Oct. 5, 1943. E. ORTENSI 2,331,221

CIRCUIT INTERRUPTER

Filed May 3, 1941 2 Sheets-Sheet 1

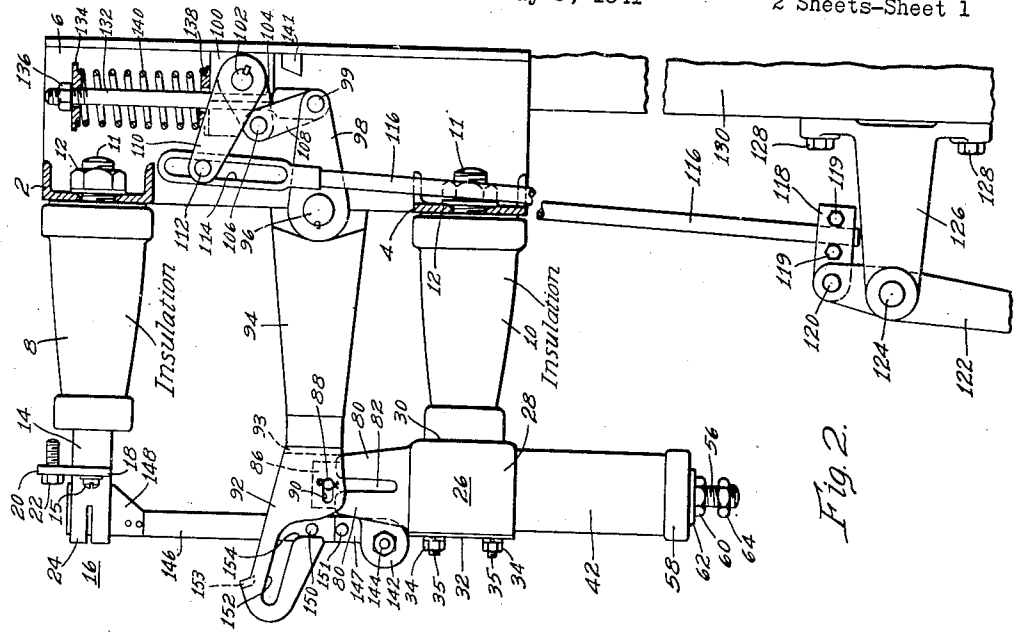


Fig. 2.

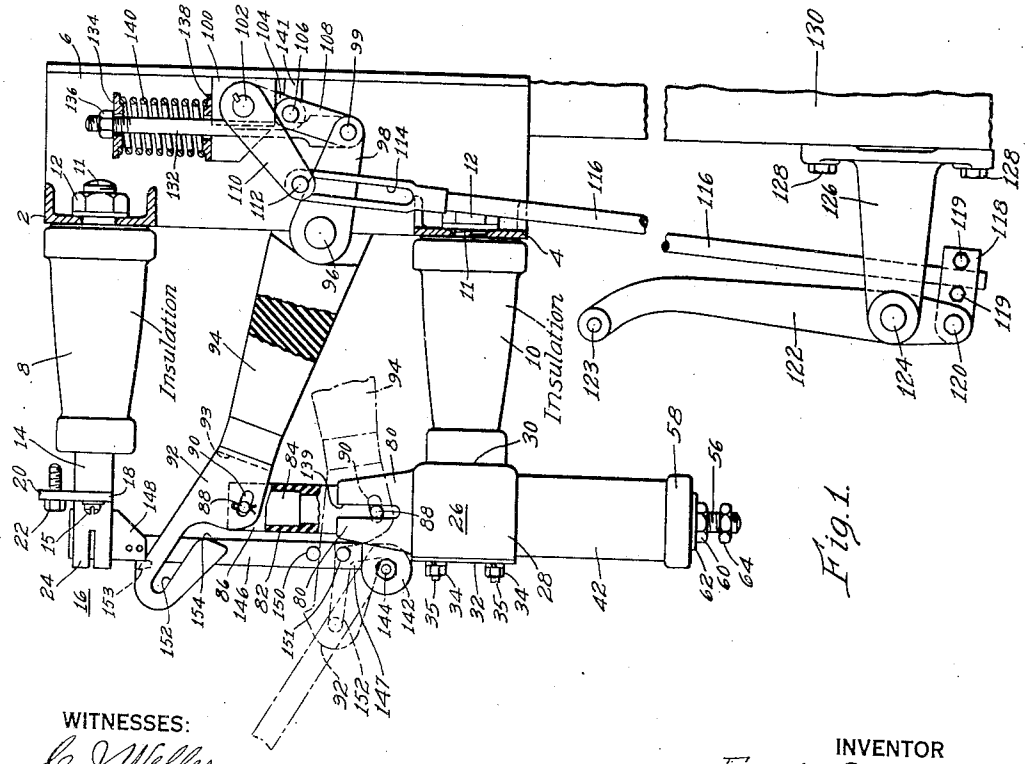


Fig. 1.

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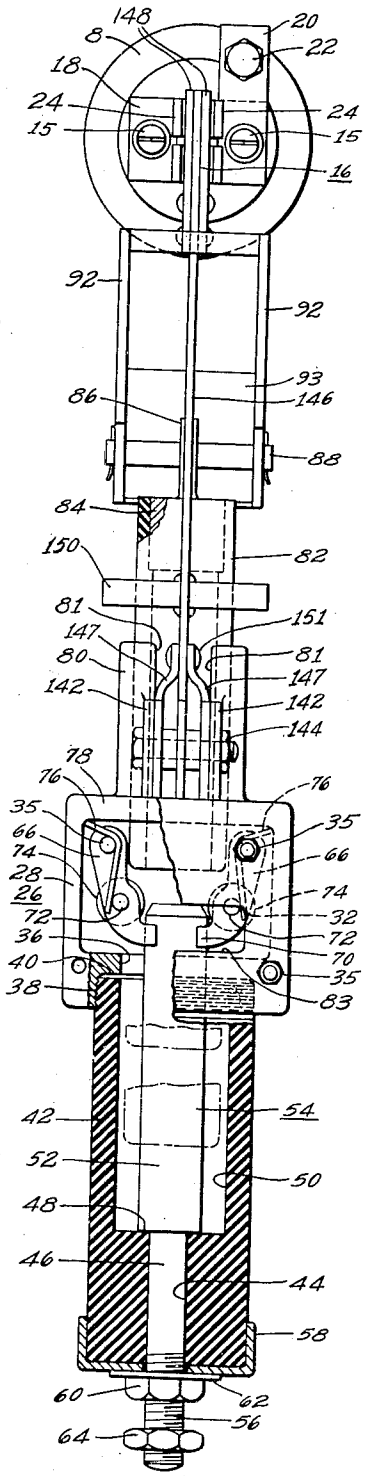
2 Sheets-Sheet 2

Fig. 3.

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# UNITED STATES PATENT OFFICE

2,331,221

## CIRCUIT INTERRUPTER

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Application May 3, 1941, Serial No. 391,628
In Italy May 25, 1940

20 Claims. (Cl. 200—48)

This invention relates generally to electric circuit-interrupting devices, and more particularly to interrupting devices capable of interrupting load currents and at the same time insert a relatively large visible air gap in the circuit.

In modern electric plants, central stations, substations and the like, the need for a disconnecting switch which is capable of interrupting load currents is recognized as desirable to avoid the expense of circuit breaker installations, especially where overload circuit interruptions may be taken care of by fuses. In order that a disconnecting switch may interrupt load currents, some sort of arc-extinguishing means should be employed to extinguish the arc struck when the switch is opened. Switches of this type have been devised, but they either have incorporated the arc-extinguishing means in the switch by modifying the switch to provide a relatively complex and expensive structure, or when arc-extinguishing means have been used separated from the switch structure the switch per se has required substantial modification from standard types of switches, and relatively extensive and complex control means have been required.

Accordingly, one object of this invention is to provide a disconnecting switch capable of interrupting load currents and utilizing a standard type of switch construction.

Another object of this invention is to provide an attachment for standard types of disconnecting switches, which is capable of interrupting load currents, and which may be employed with standard types of switches without any substantial modification thereof.

Another object of this invention is to provide a novel type of disconnecting switch which is also capable of interrupting load currents.

Another object of this invention is to provide a novel type of circuit interrupter having disconnecting and current-interrupting contacts, with novel means for actuating said contacts in a predetermined sequence.

These and other objects of this invention will become more apparent upon consideration of the following description of one embodiment thereof, taken in connection with the attached drawings, in which:

Figure 1 is a side elevational view, partly in section, illustrating a preferred embodiment of the invention, with the interrupter shown in a closed circuit position;

Fig. 2 is a view similar to Fig. 1, but showing the interrupter in a partly open position; and

Fig. 3 is an enlarged front view, partly in section, of the interrupter shown in Figs. 1 and 2.

The interrupter shown on the drawings is supported on a pair of channel members 2 and 4, respectively, and these members are, in turn, maintained in spaced relation on an angle iron 6 or the like, which may be welded or otherwise secured to channel members 2 and 4. An insulator 8, which may be of porcelain or the like, has a stud 11 extending from the base thereof through an aperture in channel 2 to be secured thereto, as by the nut 12. Similarly, a like insulator 10 is provided with a stud 11 projecting from its base through channel member 4 to be secured thereto by a nut 12. The insulator 8 is provided with a supporting extension 14 fixed thereto, and to which is secured a break contact fixture 16. The fixture 16 comprises a base portion 18 secured to the supporting extension 14, for example, as by screws 15, and rigid with base portion 18 are a pair of break contact jaws 24 for receiving one end of a switch blade therebetween. The jaws 24 are preferably of some resilient conducting material, such as, for example, copper or a copper alloy. The base 18 of the break contact fixture 16 is also provided with an integral extension 20 forming a terminal lug to which a conductor may be secured, for example, as by the machine screw 22.

Insulator 10 is adapted to support at its outer end a supporting casing 26 for a current-interrupting means. The casing 26 is preferably of some conducting material, and may be of a cast construction including opposite side walls 28, a rear wall 30 secured to the outer end of insulator 10 by any desired means, such, for example, as by bolts or the like. The casing 26 is also provided with an open front wall adapted to be substantially closed by a cover plate 32 secured to the casing by stud bolts 35 and nuts 34. The cover plate 32 is provided with a slot 83 for a purpose to be hereinafter referred to. The bottom wall of casing 26 is provided with a substantially circular opening 36, at the outer side of which there is a shoulder 40, formed by the outwardly extending interiorly threaded portion 38, adapted to cooperate with the exteriorly threaded end of an insulating tube 42, having an enlarged bore 50 of substantially the same diameter as opening 36 in the bottom wall of casing 26. Insulating tube 42 may be of any desired insulating material, preferably an insulating material, such as fibre, which is capable of evolving an arc-extinguishing gas when in proximity to an electric arc. As shown in Fig. 3, the enlarged bore 50 of in-

sulating tube 42 terminates short of the lower end of the tube in a reduced bore 44, forming between the two bores a shoulder 48 for cooperation with a shoulder formed on a conducting rod 54 extending through the bores. Conducting rod 54 includes an enlarged portion 52 adapted to be received in the enlarged bore 50, and a reduced portion 46 adapted to closely fit the small bore 44, and this reduced portion extends outwardly of the lower end of insulating tube 42 and is exteriorly threaded as at 56. The lower end of insulating tube 42 is provided with an end cap 58, and conducting rod 54 is secured in position within insulating tube 42 by a washer 62 and nut 60, which are adapted to withdraw the shoulder on the rod into firm engagement with shoulder 48 in the insulating tube 42. A second nut 64 is provided on threaded portion 56 of conductor rod 54 so that a conductor may be secured in conducting relation to rod 54. It should be noted that the enlarged portion 52 of conductor rod 54 is spaced from the inner walls of enlarged bore 50 of insulating tube 42, and that this portion 52 of the conductor rod extends entirely through the bore and into supporting casing 26.

Current-interrupting contacts for cooperation with conductor rod 54 are mounted within supporting casing 26, and, as shown, these comprise contact arms 66 pivotally mounted at one end in the casing on pivot studs 35, for pivotal movement of the other ends 70 thereof into and out of engagement with respect to the upper end of contact rod 54. Intermediate their ends, the contact arms 66 are provided with rollers 74 pivotally mounted on pivot pins 72 mounted on the contact arms. Bent resilient spring members 76 are provided for normally urging the contact arms into engagement with the upper end of conductor rod 54. These springs 76 are bent about pivot studs 35 with one end thereof finding engagement at an upper corner of supporting casing 26, and the other end thereof being in engagement with pivot pins 72.

The top wall 78 of supporting casing 26 is also provided with a substantially circular aperture, about which are provided integral upwardly extending guide portions 80 which are spaced, and of arcuate formation, to form a substantially skeletonized circular guide for a movable insulating tube 82. The tube 82, like tube 42, is preferably of an insulating material which is capable of evolving an arc-extinguishing casing when in proximity to an electric arc. The movably mounted tube 82 is adapted to have an operating means secured to the upper end thereof, and the front and rear spaces 81 between integral guide members 80 are provided for reception of a portion of such an operating means, as are the side slots 139 located intermediate the spaces 81.

In the operation of the current-interrupting means thus far described, it is apparent that in the movement of insulating tube 82 from the position shown in Figs. 1 and 3 to that shown in Fig. 2, the lower end of the tube will first engage rollers 74 on contact arms 66 to separate these contact arms, and move them away from conductor rod 54, and thereafter move between them down into the annular space between conductor rod 54 and the inner wall of enlarged bore 50 in insulating tube 42. This action obviously will not only interrupt the circuit between conductor arms 66 and conductor rod 54, but will also interpose an insulating barrier between these conducting members, and any arc struck between the members when they separate will obviously be elongated by movement of tube 82 into the bore 50 and forced into the relatively small space between tubes 82 and 42 to thereby increase the arc voltage, while at the same time the arc is subjected to a blast of arc-extinguishing gas evolved from the material of tubes 82 and 42, al of which combines to quickly and effectively extinguish any arc formed and thereby quickly and effectively interrupt the circuit. Obviously, the circuit may be readily reclosed by merely moving tube 82 upwardly to the position shown in Figs. 1 and 3, whereupon springs 76 will move conductor arms 66 back into engagement with conductor rod 54.

The upper end of insulating tube 82 is provided with a plug member 84 secured in the tube in any desired manner, and this plug member is provided with an integral extension 86 having an operating pin 88 extending transversely thereof. A substantially U-shaped operating member has the arms 92 thereof disposed on opposite sides of insulating tube 82, and these arms 92 are each provided with an elongated slot 90 for receiving operating pin 88. The arms 92 of the actuating bracket are connected by a base portion 93 secured in any desired manner to the outer end of a pivotally mounted insulating member 94, which may be of the same material as insulating supports 8 and 10. The pivoted insulator 94 has the inner end thereof secured to an actuating shaft 96 in any desired manner, and this shaft is, in turn, rotatably mounted on angle supporting member 6, and is adapted to be actuated by a crank arm 98 keyed or otherwise secured for movement with actuating shaft 96. A supporting bracket 100 is also mounted, as shown, on angle support 6 in any desired manner, such, for example, as by welding or the like, and this bracket rotatably supports a shaft 102, to which is keyed or otherwise mounted in fixed relation a toggle link 104 pivoted at its outer end by pivot 106 to a second toggle link 108, and this, in turn, is pivoted as at 99 to the outer end of insulator crank arm 98. Also keyed or otherwise secured to shaft 102 is a crank arm 110, the outer end of which carries a fixed pivot pin 112, adapted to be received in an elongated slot 114 formed in the outer end of an actuating rod 116 which extends to a remote point for operation to control the interrupting means mounted on supports 2, 4 and 6. At the remote control point, actuating rod 116 may be fixed to a bracket 118, for example, as by bolts 119, with the bracket 118 being pivotally mounted as at 120 to one end of an actuating lever 122. The actuating lever 122 is adapted to be pivotally mounted adjacent pivot 120, on a shaft 124 supported by a bracket 126 secured in operative relation to a supporting wall or other vertical supporting member 130, for example, as by stud screws 128. The outer end of actuating lever 122 may be provided with a handle portion 123 for manual operation, if desired. In order to normally bias the actuating means to an open circuit position, a rod 132 is pivotally connected to one toggle link 108, for example, as by the pivot pin 99, and is adapted to extend upwardly through bracket 100 where it is provided with a pair of springs supporting washers 134 and 138 for supporting therebetween a coil compression spring 140, maintained in a compressed condition by nut 136 engaging with the upper threaded end of rod 132 to normally bias this rod for movement upward.

In the operation of the actuating means described above, and assuming that the switch is

in the closed circuit position shown in Fig. 1 of the drawings, it will be noted that toggle links 104 and 108 are at an overcenter position where the upward bias of coil spring 140 acting through rod 132 on pivot 99 tends to maintain the toggle links in engagement with a fixed stop 141, welded or otherwise secured to angle support 6. Now, if actuating lever 122 is moved in a counter-clockwise direction about its pivot 124, it is obvious that rod 116 will thereby be moved upwardly, but no other parts of the mechanism will be moved until the lower end of slot 114 provided in actuating rod 116 abuts pivot pin 112 on crank arm 110, or in other words, substantially 180° of movement of actuating lever 122 from the position shown in Fig. 1 will be necessary before causing any movement of the switch to its open circuit position. However, as soon as the lower end of slot 114 abuts pivot pin 112, it will cause clockwise movement of crank arm 110 about its pivot 102, carrying with it toggle link 104 until the toggle links 104 and 108 are moved over center, after which coil compression spring 140 will operate to quickly break the links to and beyond the position shown in Fig. 2 of the drawings. Furthermore, this movement of the mechanism takes place independently of any movement of actuating rod 116 or lever 122, inasmuch as the pivot pin 112 during this movement will merely slide in slot 114 in the actuating rod. This movement of the toggle levers obviously will cause counter-clockwise movement of insulating crank 98 and insulator 94, which, by virtue of the pin and slot connection 88—90 with insulating tube 82, will cause this tube to move downwardly in casing 26 and interrupt the circuit in the manner previously described. To reclose the circuit, it is obviously necessary merely to move actuating lever 122 in a clockwise direction about its pivot shaft 124 to thereby move rod 116 downwardly, and inasmuch as pivot pin 112 on crank 110 is already adjacent the upper end of slot 114, this crank arm will be moved in a counter-clockwise direction together with shaft 102 and toggle link 104 to move the toggle pivot 106 over center and against stop 141, to thereby lock the operating mechanism in the open circuit position. It will be noted that coil spring 140, when the switch is closed, exerts a bias in a direction to open the switch, but is normally prevented from operation by the toggle links 104 and 108 which, in effect, form a toggle latch which may be released by operating rod 116 and lever 122, and also may be reset by this same means. However, when it is released, it operates quickly and independently of the manual tripping and resetting means 122 and 116, to open the circuit through the current-interrupting means with a quick or snap action.

The supporting casing 26 on insulator 10 is also provided with forwardly extending supporting lugs 142 which may be integral with the top wall and the front guide extensions 80, for pivotally supporting a disconnecting switch blade 146. As shown, for example, in Fig. 3, the disconnecting switch blade 146 is provided at its lower end with resilient contact strips 147 positioned at opposite sides thereof and secured at one end to the blade, for example, as by rivet 151, and the blade and contact strips are adapted to be positioned between supporting lugs 142 and secured for rotation with respect to the lugs by a pivot bolt 144 passing through the lugs, contact strips and blade. It will be noted that the contact strips 147 provide a means of obtaining a good electrical contact under pressure between the supporting casing 26 and the switch blade. The outer end of switch blade 146 is also provided with contact plate portions 148 which may also be of resilient material, if desired, and these plate portions are adapted to be received between the contact jaws 24 previously described, in the closed position of the switch. Adjacent, but spaced above, the pivot mounting 144 for the switch blade 146, there is provided an actuating pin 150 extending outwardly a substantial distance from the blade on opposite sides thereof and secured thereto, for example, as by soldering, welding or the like. The pin 150 extends laterally of the blade so as to be engaged in slots provided in the arms 92 of the actuating bracket mounted on pivoted insulator 94. As shown in Figs. 1 and 2, the slot provided in these arms comprises an inner portion 152 and an angularly disposed portion opening to one side of each arm as at 154. The outer ends of bracket arms 92 are connected by a cross-bar 153 which may be integral or fixedly secured to the arms and is adapted not only to prevent relative movement of the arms but also to engage the outer end of the blade 146 in the closed position of the switch to prevent accidental opening of the switch before the current-interrupting means has opened the circuit.

It can now be seen that when the operating means is actuated to open the current-interrupting contacts 66—54 within supporting casing 26, to open the circuit through the device, that adjacent the end of movement of pivoted insulator 94, pin 150 on the switch blade will enter the angular portion 154 of the slot in actuating bracket arms 92, as shown in Fig. 2, whereupon continued movement of insulator 94 in a counter-clockwise direction will cause opening movement of the switch blade by the cam action of the upper edge of slot 152 on pin 150 acting as a cam follower. This will cause opening of the disconnecting switch and movement of the parts to the fragmentary dotted line position shown in Fig. 1. It is, therefore, apparent that in interrupting the circuit through the device the circuit is always interrupted first by current-interrupting contacts 66 and 54, while the disconnecting switch blade remains stationary in a closed circuit position, and only thereafter it is moved to open the circuit and insert a relatively large air gap.

The interrupter may be connected in circuit by having one conductor connected to the lower portion 56 of conductor rod 54, and the circuit through the device may be traced from conductor rod 54, through contact arms 66, supporting casing 26, switch blade 146, contact jaws 24 to terminal lug 20, to which may be attached the other conductor of the circuit.

In closing the circuit after an interrupting operation, the sequence of operation of the disconnecting switch blade and current-interrupting contacts is just the reverse of the circuit-interrupting operation. That is, when the pivoted insulator is moved from the dotted line position shown in Fig. 1, clockwise to its full line position, the first thing that occurs is movement of switch blade 146 into engagement with contact jaws 24 as insulating tube 82 gradually moves upwardly, and as it approaches the end of its movement it moves from between contact arms 66 and permits them to close the circuit, only after the disconnecting switch blade has first been moved into a closed circuit position. This particular sequence of

operation in both opening and closing the circuit through the device obviously insures no arcing at the disconnecting switch contacts, and further insures that the circuit will always be first opened and finally closed at the current-interrupting contacts 70 and 54.

A particular advantage of this structure resides in the quick opening action of the interrupter under the influence of coil spring 140 independently of the actuating means 122 and 116. A quick opening of the circuit is especially desirable to interrupt load currents, especially where a structure is employed such as that of applicant's where the arc is elongated and confined to increase the arc voltage. Obviously, the quicker this action can be made to attain an arc voltage which will prevent restriking of the arc following a current zero, the fewer cycles of arcing will be obtained.

Applicant's current-interrupting means is substantially enclosed in casing 26, which is provided with the vent slot 33 in cover plate 32 for laterally venting the gases generated by the arc in insulating tube 42, away from the live parts of the circuit. It should also be noted that applicant has provided a pair of circuit-interrupting means, one of which is in the nature of current-interrupting means and the other of which is in the nature of a disconnecting means, which are arranged in series circuit relation and which are adapted to be operated only in a predetermined sequence, so that the current-interrupting means always operates to first interrupt and finally close the circuit, together with a novel form of operating means to provide a quick opening of the circuit under a manual control, and which in the closed circuit position of the interrupter operates to positively maintain the disconnecting means locked against opening movement until the current-interrupting means has previously operated to interrupt the circuit. This is due to the locking action of toggle levers 106 and 108 which maintain connecting bar 153 on insulator 94 in a position to prevent opening movement of blade 146. It should also be noted that when the interrupter is in an open position, for example, as shown in dotted lines in Fig. 1, the disconnecting switch blade again is positively prevented from reclosing unless the current-interrupting contacts are in an open circuit position. This, of course, is effected by engagement of operating pin 150 in the slot 152 in the operating bracket on insulator 96.

Having described a preferred embodiment of the invention in accordance with the patent statutes, it is desired that the invention be not limited to this particular form disclosed, inasmuch as it will be obvious particularly to persons skilled in the art that many changes and modifications may be made in this particular embodiment without departing from the broad spirit and scope of this invention. Therefore, it is desired that the invention be interpreted as broadly as possible, and that it be limited only by the prior art and by what is expressly stated in the following claims.

I claim as my invention:

1. In circuit interrupting means, a disconnecting switch including a blade member mounted for movement into and out of engagement with a cooperating contact, current interrupting means adjacent said switch and including separable contacts connected in series circuit relation with said switch, actuating means including a pivoted lever having a direct connection with said separable current interrupting contacts, and means fixed on said blade member and positioned at a point in the path of movement of a portion of said lever so as to be engaged thereby in a circuit interrupting operation to move said blade member away from said cooperating contact only after said lever has moved a predetermined amount to open said separable current interrupting contacts.

2. In circuit interrupting means, a disconnecting switch including a blade member mounted for movement into and out of engagement with a cooperating contact, current interrupting means adjacent said switch and including separable contacts connected in series circuit relation with said switch, actuating means including a pivoted lever having a direct connection with said separable current interrupting contacts, means fixed on said blade member and positioned at a point in the path of movement of a portion of said lever so as to be engaged thereby in a circuit interrupting operation to move said blade member away from said cooperating contact only after said lever has moved a predetermined amount to open said separable current interrupting contacts, and whereby in a circuit closing operation said lever first moves said blade member into engagement with said cooperating contact and becomes disengaged from said blade member, prior to closure of said separable current interrupting contacts.

3. In circuit interrupting means, a disconnecting switch including a blade member mounted for movement into and out of engagement with a cooperating contact, current interrupting means adjacent said switch and including separable contacts connected in series circuit relation with said switch, a pivoted actuating lever for opening and closing said separable contacts and directly connected to at least one of said separable contacts, said lever having a cam portion, and cam follower means on said blade member positioned at a point in the path of movement of said cam portion but spaced therefrom in the closed circuit position, so that said cam follower means is engaged by said cam portion only after said lever in its circuit opening movement has opened said separable contacts.

4. In circuit interrupting means, a disconnecting switch including a blade member mounted for movement into and out of engagement with a cooperating contact, current interrupting means adjacent said switch and including separable contacts connected in series circuit relation with said switch, a pivoted actuating lever for opening and closing said separable contacts and directly connected with at least one of said separable contacts, said lever having an open-ended cam slot, cam follower means on said blade member positioned at a point in the path of movement of said cam portion but spaced therefrom in the closed circuit position, whereby in a circuit interrupting operation said blade member will be opened by said lever only after said lever in its circuit opening movement has opened said separable contacts.

5. Circuit interrupting means, including separable contacts, operating means including a pivoted operating lever for opening and closing said contacts, resilient means biasing said lever for movement in a direction to open said contacts, latch means normally preventing movement of said lever under the influence of said biasing means, and a control member having a lost motion connection with said operating means and operative upon movement in one direction to re-

lease said latch means and operative upon movement in the opposite direction to move said lever in a direction to close said contacts and reset said latch means.

6. Circuit interrupting means, including separable contacts, operating means including an operating lever for opening and closing said contacts, resilient means biasing said lever for movement in a direction to open said contacts, toggle means movable to an overcenter latching position for normally preventing movement of said lever under the influence of said biasing means, and a control member having a lost motion connection with said toggle means, whereby it is effective upon movement in opposite directions to move said toggle means overcenter to said latching position and to a released position wherein said biasing means is effective to rapidly open said contacts.

7. In circuit interrupting means, a pair of spaced insulating supports, contact means carried by one of said supports, current interrupting means and a switch blade mounted on the other of said supports, said switch blade mounted for movement into and out of engagement with said contact means independent of said current interrupting means, said current interrupting means including separable contacts connected in serial arrangement with said blade, operating means associated with said current interrupting means and operable in one direction to open said separable contacts, and said operating means being related to said blade in a manner such that it is operable to move said blade away from said contact means only upon continued movement of said operating means in the same direction after separation of said contacts.

8. In a circuit interrupter, a base, a pair of spaced insulating supports mounted on said base, contact means carried by one of said supports, current interrupting means and a switch blade mounted on the other of said supports, said switch blade mounted for movement into and out of engagement with said contact means independent of said current interrupting means, said current interrupting means including separable contacts connected in serial arrangement with said blade, operating means associated with said current interrupting means and movably mounted on said base so as to be operable in one direction to open said separable contacts, and said operating means being related to said blade in a manner such that it is operable to move said blade away from said contact means only upon continued movement of said operating means in the same direction after separation of said contacts.

9. In circuit interrupting means, a pair of spaced insulating supports, contact means carried by one of said supports, current interrupting means mounted on the other of said supports, a switch blade mounted on said current interrupting means for movement into and out of engagement with said contact means, said current interrupting means including separable contacts connected in serial arrangement with said blade, operating means associated with said current interrupting means and operable in one direction to open said separable contacts, and said operating means being related to said blade in a manner such that it is operable to move said blade away from said contact means only upon continued movement of said operating means in the same direction after separation of said contacts.

10. A disconnecting switch including blade means mounted for movement into and out of engagement with cooperating contact means, and operating means having lost motion with respect to said blade means so as to be operable in opening said switch to deliver an impact to said blade means to forcibly move said blade means out of engagement with said cooperating contact, means biasing said operating means for movement in a direction to open said switch, and releasable latch means for normally preventing movement of said operating means under the influence of said biasing means.

11. In circuit interrupting means, separable disconnecting contacts and current interrupting contacts arranged in series circuit relation, operating means for said contacts including a movably mounted actuating member having a direct connection to at least one of said interrupting contacts and a lost motion connection with at least one of said disconnecting contacts, whereby said member is movable in one direction in a circuit interrupting operation to first open said current interrupting contacts while said disconnecting contacts remain in engagement, and to thereafter open said disconnecting contacts, means biasing said member in said one direction, latch means for normally preventing movement of said member, said member including a portion engageable with at least one of said disconnecting contacts in the latched position of said member for positively preventing unauthorized opening of said disconnecting contacts, and means for releasing said latch means to permit said biasing means to rapidly open said contacts in succession.

12. In circuit interrupting means, a disconnecting switch including a blade member mounted for movement into and out of engagement with a cooperating contact, current interrupting means adjacent said switch and including separable contacts connected in series circuit relation with said switch, operating means for said switch and interrupting means including a member movable in one direction in a circuit interrupting operation to first separate said current interrupting contacts and to thereafter engage and move said blade member away from said cooperating contact, means biasing said member in said one direction, latch means for normally preventing movement of said member, and means for releasing said latch means to permit said biasing means to rapidly open said interrupting means and switch in succession.

13. In circuit interrupting means, a disconnecting switch including a blade member mounted for movement into and out of engagement with a cooperating contact, current interrupting means adjacent said switch and including separable contacts connected in series circuit relation with said switch, operating means for said switch and interrupting means including a member movable in one direction in a circuit interrupting operation to first separate said current interrupting contacts and to thereafter move said blade member away from said cooperating contact, said member being movable in an opposite direction in a circuit closing operation to first move said blade member into engagement with said cooperating contact and to thereafter close said current interrupting contacts, means biasing said member in said one direction, latch means for normally preventing movement of said member, and means for releasing said latch means to permit said biasing means to rapidly open said interrupting means and switch in succession, said last mentioned means being operable to reset said

member in latched position following a circuit interrupting operation.

14. In circuit interrupting means, a pair of spaced insulating supports, contact means carried by one of said supports, current interrupting means and a switch blade mounted on the other of said supports, said switch blade mounted for movement into and out of engagement with said contact means independent of said current interrupting means, said current interrupting means including separable contacts in series circuit with said blade, means of insulating material movable in a path extending between said supports and in a direction away from said contact means support to move between said separable contacts to open the circuit therethrough, and operating means operable in a circuit opening operation upon movement thereof in one direction to first actuate said insulating means to open said separable current interrupting contacts while said blade member remains stationary, and to thereafter move said blade member away from said cooperating contact.

15. In circuit interrupting means, a pair of spaced insulating supports, contact means carried by one of said supports, current interrupting means and a switch blade mounted on the other of said supports, said switch blade mounted for movement into and out of engagement with said contact means independent of said current interrupting means, said current interrupting means including separable contacts in series circuit with said blade, means of insulating material movable in a path extending between said supports and in a direction away from said contact means support to move between said contacts to open the circuit therethrough and elongate the arc, other means of insulating material forming with said movable insulating means a restricted arc passage having at least inner wall portions of an insulating material which is capable of evolving an arc extinguishing gas when in proximity to an electric arc, said arc passage extending in the direction of the path of movement of said movable insulating means, a vent for said passage so that gases will be discharged therefrom at an angle to said path of movement, and operating means operable in a circuit opening operation upon movement thereof in one direction to actuate said movable insulating means to first open said separable current interrupting contacts while said blade member remains stationary, and to thereafter move said blade member away from said cooperating contact.

16. In circuit interrupting means, a pair of spaced insulating supports, contact means carried by one of said supports, current interrupting means and a switch blade mounted on the other of said supports, said switch blade mounted for movement into and out of engagement with said contact means, said current interrupting means including an enclosure mounted on said other support and extending therefrom in a direction away from said one support, separable contacts in said enclosure connected in serial arrangement with said switch blade, operating means associated with said current interrupting means and operable in one direction to open said separable contacts, and said operating means being related to said blade in a manner such that it is operable to move said blade away from said contact means only upon continued movement of said operating means in the same direction.

17. In circuit interrupting means, a pair of spaced insulating supports, contact means carried by one of said supports, current interrupting means and a switch blade mounted on the other of said supports, said switch blade mounted for movement into and out of engagement with said contact means, said current interrupting means including an enclosure mounted on said other support and extending therefrom in a direction away from said one support, separable contacts in said enclosure connected in serial arrangement with said switch blade, insulating means extending from said enclosure toward said one support and movable into said enclosure to separate said separable contacts therein, and operating means operable in a circuit opening operation upon movement thereof in one direction to first actuate said insulating means to open said separable current interrupting contacts while said blade member remains stationary, and to thereafter move said blade member away from said cooperating contact.

18. In circuit interrupting means, a disconnecting switch including a blade member mounted for movement into and out of engagement with a cooperating contact, current interrupting means adjacent said switch and including separable contacts connected in series circuit relation with said switch, operating means for said switch and interrupting means, said operating means including an actuating member directly connected with at least one of said separable contacts, spaced stop portions on said blade member between which said actuating member is movable, means for locking said actuating member in closed circuit position in engagement with one of said stop portions to prevent movement of said blade member out of engagement with said cooperating contact, said actuating member biased to move in a direction to open the circuit, whereby upon release of said locking means said actuating member moves between said stop portions to separate said separable contacts and thereafter engages the other of said stop portions to move said blade member out of engagement with said cooperating contact.

19. In circuit interrupting means, a pair of spaced insulating supports, contact means carried by one of said supports, current interrupting means and a switch blade mounted on the other of said supports, said current interrupting means including separable contacts, said switch blade mounted for movement into and out of engagement with said contact means, and a tiltably mounted insulator having a direct connection with said separable contacts and a lost motion connection with said blade.

20. In circuit interrupting means, a disconnecting switch including a blade member mounted for movement into and out of engagement with a cooperating contact, operating means for said switch, said operating means including an actuating member, spaced stop portions on said blade member between which said actuating member is movable, means for locking said actuating member in closed circuit position in engagement with one of said stop portions to prevent movement of said blade member out of engagement with said cooperating contact, said actuating member biased to move in a direction to open the circuit, whereby upon release of said locking means said actuating member moves between said stop portions to engage the other of said stop portions with an impact and move said blade out of engagement with said cooperating contact.

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