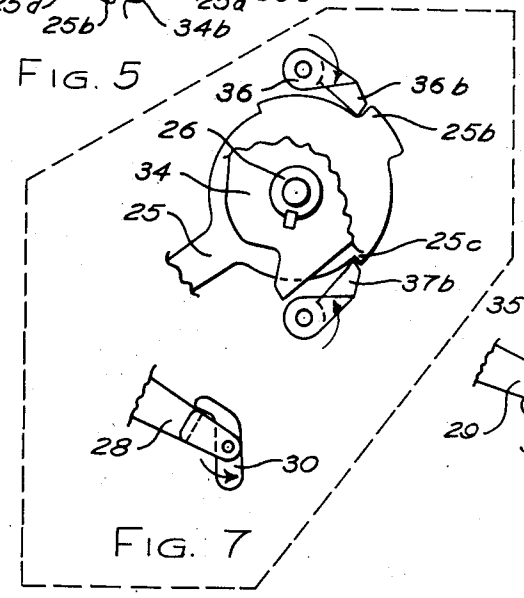


FIG. 7

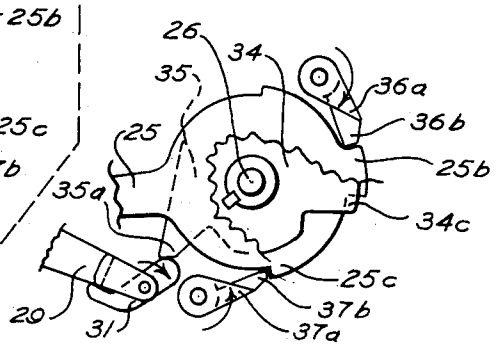


FIG. 8

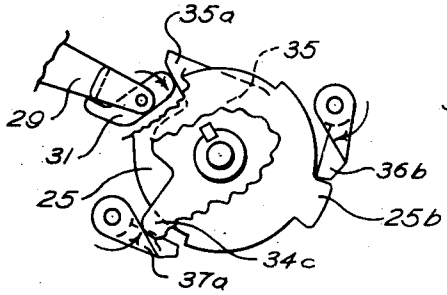


FIG. 9

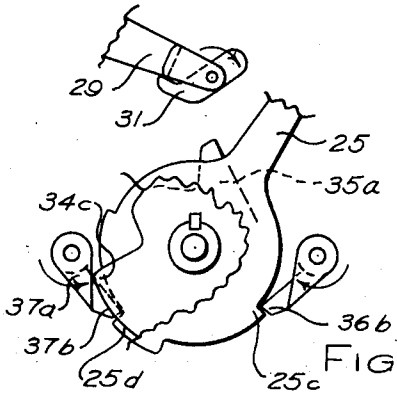


FIG. 10

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2,555,588

ELECTRIC SWITCH

William A. Gussow, Hampton, Ga., assignor to Southern States Equipment Corporation, a corporation of Georgia

Application August 26, 1948, Serial No. 46,333

9 Claims. (Cl. 200—146)

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This invention relates to high voltage electric switches of the type in which the main air break switch arm is supplemented by an arc suppressing device which makes possible the safe opening of the switch under much heavier loads than otherwise. One purpose is to provide a switch in which the exposed members are weatherproof and in which the smaller high speed arc-suppressing members are adequately housed; another purpose is to combine all these members into a compact and simple unit; another purpose is to provide an air break switch capable of closing as well as opening a high voltage circuit many times without serious deterioration; and other purposes will be evident from the specification and claims.

In the drawings Figure 1 shows in small scale a side view of one form of switch embodying this invention; Figure 2 in larger scale shows a cross section of the swing end of the switch arm; Figure 3 is a vertical cross section of the hinge end of the switch arm; Figure 4 is a cross section of the hinge end of the switch arm on the line 4—4 in Figure 3; Figures 5 to 10 inclusive are diagrams showing the operation of certain parts shown in Figures 3 and 4.

A base 1 supports two stationary insulator units 2, 3 and one rotative insulator unit 4 which is operable by crank 5. Crank 6 is fixed to insulator unit 4 and rod 7 connects crank 6 with switch arm 8 which has many parts and which is pivotally mounted on hinge base 9 by hinge pin 10. Insulator 2 supports the main jaw contact 11 and the arcing horn 12 which serves as an auxiliary contact arm. Line connections are at 13 and 14.

Switch arm 8 includes a box 15 at its hinge end, a tubular conducting arm 16, an insulating section 17 and a conducting arcing tip 18 which cooperates with horn 12. Inside of the members 16, 17, and 18, as shown in Figure 2, is a conducting rod 19 which has an insulation tip 20 made of horn fibre or other suitable material and secured to rod 19 by screw 21. In the fully closed position, shown in Figure 2, contacts 22, 22 connect rod 19 with tip 18. The clearances around 19 and 20 are exaggerated in Figure 2 for clarity. As made, the rod members make an easy slip fit inside the tubular members. Rod 19 is connected by flexible conductor 23 to rod 24. Rod 24 is pivotally connected, as shown in Figure 3, to crank member 25 which is rotatable about shaft 26 from the fully closed position shown in full lines to the fully open position shown in dotted lines. A flexible conductor 27

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gives good electrical conductivity from rod 24 to box 15.

Hinge pin 10 is securely held, by set screws or otherwise, against turning in base 9, but box 15 turns freely about pin 10 as its pivotal hinge support. Supported by pin 10, inside box 15, and held stationary by set screws or otherwise are two fixed arms 28, 29, which carry, respectively, two ratchets 30, 31 pivotally mounted on the free ends of arms 28, 29. Provision is preferably made for adjusting the position of each of the ratchets and suitable springs bias the ratchets to normal position.

Shaft 26 is pivotally supported at the ends by bars 32, 33 and shaft 26 also supports collars 34, 35 which are keyed to shaft 26 by keys 26*a* and 26*b*, respectively, so that collars 34, 35 and shaft 26 form a single rigid rotatable member. A coil spring 40 is held at one end by crank 25 and at the other end by collar 34, another coil spring 41 is held by crank 25 at one end and by collar 35 at the other end. Collar 34 has a dent 34*a* which is cooperable with ratchet 30, and collar 35 has a dent 35*a* which is cooperable with ratchet 31. A pivotally mounted member 36 includes a pointed crank 36*a* and a ratchet 36*b*, and a similar member 37 includes crank 37*a* and ratchet 37*b*. In the closed switch position ratchet 30 holds dent 34*a* against turning as the switch starts to open. In the open switch position ratchet 31 holds dent 35*a* against turning as the switch starts to close. Collar 34 has two ratchet-releasing projections 34*b*, 34*c*, which engage respectively with cranks 36*a* and 37*a*. Crank member 25, see Figure 5, has two dents 25*a* and 25*b* which are engageable by ratchet 36*b*, and two dents 25*c* and 25*d* which are engageable by ratchet 37*b*.

Opening operation is as follows: Figure 5 shows that crank 25 is held by 36*b* and 37*b* against turning about the axis of shaft 26. But as crank 5 is turned and rod 7 is moved, box 15 is rotated counter-clockwise about hinge pin 10. And since ratchet 30 is stationary it holds dent 34*a* against moving with box 15. Therefore, as shaft 26 moves with box 15, collar 34 is forced to rotate counter-clockwise about the axis of shaft 26. This turns shaft 26 and collars 34, 35, while crank member 25 is held stationary by ratchet 36*b*. Therefore coil spring 40 has its tension increased and crank 25 is biased counter-clockwise. As this motion continues projection 34*b* engages crank 36*a* and rotates it counter-clockwise thereby forcing ratchet 36*b* out of engagement with 25*a*. The parts are then as

shown in Figure 6; but since 25 is strongly biased by spring 40, crank 25 is instantly rotated counter-clockwise until ratchet 36b engages with dent 25b and dent 25c is simultaneously engaged by ratchet 37b. Therefore crank 25 is again held stationary as to box 15.

As crank 25 moves, conductor rod 19 is moved instantly away from contacts 22, 22 and through the small part of insulating section 17 where there is preferably a lining of horn fibre 39. The chamber inside of 17 is vented by one or more holes 17'. The insulation tip 20 is drawn inside the lining 39 and the arc caused by opening the circuit is quenched in the small space between tip 20 and lining 39.

When fully closed the current is carried by tubular arm 16 and main contacts 11, but as the switch is being opened and a gap is formed between 16 and 11, then the current is transferred to the shorter air gap between horn 12 and tip 18. Therefore the entire current flows momentarily through rod 19, tip 18 and horn 12. The parts are so adjusted that dent 25a is released by ratchet 36b just as the tip 18 is at the position shown by dotted lines in Figure 1 and the gap between tip 18 and horn 12 starts to increase and so the increasing of the exterior arc aids in the quenching of the arc between members 20 and 39. And the increasing air gap between tip 18 and horn 12 prevents the reestablishment of the arc after it has once broken. Continued opening motion brings the parts to the position shown in Figure 7, and it will be noted that ratchet 37b now has engaged dent 25c thereby holding crank 25 in its fully opened position.

Figure 8 shows the positions of members when the closing movements begin. Dent 35a is engaged with ratchet 31 and dent 25c is held by ratchet 37b. As the switch arm 8 rotates about shaft 10, the stationary ratchet 31 holds dent 35a so that collars 34 and 35 are rotated clockwise with shaft 26, thereby stressing spring 41. When projection 34c engages crank 37a it rotates ratchet 37b clockwise and thereby releases it from dent 25c. This is shown in Figure 9, and instantly spring 41 rotates crank 25 clockwise, thereby moving rod 19 towards tip 18 and establishing metallic contact before the high voltage of the circuit has established a damaging arc inside insulating section 17. In rotating crank 25 clockwise, dent 25d becomes engaged by ratchet 37b, stopping crank 25 in its fully closed position; and at the same time dent 25c is engaged by ratchet 36b. Further closing motion of switch arm 8 brings tubular arm 16 into engagement with jaws 11, and separates dent 35a from ratchet 31. Figure 10 indicates the positions of these parts when fully closed.

Meanwhile dent 34a has pushed past ratchet 30, which first moves out of the way and then is snapped back by its biasing spring to its normal position shown in Figure 5, ready for the opening movements to be made.

Adjustments are provided for springs 40, 41, so that when crank 25 is held by ratchets 36b and 37b in either the fully closed or fully opened position, then the ratchet 30 or the ratchet 31 is engaged with its proper dent, as indicated in Figure 5 and Figure 8, respectively. It has been found advisable to have spring 40 and spring 41 both under partial tension in normal positions, when the switch is either fully closed or fully opened. Then when an operation occurs, tension on one spring is relaxed and tension on the other one is increased. The net results, however, are just as described previously. Adjustments are also provided between arms 28 and 29 and their respective ratchets 30 and 31. But such adjustments are omitted from the drawings for clarity.

If desired, the closing spring 41 can be omitted together with some of the associated members, while still retaining spring 40 and its functions. And many other changes could be made by one familiar with the art without departing from the spirit and purposes of this invention.

We claim:

1. In an electric switch, a stationary contact and a stationary horn connected in spaced relation therewith, a hinge pin and its mounting spaced away from said contact and a unitary switch arm rotatable about said hinge pin; said switch arm including a box member, an extended tubular main conductor arm cooperable with said stationary contact to form the main circuit which the switch opens and closes, a smaller conductor movable longitudinally within the tubular main conductor arm, an arcing tip at the swing end of the switch arm cooperable with said horn and with the said smaller conductor to form the secondary circuit which the switch opens and closes, and arc suppressing means coordinated with said secondary circuit including an opening spring operable to move the said smaller conductor at high speed as the switch is being opened, and also including a closing spring operable to move the said smaller conductor at high speed during the closing motion of the switch.

2. In an electric switch, a stationary contact, a stationary hinge pin in spaced relation to said contact, a box rotatable about said hinge pin and comprising part of a switch arm, a tubular main conducting arm integral with said box and extending to cooperate with said stationary contact to form the main circuit which the switch opens and closes, and carried by said tubular arm an arc suppressing device which includes a small conductor that is movable longitudinally and that is part of a secondary circuit within said tubular main arm, an arm fixedly supported inside said rotatable box by said stationary hinge pin, and a closing spring inside said box to operate said small conductor at high speed during the latter part of the closing motion of the switch.

3. In an electric switch, a stationary insulated jaw contact, a switch arm structure movable into and out of engagement with said contact; said switch arm structure including a tubular main conducting arm, a tubular insulating section partly within the swing end of said conducting arm and partly extended beyond the end of said conducting arm, a conducting arcing tip supported by the extended portion of said insulating section, a recess inside the arcing tip coaxial with the said tubular insulating section, a conductor rod which has an extended end of insulating material and which extends through the said tubular conducting arm and the said tubular insulating section and thereby makes electrical contact with said arcing tip to form part of a secondary circuit which is within the tubular main conducting arm, and with the extended end of insulating material housed in said recess, together with one spring member operable when the switch is being opened to withdraw the said rod suddenly away from said arcing tip and simultaneously to move the said insulating end of the rod to replace the conducting part of the rod within the said insulating section, and with a second spring member operable as the switch is being closed to

move the said rod at high speed to its circuit closing position.

4. In an electric switch, a stationary contact, a hinge pin in spaced relation to said contact, a switch arm structure rotatable about the axis of said hinge pin, said switch arm structure including an extended tubular conducting arm cooperable with said stationary contact, to open or close the main circuit through the switch, a rigid conductor rod which is movably contained within said tubular arm and which forms part of a secondary circuit therethrough, an opening spring connected with said conductor rod, holding members to stress said opening spring as switch arm starts to open, and releasing members to release said holding members when the switch arm has been opened a predetermined part of its travel, and a closing spring connected with said conducting rod, holding members to stress the said closing spring as the switch arm starts to close, and releasing members to release the said holding members as the switch arm completes a predetermined part of its closing travel.

5. In an electric switch, a stationary contact, a hinge pin in spaced relation to said contact, a switch arm structure rotatable about the axis of said hinge pin, said switch arm structure including an extended tubular conducting arm cooperable with said stationary contact to open or close the main circuit through the switch, a rigid conductor rod movably contained within said tubular arm, a closing spring connected with said rod, holding members to stress said spring as the switch arm starts its closing motions, and releasing members to release said holding members when the switch arm has been moved over a predetermined part of its closing travel.

6. In an electric switch, a stationary hinge supported thereby a box member movably supported by the hinge pin, an extended tubular switch arm integrally supported by the box member, said switch arm having three coaxial sections, first, a main conductor tube secured to the box, second, an insulating section extending into and supported by the swing end of the conductor tube, and third, a recessed conductor arcing tip supported by the insulating section; a conductor rod having a flexible tip which is at least partly of metal, extending from the interior of the box member through the tubular switch arm to make contact with the conductor arcing tip; a stationary main contact spaced away from the hinge pin and cooperable with the main conductor tube to open or close the main circuit through the switch, an auxiliary contact arm connected with but spaced away from the main contact, to make contact only with the arcing tip of the switch arm; operating means, including an opening spring, located within the box member and operable as the switch is being opened to move the conductor rod instantaneously within the tubular arm after the main conductor tube has moved away from the main contact and while the conductor arcing tip is still adjacent to the auxiliary contact arm, together with means to rotate the box member about the hinge pin and thereby to operate the switch.

7. In an electric switch, a stationary hinge supported thereby, a box member movably supported by the hinge pin, an extended tubular switch arm integrally supported by the box member, said switch arm having three coaxial sections, first, a main conductor tube secured to the box, second, an insulating section extending into and supported by the swing end of the conductor tube, and third, a recessed conductor arcing tip supported by the insulating section; a conductor rod having a flexible tip which is at least partly of metal, extending from the interior of the box member through the tubular switch arm to make contact with the conductor arcing tip; a stationary main contact spaced away from the hinge pin and cooperable with the main conductor tube to open or close the main circuit through the switch, an auxiliary contact arm connected with but spaced away from the main contact to make contact only with the arcing tip of the switch arm; operating means, including a closing spring located within the box member and operable as the switch is being closed to move the conductor rod instantaneously within the tubular arm as the tip closely approaches the auxiliary contact arm, and thereby to close that part of the auxiliary circuit that is within the tubular arm.

8. In an electric switch, a unitary switch arm which is movable between open circuit and closed circuit positions and which has one main circuit and one secondary arc suppressing circuit with a contact making movable element, a closing spring operable as the switch arm is being closed to bias the movable element towards its closed circuit position, holding means to hold the movable element in open circuit position against the bias of said spring, and releasing means operable to release said holding means when the unitary switch arm has been moved from its open position over a predetermined part of its travel towards its closed circuit position.

9. In an electric switch, a pivotally mounted switch arm movable between open circuit and closed circuit positions, arc suppressive means which are carried by said arm and which includes a contact making movable element which is connected at one end with the swing end of a rotatable crank member, a closing spring operable to bias the crank member towards closed circuit position as the switch arm is moved towards closed circuit position, a dent on the crank member and a ratchet on a fixed adjacent pivot cooperable with said dent to hold the crank member from being moved by the closing spring until the spring has been stressed to a predetermined tension, and releasing means then operable to release the ratchet and allow the closing spring to turn the crank instantly to its closed circuit position.

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