June 20, 1944. S. I. LINDELL ET AL 2,351,826

SWITCH CONSTRUCTION

Filed Aug. 2, 1940 3 Sheets-Sheet 1

Fig. 1.

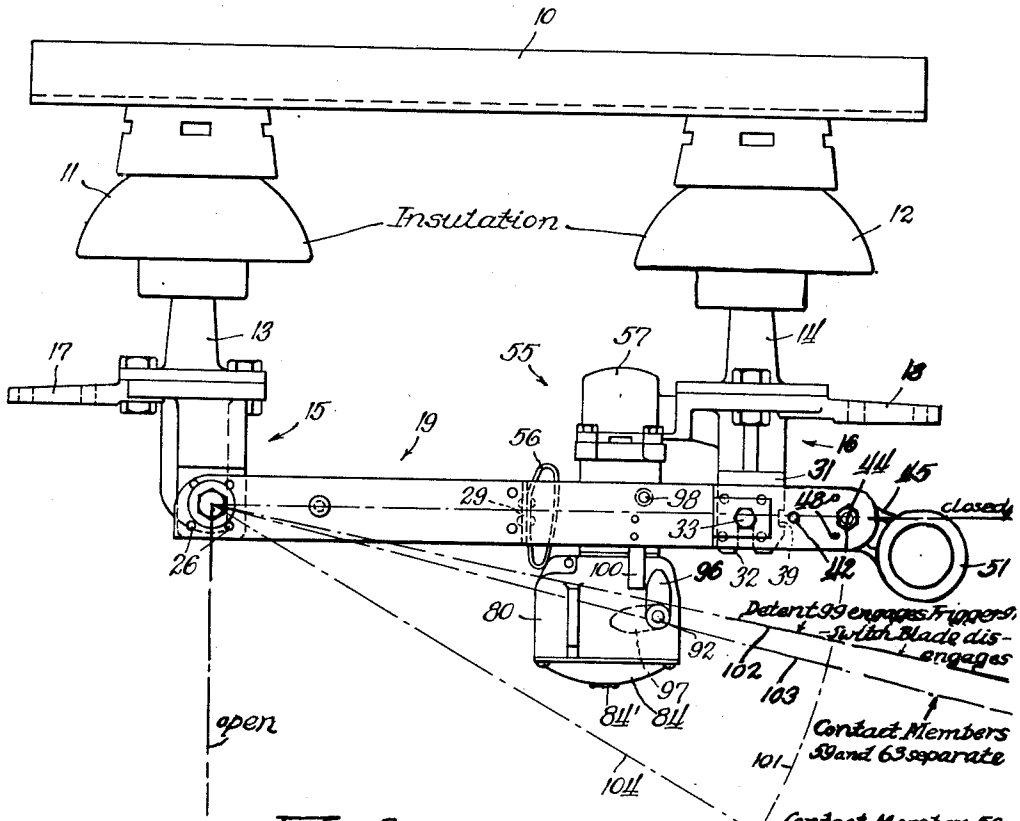
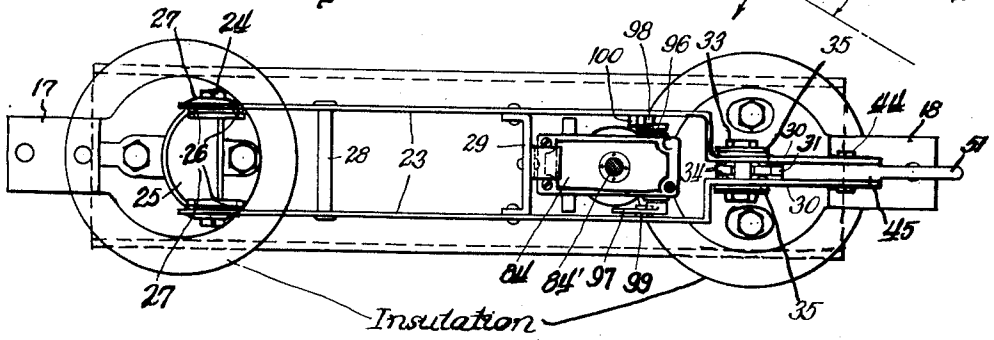



Fig. 2.




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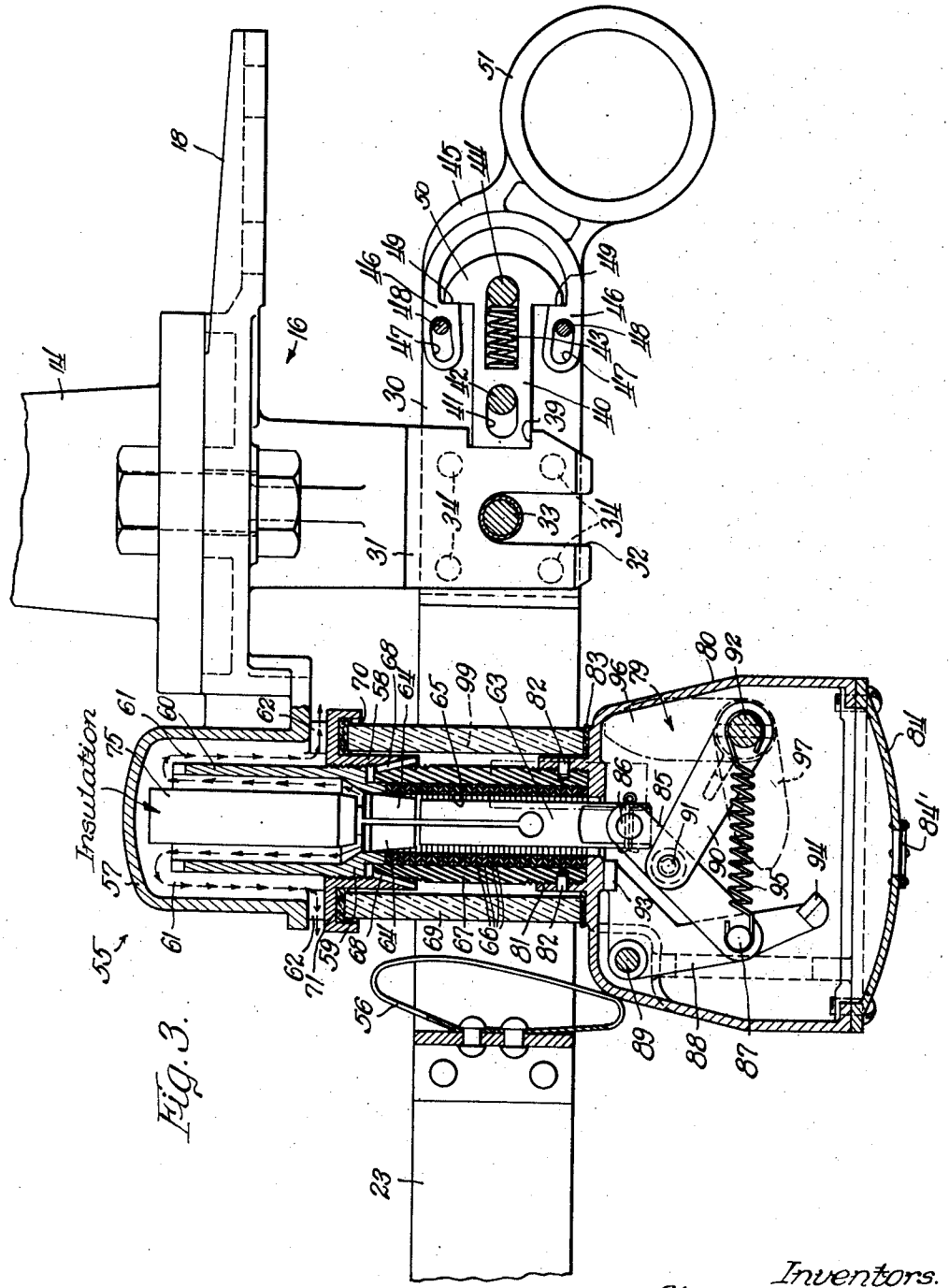



Fig. 3.

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SWITCH CONSTRUCTION

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Fig. 6.

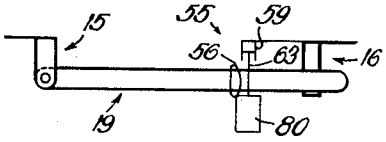



Fig. 7.

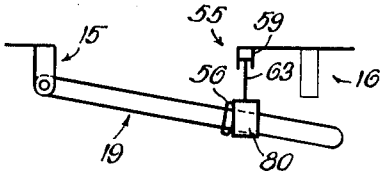



Fig. 8.

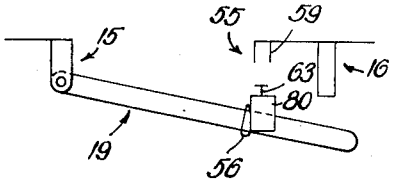



Fig. 5.

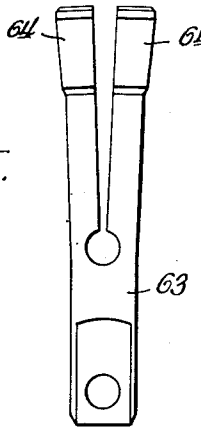
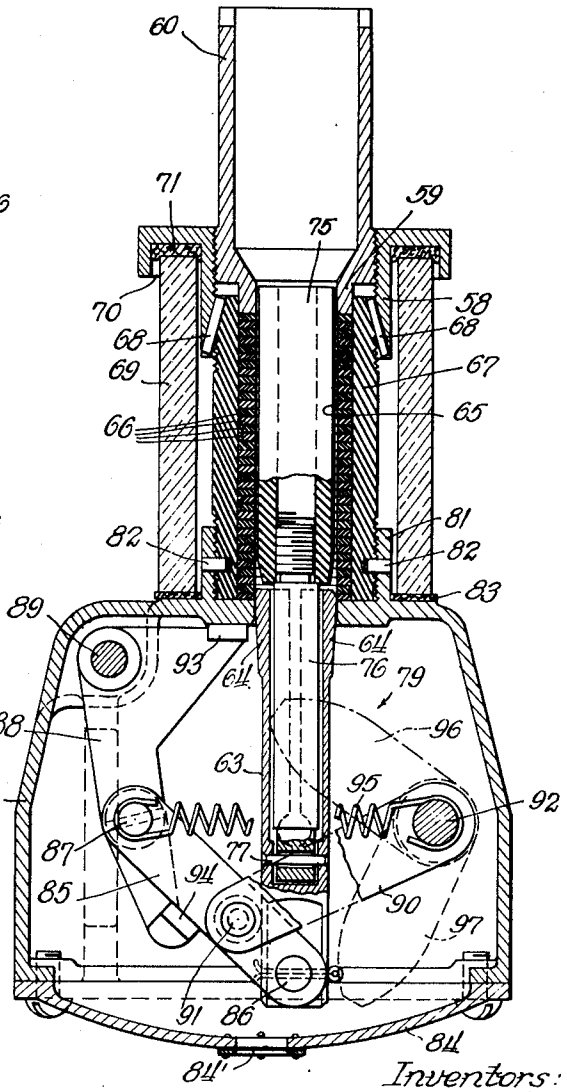



Fig. 4.




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Patented June 20, 1944

2,351,826

# UNITED STATES PATENT OFFICE

2,351,826

## SWITCH CONSTRUCTION

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Application August 2, 1940, Serial No. 349,898

27 Claims. (Cl. 200—146)

This invention relates, generally, to disconnecting switches and it has particular relation to disconnecting switches that are adapted to be opened under load.

In many instances it is desirable to open a high voltage disconnecting switch while normal load current is flowing in the circuit in which it is connected. It is necessary to interrupt the flow of current. This is usually accomplished by moving a switch blade to an open circuit position and at the same time drawing an arc between it and a cooperating stationary switch member. The switch members are more or less burned or fused because of the heat of the arc depending upon the amount of current in the circuit at the particular instance that the switch is opened. This causes a rapid deterioration of the switch members if the switch is called upon to interrupt current flow in this manner a number of times and, therefore, frequent replacements or maintenance are required. There is also the possibility under more severe circuit conditions that a long arc may be sustained and establish itself between the switch and an adjacent circuit or ground when an attempt is made to interrupt the load current in this manner. It is to the avoidance of the formation of an arc between the switch members themselves when a disconnecting switch is operated to the open position under load conditions that this invention is particularly addressed.

An object of this invention is to effect final circuit interruption in a load break device in a new and improved manner when a disconnecting switch is operated to the open circuit position.

Another object of this invention is to provide for engaging and disengaging the load break device prior to engagement and disengagement of the disconnecting switch members.

Still another object of this invention is to both close and open the circuit to the load break device on predetermined relative movement of the disconnecting switch members.

It is another object of this invention to provide for operating the load break device to both the closed and the open positions with a snap action.

It is still another object of this invention to prevent operation of the load break device when the disconnecting switch is in the closed position without requiring that the switch be operated to the open position.

It is also an object of this invention to provide for extinguishing the arc in the load break device in a new and improved manner.

A further object of this invention is to effect operation of the load break device to both the closed and open circuit positions as a result of relatively small movement between the members of the disconnecting switch in corresponding directions.

A still further object of this invention is to provide for operating a quick break load device by the opening of a more or less conventional hook stick operated disconnecting switch arranged to be operated at the usual speed and to provide such a device that can be operated by a lineman or operator from almost any position on a pole or other supporting structure in the usual manner of a conventional disconnecting switch.

Other objects of this invention will, in part, be obvious and in part appear hereinafter.

For a more complete understanding of the nature and scope of this invention, reference may be had to the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is a view, in side elevation, of a disconnecting switch with which a load break device constructed according to this invention is assembled;

Figure 2 is a bottom plan view of the switch construction shown in Figure 1;

Figure 3 is a detail sectional view showing the load break device and certain of the associated disconnecting switch parts at an enlarged scale as compared to the scale used for Figures 1 and 2, the switch and load break device being illustrated in the switch closed position;

Figure 4 is a sectional view of the load break device at a somewhat larger scale than that employed in Figure 3 and illustrating it in the open circuit position;

Figure 5 is a view, in side elevation, of the movable contact member of the load break device; and

Figures 6, 7, and 8 illustrate, diagrammatically, different steps in the operation of the disconnecting switch having incorporated therein the load break device of the present invention.

Referring now particularly to Figures 1 and 2 of the drawings, it will be observed that the reference character 10 designates a base on which suitable insulators 11 and 12 can be mounted. The base 10 may be in the form of a metallic channel base and the insulators 11 and 12 may be of conventional design. For purposes of illustration herein the insulators 11 and 12 are shown as depending from the base 10. Obvi-

ously, the base 10 can be placed in other positions; for example, it can be placed in an upright position with the insulators 11 and 12 projecting horizontally therefrom. Also, the base 10 can be reversed with the insulators 11 and 12 projecting upwardly therefrom.

Support members 13 and 14 are carried by the insulators 11 and 12 and they, in turn, carry stationary switch members, shown generally at 15 and 16, respectively. The stationary switch members 15 and 16 are provided with extensions 17 and 18 to which line terminals can be connected as will be readily understood. For interconnecting the stationary switch members 15 and 16, a switch blade, shown generally at 19, is pivotally mounted on the switch member 15 and is arranged to be moved into and out of engagement with the switch member 16.

As shown more clearly in Figure 2 of the drawings, the switch blade 19 is made up of two blade members 23 which are pivotally mounted by means of a bolt 24 that extends through a housing 25 which forms a part of the stationary switch member 15. The blade members 23 are provided with projecting portions 26, which may be formed by suitable upsetting operations, to provide point contact engagement with the adjacent side walls of the housing 25. Spring washers 27, compressed by the bolt 24, serve to bias the projections 26 into pressure contact engagement with the sides of the housing 25. The blade members 23 are held in proper relationship by means of spacers 28 and 29. The spacer 28 is in the form of a rivet whose ends are headed over to secure it in place. Spacer 29 comprises a generally U-shaped member, the ends of which are secured by any suitable means such as rivets to the blade members 23. The spacer 29 performs an additional function other than spacing the blade members 23, which will be set forth hereinafter.

The righthand ends 30 of the blade members 23 are formed so as to be relatively close together for engagement with a tongue 31 which forms a part of the stationary switch member 16. The tongue 31 is provided with a centrally located slot 32 for receiving therein a bolt 33 which projects through the ends 30 of the blade members 33. These ends 30 are provided with inwardly extending projections 34, that are formed by suitable upsetting operations as previously described, for providing point contact engagement with the adjacent faces of the tongue 31. Generally U-shaped spring members 35 are arranged to be stressed by the bolt 33 for holding the projections 34 in pressure contact engagement with the tongue 31.

It is desirable that the switch blade 19 be locked in the switch closed position for reasons well known to those skilled in the art. This is particularly necessary when the underhung construction shown in the drawings is employed. For this purpose the tongue 31 is provided with a notch 39, Figure 3, for receiving a latch bolt 40 that is provided with an elongated opening 41 which permits movement relative to a pin 42 that extends between the ends 30 of the blade members 23. The latch bolt 40 is urged to the locking position by means of a coil compression spring 43 which reacts against a bolt 44 on which is pivoted a latch lever 45. The latch lever 45 is provided with bifurcated end portions 46 which have arcuate slotted openings 47 that permit movement relative to pins 48 which extend between the ends 30 of the blade members 23. These end portions 46 are also provided with shoulders 49 against which abut a head portion 50 that is integrally formed with the latch bolt 40. The latch lever 45 is provided with an integrally formed eye 51 which is arranged to receive a prong of a switch stick for operating the switch blade 19 to the open or closed positions.

It will be apparent that rotation of the latch lever 45, as viewed in Figure 3, in a clockwise direction on insertion in the eye 51 of a prong of a switch stick will move the latch bolt 40 out of the notch 39 so that the switch blade 19 can then be moved to the open position on continued application of force to the eye 51. It will also be apparent that the reverse movement of the latch lever 45 will cause a like movement of the latch bolt 40 and continued application of force to the eye 51 when the switch is in the open position will bring the switch blade 19 into the switch closed position as shown in Figures 1, 2, and 3 of the drawings.

If special means are not provided, when the switch blade 19 is operated to the open circuit position with current flowing in the circuit, an arc will be formed between the ends 30 of the blade members 23 and the tongue 31. It is the purpose of the present invention to avoid the formation of such an arc and to preserve the same switch members themselves in essentially their initial condition with their functioning essentially unimpaired by pitting and other erosion caused by the formation of such arcs.

With this important object in mind, the load break device, shown generally at 55 in Figure 1 of the drawings, is provided. Load break device 55 is stationarily mounted on the stationary switch member 16 and it is arranged to be engaged by a bow-shaped contact member 56 that is carried by the spacer 29. The bow contact member 56 is formed of suitable good conducting spring material such as phosphor bronze.

The details of construction of the load break device 55 are more clearly shown in Figure 3 of the drawings, to which reference will now be had. The load break device 55 includes a metallic cap 57 that is formed integrally with the stationary switch member 16. It will be recalled that this switch member includes the extension 18 for receiving a line terminal and the tongue 31 which cooperates with the ends 30 of the blade members 23. The cap 57 has bolted thereto a downwardly extending internally threaded extension 58 which is adapted to carry a cylindrical contact member 59 that is provided with a cylindrical extension 60 which extends up into the cap 57. The extension 60 is provided so as to form a devious path, as indicated by the arrows 61 for the products of the arc that is formed with the cylindrical contact member 59 as one terminal. It will be observed that this devious path extends upwardly into the cap 57 and then downwardly and out to the atmosphere through laterally opening vents 62.

Cooperating with the cylindrical stationary contact member 59 is a generally rod-like movable contact member 63 which is shown separately in Figure 5 of the drawings. The movable contact member 63 is bifurcated to provide biased apart contact fingers 64 which engage the cylindrical stationary contact member 59 under pressure.

Instead of an arc being formed between the switch blade 19 and the tongue 31 of the stationary switch member 16, the load break device 55 is so arranged and constructed that the arc is

drawn between the stationary cylindrical contact member 59 and the movable rod-like contact member 63. As will hereinafter appear, provision is made for operating the movable contact member 63 with a snap action. It moves within a bore 65 which has the same diameter as the cylindrical contact member 59 and which is formed by a stack of rings 66 of material, such as fiber, which is adapted to evolve an arc extinguishing medium when subjected to the heat of an arc. The rings 66 of insulating material are surrounded and reinforced by a sleeve 67 of insulating material which may be a phenolic condensation product, such as "Bakelite." It will be observed that the sleeve 67 is threaded into the extension 58 and that it is held in place therein against rotation by pins 68.

With a view to protecting the sleeve 67 from the weather and to provide improved insulating qualities with respect to the cap 57, an outer sleeve of insulation 69 is provided around the sleeve 67. The sleeve 69 is formed of suitable insulating material such as porcelain. Its upper end projects into a downwardly opening groove 70 in the extension 58 and a gasket 71 of suitable readily compressible material is provided between the upper end of the sleeve 69 and the bottom of the groove 70.

It is desirable, not only to provide the bore 65 in the rings 66 of insulation with the attendant evolution of an arc extinguishing medium for extinguishing the arc that is drawn between the contact members 59 and 63 but also it is desirable to provide additional means for confining this arc and facilitating its extinction.

For this purpose a trailer 75 of insulating material is provided. The trailer 75 is formed of a material, such as fiber, which will evolve an arc extinguishing medium when subjected to the heat of the arc. The trailer 75 is arranged to move with the rod-like contact member 69 and to substantially fill the bore 65. As a result, the arc that is formed between the contact members 59 and 63 is confined by the trailer 75 to the space between its outer wall and the bore 65. This greatly facilitates the extinction of the arc.

As shown in Figure 4 of the drawings, the trailer 75 is tubular in form and at its lower end it is threaded onto a trailer rod 76 which projects into the rod-like movable contact member 63 and is secured therein by a pin 77. The trailer rod 76 loosely fits within the contact member 63 and can rock about the pin 77. This then permits a certain degree of freedom of movement of the trailer 75 with respect to the contact member 63.

As indicated, the movable contact member 63 is operated with a snap action. For this purpose, a toggle linkage, shown generally at 79 in Figure 3, is provided. The toggle linkage 79 is mounted within a metallic housing 80 which is provided with an upwardly extending internally threaded cylindrical portion 81 that is screwed onto the lower threaded end of the sleeve 67 surrounding the washers 66 of insulation. Pins 82 serve to hold the housing 80 in place on the sleeve 67. A gasket 83 of suitable deformable material is provided between the lower end of the sleeve 69 and the upper side of the housing 80. As shown in Figure 2 of the drawings, the housing 80 is of such width that it fits between the blade members 23 of the switch blade 19. Its lower end is closed by a cover plate 84. A screen 84' is provided in the cover plate 84 to permit the escape of any water which may condense within the load break device 55.

The toggle linkage 79 comprises essentially three links. A first link 85 is connected by means of a pin 86 to the lower end of the movable contact member 63. The first link 85 actually comprises a pair of leaf spring members of phosphor bronze that are positioned on opposite sides of the contact member 63. They are pivoted on a pin 87 that is carried by a second link 88 which is rotatably mounted about a fixed pivot that is provided by a pin 89 which is carried by the housing 80. A third link 90 has its outer bifurcated end pinned to the first link 85 by a pin 91, and it is mounted for movement with a rock shaft 92 which is carried by the housing 80 and extends beyond the same at each end. The link 90 has a press fit on the rock shaft 92. The second link 88 is provided with stop portions 93 and 94 which cooperate with the under side of the upper end of the housing 80 and the first link 85, respectively, for limiting the movement of the toggle linkage 79 in each direction. A biasing action to provide the snap action is provided by a pair of coil tension springs 95 only one of which is shown and which interconnect the pin 87 and the rock shaft 92.

At its ends the rock shaft 92 is provided with triggers or operating arms 96 and 97 which are more clearly shown in Figures 1 and 2 of the drawings. The triggers 96 and 97 are mounted in staggered relation on the rock shaft 92 and are arranged to be engaged by detents 98 and 99 in the form of rivets which project inwardly from the blade members 23. When the switch blade 19 is operated to the switch closed position, the detent 98 is arranged to engage the trigger 96 and operate the load break device 55 to the switch closed position. Likewise, when the switch blade 19 is operated to the open position, the detent 99 is arranged to engage the trigger 97 and operate the load break device 55 to the open circuit position.

When the switch blade 19 is in the switch closed position, the trigger 96 occupies the position shown in Figure 1. It is desirable to prevent independent operation of the load break device 55 while the switch blade 19 occupies this position, for otherwise it would be possible to open the switch without employing the load break device 55 for effecting arc extinction. For the purpose of interlocking the operation of the load break device 55 with the movement of the switch blade 19, a lock member 100 is secured to the blade member 23 which is on the same side of the housing 80 as the trigger or operating arm 96. The lock member 100 is secured to the blade member 23 by any suitable means, such as rivets. It will be observed that it occupies a position which is generally parallel to the trigger or operating arm 96. In this position, it is not possible to move the trigger or operating arm 96 and thus independent operation of the load break device 55 when the switch blade 19 is in the switch closed position is prevented.

In describing the operation of the present invention, it will first be assumed that the switch blade 19 is in the switch closed position as illustrated in Figures 1, 2, 3 and 6 of the drawings. As illustrated diagrammatically in Figure 6, the stationary switch members 15 and 16 are interconnected by the switch blade 19 which is in engagement with the switch member 16. The bow-contact member 56 is in engagement with the housing 80 and the contact members 59 and 63 are in engagement. This provides a shunt path between the switch blade 19 and the stationary

switch member 16. However, because of the relatively good contact engagement between the switch blade 19 and the stationary switch member 16, the major portion of the current flows directly therethrough and only a relatively small portion is directed through the contact members 59 and 63 of the load break device 55.

The prong of a hook stick is inserted in the eye 51 of the latch lever 45 and a pull is applied thereto for the purpose of withdrawing the latch bolt 40 from the slot 39 in the tongue 31. It will be understood that the pull applied to the eye 51 will be continuous and that the switch blade 19 will ordinarily be operated with a continuous movement to the switch open position. During the initial portion of its movement, the switch blade 19 disengages the tongue 31 of the stationary switch member 16 to provide an air gap that is sufficient to prevent formation of an arc therebetween when the circuit is being opened by the load break device 55, and transfers the entire flow of current to the load break device 55, as illustrated diagrammatically in Figure 7 of the drawings. Until the detent 99 engages the trigger or operating arm 97, the load break device 55 remains inactive. During this movement of the switch blade 19 it is being accelerated and the bow-contact member 56 slides over the housing 80 in order to maintain circuit connection with the load break device 55.

The switch blade 19 is swung in a clockwise direction as indicated by the arrow 101 in Figure 1 of the drawings until the detent 99 occupies a position along the line 102 where it engages the trigger or operating arm 97. The continued movement of the switch blade 19 in the direction indicated by the arrow 101 causes the rock shaft 92 to move and carry with it the third link 90. Corresponding movement of the first and second links 85 and 88 results with the contact member 63 being drawn into the bore 65 in the washers 66 and an arc being formed between the contact members 59 and 63. The pin 87 moves toward the left, as viewed in Figure 3, while the contact member 63 travels generally along a straight line through the bore 65 since the linkage 79 is so proportioned that the pin 86 moves substantially along the axis of the bore 65. The trailer 75 follows the contact member 63 into the bore 65 and confines the arc as described and assists in extinguishing the same. When the detent 99 occupies a position along the line 103, Figure 1, the contact members 59 and 63 have been separated and the arc drawn therebetween. It will be observed that only a relatively small angular movement of the switch blade is required, i. e., that represented by the angle between the lines 102 and 103, in order to effect the separation of the contact members 59 and 63 and draw the arc in the load break device 55. The movement of the contact member 63 remains under the control of the switch blade 19 and moves conjointly therewith until the pins 87, 91, and 86 are in alignment with the rock shaft 92. In this position the springs 95 are stretched to their fullest extent and the toggle linkage 79 occupies its center position. The continued movement of the rock shaft 92 past this position then permits the springs 95 to contract and operate the toggle linkage 79 with a snap action to the position as shown in Figure 4 of the drawings. By this time under normal operating conditions, the arc between the contact members 59 and 63 will have been completely extinguished so that when the switch blade 19 occupies a position along the line 104, Figure 1, and the bow-contact member 56 disengages the housing 80, no arc is drawn therebetween. The relative position of the various parts of the switch just after the arc has been extinguished and before the bow-contact member 56 disengages the housing 80 is diagrammatically illustrated in Figure 8 of the drawings.

When the switch blade 19 is operated to the switch closed position, the reverse of the preceding sequence of operations takes place. The bow-contact member 56 first engages the housing 80, as illustrated in Figure 8 of the drawings. The detent 98 then engages the trigger or operating arm 96 and moves the toggle linkage 79 to the center position. Thereupon, the contact member 63 is moved with a snap action into contact engagement with the stationary contact member 59 to close the circuit through the load break device as is diagrammatically illustrated in Figure 7 of the drawings. Further movement of the switch blade 19 then brings the ends 30 of the blade members 23 into contact engagement with the tongue 31 of the stationary switch member 16 and finally, on release of the latching arm 45, the latch pin 40 engages the notch 39 in the tongue 31 and holds the switch blade 19 in the closed position. Meanwhile, the locking member 100 has been moved to the position shown in Figure 1 of the drawings where it prevents movement of the trigger or operating arm 96 and thereby prevents operation of the load break device as long as the switch blade 19 remains in the switch closed position.

It will be noted that the springs 95 hold the toggle linkage in either of its extreme positions and thus accidental operation due to vibration is prevented.

An important feature of the switch construction disclosed herein resides in the positive engagement and operation of the load break device 55 in such manner that the switch cannot be closed or opened without engaging and operating the load break device 55 in the proper relationship to the opening and closing of the switch blade 19.

Another important feature is provided by the use of such lever ratios that the contact members 59 and 63 of the load break device 55 are closed or opened at relatively great speed. The last portion of the stroke in either direction involves a snap action because of the springs 95. This augments the speed of operation due to the movement of the switch blade 19 alone. If friction or sleet should prevent this snap action, then the movement is carried to completion by force transmitted through the switch blade. The springs 95 assure completion of the stroke without requiring critical adjustment of the engagement between the detents 98 and 99 and the triggers or operating arms 96 and 97.

It will be observed that the load break device 55 is completely protected from the weather. The ends of the rock shaft 92 and the triggers or operating arms 96 and 97 constitute the only moving parts that are outside and exposed to sleet. However sleet that may be formed about these parts can be readily broken by the impact of the moving switch blade 19 which attains considerable speed before the detents 98 and 99 engage the triggers or operating arms 96 and 97.

Since certain changes can be made in the foregoing construction and different embodiments of the invention can be made without departing from the scope thereof, it is intended that all matter shown in the accompanying

drawings and described hereinbefore shall be interpreted as illustrative and not in a limiting sense.

What is claimed as new is:

1. Load break switch means comprising, in combination, a pair of relatively movable switch members, a load break device carried by one switch member and adapted to be engaged by the other switch member prior to engagement or disengagement of said switch members, means for closing the circuit between said switch members through said load break device on predetermined relative movement of said switch members toward each other and for opening said circuit within said load break device on predetermined relative movement of said switch members away from each other, and means carried by and movable with said other switch member for preventing independent operation of said load break device when said switch members are in engagement.

2. Load break switch means comprising, in combnation, a pair of relatively movable switch members, a load break device carried by one switch member and adapted to be engaged by the other switch member prior to engagement or disengagement of said switch members, means for initiating the closing of the circuit between said switch members through said load break device on predetermined relative movement of said switch members toward each other and for initiating the opening of said circuit within said load break device on predetermined relative movement of said switch members away from each other, snap acting means for completing the operation of said load break device to the closed or open positions, and means carried by said other switch member for interlocking with said load break device to prevent independent operation thereof when the circuit is closed through said switch members.

3. Load break switch means comprising, in combination, a pair of relatively movable switch members; a load break device including a pair of separable contact members one connected to one switch member and the other connected to the other switch member prior to engagement or disengagement of said switch member, a rock shaft and operating means carried thereby, and lever means operatively interconnecting said other contact member and said rock shaft and adapted to move the former generally along a straight line toward the open or closed position on rocking of the latter; and means on said other switch member adapted to engage said operating means on said rock shaft after disengagement from said one switch member on movement to the switch open position and prior to engagement therewith on movement to the switch closed position for positively rocking said rock shaft by force transmitted through said other switch member for positively opening the circuit between said switch members by said load break device and for positively closing the circuit therebetween by the same.

4. Load break switch means comprising, in combination, a pair of relatively movable switch members; a load break device including a pair of separable contact members one connected to one switch member and the other connected to the other switch member prior to engagement or disengagement of said switch members, insulating means having a bore through which said other contact member is movable after separation from said one contact member for confining the arc drawn therebetween, a rock shaft and operating means carried thereby, and lever means operatively interconnecting said other contact member and said rock shaft and adapted to move the former generally along a straight line toward the open or closed position on rocking of the latter; and means on said other switch member adapted to engage said operating means on said rock shaft after disengagement from said one switch member on movement to the switch open position and prior to engagement therewith on movement to the switch closed position for positively rocking said rock shaft by force transmitted through said other switch member for positively opening the circuit between said switch members by said load break device and for positively closing the circuit therebetween by the same.

5. Load break switch means comprising, in combination, a pair of relatively movable switch members; a load break device including a pair of separable contact members one connected to one switch member and the other connected to the other switch member prior to engagement or disengagement of said switch members, insulating means having a bore through which said other contact member is movable after separation from said one contact member for confining the arc drawn therebetween, a plug of insulating material adapted to follow said other contact member into said bore and to substantially fill the same for limiting the space available for said arc to that provided between the walls of the plug and bore, a rock shaft and operating means carried thereby, and over center toggle means operatively interconnecting said other contact member and said rock shaft for spring actuating said contact members toward the open and closed positions; and means on said other switch member adapted to engage said operating means on said rock shaft after disengagement from said one switch member on movement to the switch open position and prior to engagement therewith on movement to the switch closed position for opening the circuit between said switch members by said load break device and for closing the circuit therebetween by the same.

6. Load break switch means comprising, in combination, a pair of relatively movable switch members; a load break device including a pair of separable contact members one connected to one switch member and the other connected to the other switch member prior to engagement or disengagement of said switch members, means enclosing the space adjacent said contact members and providing a devious path therethrough for venting the arc drawn therebetween to the atmosphere, a rock shaft and operating means carried thereby, and over center toggle means operatively interconnecting said other contact member and said rock shaft for spring actuating said contact members toward the open and closed positions; and means on said other switch member adapted to engage said operating means on said rock shaft after disengagement from said one switch member on movement to the switch open position and prior to engagement therewith on movement to the switch closed position for opening the circuit between said switch members by said load break device and for closing the circuit therebetween by the same.

7. Load break switch means comprising, in combination, a pair of relatively movable switch members; a load break device including a pair of separable contact members one connected to one

switch member and the other connected to the other switch member prior to engagement or disengagement of said switch members, a cylindrical metallic extension from said one contact member, metallic means enclosing said extension and therewith providing a devious path for venting to the atmosphere the arc drawn between said contact members, a rock shaft and operating means carried thereby, and over center toggle means operatively interconnecting said other contact member and said rock shaft for spring actuating said contact members toward the open and closed positions; and means on said other switch member adapted to engage said operating means on said rock shaft after disengagement from said one switch member on movement to the switch open position and prior to engagement therewith on movement to the switch closed position for opening the circuit between said switch members by said load break device and for closing the circuit therebetween by the same.

8. Load break switch means comprising, in combination, a pair of relatively movable switch members; a load break device including a pair of separable contact members one connected to one switch member and the other connected to the other switch member prior to engagement or disengagement of said switch members, means enclosing the space adjacent said contact members and providing a devious path therethrough for venting the arc drawn therebetween to the atmosphere, insulating means cooperating with said contact members for confining and assisting in extinguishing said arc, a rock shaft and operating means carried thereby, and over center toggle means operatively interconnecting said other contact member and said rock shaft for spring actuating said contact members toward the open and closed positions; and means on said other switch member adapted to engage said operating means on said rock shaft after disengagement from said one switch member on movement to the switch open position and prior to engagement therewith on movement to the switch closed position for opening the circuit between said switch members by said load break device and for closing the circuit therebetween by the same.

9. Load break switch means comprising, in combination, a pair of relatively movable switch members; a load break device including a pair of separable contact members one connected to one switch member and the other connected to the other switch member prior to engagement or disengagement of said switch member, a cylindrical metallic extension from said one contact member, metallic means enclosing said extension and therewith providing a devious path for venting to the atmosphere the arc drawn between said contact members, insulating means having a bore through which said other contact member is movable after separation from said one contact member for confining said arc, a plug of insulating material positioned in said extension when said contact members are closed and adapted to follow said other contact member into said bore and to substantially fill the same for limiting the space available for said arc to that provided between the walls of the plug and bore, a rock shaft and operating means carried thereby, and over center toggle means operatively interconnecting said other contact member and said rock shaft for spring actuating said contact members toward the open and closed positions; and means on said other switch member adapted to engage said operating means on said rock shaft after disengagement from said one switch member on movement to the switch open position and prior to engagement therewith on movement to the switch closed position for opening the circuit between said switch members by said load break device and for closing the circuit therebetween by the same.

10. Load break switch means comprising, in combination, a pair of relatively movable switch members; a load break device including a pair of separable contact members one connected to one switch member and the other connected to the other switch member prior to engagement or disengagement of said switch members, a first link pivoted to said other contact member, a second link pivoted to said first link, means mounting said second link about a fixed pivot, a third link pivoted to said first link, a rock shaft fast to said third link, spring means cooperating with said links to bias said contact members toward the open or closed position depending upon the direction and degree of movement of said links, and operating means carried by said rock shaft; and means on said other switch member adapted to engage said operating means on said rock shaft after disengagement from said one switch member on movement to the switch open position and prior to engagement therewith on movement to the switch closed position for opening the circuit between said switch members by said load break device and for closing the circuit therebetween by the same.

11. Load break switch means comprising, in combination, a pair of relatively movable switch members; a load break device including a pair of separable contact members one connected to one switch member and the other connected to the other switch member prior to engagement or disengagement of said switch members, insulating means having a bore through which said other contact member is movable after separation from said one contact member for confining the arc drawn therebetween, a plug of insulating material adapted to follow said other contact member into said bore and to substantially fill the same for limiting the space available for said arc to that provided between the walls of the plug and bore, a first link pivoted to said other contact member, a second link pivoted to said first link, means mounting said second link about a fixed pivot, a third link pivoted to said first link, a rock shaft fast to said third link, spring means cooperating with said links to bias said contact members toward the open or closed position depending upon the direction and degree of movement of said links, and operating means carried by said rock shaft; and means on said other switch member adapted to engage said operating means on said rock shaft after disengagement from said one switch member on movement to the switch open position and prior to engagement therewith on movement to the switch closed position for opening the circuit between said switch members by said load break device and for closing the circuit therebetween by the same.

12. Load break switch means comprising, in combination, a pair of relatively movable switch members; a load break device including a pair of separable contact members one connected to one switch member and the other connected to the other switch member prior to engagement or disengagement of said switch members, a cylindrical metallic extension from said one con-

tact member, metallic means enclosing said extension and therewith providing a devious path for venting to the atmosphere the arc drawn between said contact members, insulating means having a bore through which said other contact member is movable after separation from said one contact member for confining said arc, a plug of insulating material positioned in said extension when said contact members are closed and adapted to follow said other contact member into said bore and to substantially fill the same for limiting the space available for said arc to that provided between the walls of the plug and bore, a first link pivoted to said other contact member, a second link pivoted to said first link, means mounting said second link about a fixed pivot, a third link pivoted to said first link, a rock shaft fast to said third link, spring means cooperating with said links to bias said contact members toward the open or closed position depending upon the direction and degree of movement of said links, and operating means carried by said rock shaft; and means on said other switch member adapted to engage said operating means on said rock shaft after disengagement from said one switch member on movement to the switch open position and prior to engagement therewith on movement to the switch closed position for opening the circuit between said switch members by said load break device and for closing the circuit therebetween by the same.

13. Load break switch means comprising, in combination, a pair of relatively movable switch members; a load break device including a pair of separable contact members one being connected to and mounted on one switch member, a metallic housing connected to the other contact member, means mounting said housing in insulated spaced relation with respect to said one contact member, means within said housing for moving said other contact member toward the open and closed positions, and operating means for said contact member moving means outside of said housing; contact means on said other switch member adapted to engage said housing prior to engagement or disengagement of said contact members and switch members, and means on said other switch member adapted to engage said operating means after disengagement from said one switch member on movement to the switch open position and prior to engagement therewith on movement to the switch closed position for opening the circuit between said switch members by said load break device and for closing the circuit therebetween by the same.

14. Load break switch means comprising, in combination, a pair of relatively movable switch members; a load break device including a pair of separable contact members one being connected to and mounted on one switch member, a metallic housing connected to the other contact member, means mounting said housing in insulated spaced relation with respect to said one contact member, a shaft rockably mounted on said housing having operating means mounted exteriorly thereof, and over center toggle means mounted within said housing and operatively interconnecting said other contact member and said rock shaft for spring actuating said contact members toward the open and closed positions; contact means on said other switch member adapted to engage said housing prior to engagement or disengagement of said contact members and switch members, and means on said other switch member adapted to engage said operating means after disengagement from said one switch member on movement to the switch open position and prior to engagement therewith on movement to the switch closed position for opening the circuit between said switch members by said load break device and for closing the circuit therebetween by the same.

15. Load break switch means comprising, in combination, a pair of relatively movable switch members; a load break device including a pair of separable contact members one being connected to and mounted on one switch member, a metallic housing connected to the other contact member, an inner sleeve of insulation rigidly interconnecting said housing and said one contact member, an outer sleeve of insulation interposed between said housing and said one contact member for protecting said inner sleeve, a plurality of flat rings of fiber within said inner sleeve providing a bore through which said other contact member is movable after separation from said one contact member for confining the arc drawn therebetween, a shaft rockably mounted on said housing having operating means mounted exteriorly thereof, and over center toggle means mounted within said housing and operatively interconnecting said other contact member and said rock shaft for spring actuating said contact members toward the open and closed positions; contact means on said other switch member adapted to engage said housing prior to engagement or disengagement of said contact members and switch members, and means on said other switch member adapted to engage said operating means after disengagement from said one switch member on movement to the switch open position and prior to engagement therewith on movement to the switch closed position for opening the circuit between said switch members by said load break device and for closing the circuit therebetween by the same.

16. Load break switch means comprising, in combination, a pair of relatively movable switch members; a load break device including a pair of separable contact members one being connected to and mounted on one switch member, a metallic housing connected to the other contact member, an inner sleeve of insulation rigidly interconnecting said housing and said one contact member, an outer sleeve of insulation interposed between said housing and said one contact member for protecting said inner sleeve, a plurality of flat rings of fiber within said inner sleeve providing a bore through which said other contact member is movable after separation from said one contact member for confining the arc drawn therebetween, a plug of fiber adapted to follow said other contact member into said bore and to substantially fill the same for limiting the space available for said arc to that provided between the walls of the plug and bore, a shaft rockably mounted on said housing having operating means mounted exteriorly thereof, and over center toggle means mounted within said housing and operatively interconnecting said other contact member and said rock shaft for spring actuating said contact members toward the open and closed positions; contact means on said other switch member adapted to engage said housing prior to engagement or disengagement of said contact members and switch members, and means on said other switch member adapted to engage said operating means after disengagement from said one switch member on movement to the switch open position and prior to engagement therewith on movement to the switch closed position for opening the circuit between said switch members by said load

break device and for closing the circuit therebetween by the same.

17. Load break switch means comprising, in combination, a stationary switch member, a switch blade and means for pivotally mounting the same to engage and disengage said switch member, a stationary load break device having a stationary contact member connected to said switch member and a movable cooperating contact member, means for connecting said switch blade to said movable contact member prior to engagement or disengagement of said switch member and switch blade, a shaft and means rockably mounting the same with its axis parallel to and spaced a relatively great distance from the pivot axis of said switch blade, a linkage interconnecting said movable contact member and said shaft and adapted to move the former generally along a straight line toward open and closed positions on rotation of the latter, operating means extending radially from said shaft, and means on said switch blade adapted to engage said operating means a relatively small distance from the axis of rotation of said shaft whereby a relatively great angular movement of said shaft is positively effected on relatively small angular movement of said switch blade by force transmitted therethrough, said toggle linkage being arranged to further amplify said relatively small angular movement of said switch blade to effect relatively great movement of said movable contact member.

18. Load break switch means comprising, in combination, a stationary switch member, a pair of spaced apart switch blades adapted to be moved as a unit and means for pivotally mounting them to engage and disengage said switch member, a load break device mounted on said stationary switch member between said switch blades in the closed position, a stationary contact member in said load break device connected to said stationary switch member and a cooperating movable contact member, resilient contact means carried by said switch blades for connecting them to said movable contact member prior to engagement or disengagement of said switch member and switch blades, a shaft and means rockably mounting the same on said load break device between said switch blades with its axis parallel to and spaced a relatively great distance from the pivot axis of said switch blades, a toggle linkage interconnecting said movable contact member and said shaft, an operating arm at each end of said shaft extending radially therefrom in staggered relation, and a detent extending inwardly from each switch blade and adapted to engage a corresponding operating arm at a relatively small distance from the axis of rotation of said shaft whereby a relatively great angular movement of said shaft is effected on relatively small angular movement of said switch blades, one detent being adapted to engage one operating arm when said switch blades are moved to the switch closed position and the other detent being adapted to engage the other operating arm when said switch blades are moved to the switch open position, said toggle linkage being arranged to further amplify said relatively small angular movement of said switch blade to effect relatively great movement of said movable contact member.

19. A load break device comprising, in combination, a pair of separable contact members, a first link pivoted to one contact member, a second link pivoted to said first link, means mounting said second link about a fixed pivot, a third link pivoted to said first link, a rock shaft fast to said third link, and spring means cooperating with said links to bias said contact members toward the open or closed position depending upon the direction and degree of movement of said rock shaft.

20. A load break device comprising, in combination, a pair of separable contact members, insulating means having a bore through which one of said contact members is movable after separation from the other contact member for confining the arc drawn therebetween, a plug of insulating material adapted to follow said one contact member into said bore and to substantially fill the same for limiting the space available for said arc to that provided between the walls of the plug and bore, a first link pivoted to said one contact member, a second link pivoted to said first link, means mounting said second link about a fixed pivot, a third link pivoted to said first link, and a rock shaft fast to said third link, the operative relationship between said links being such as to cause said one contact member to move generally along a straight line toward the open or closed position depending upon the direction of movement of said rock shaft.

21. Load break switch means comprising, in combination, a pair of relatively movable switch members; a load break device including a pair of separable contact members one connected to one switch member and the other connected to the other switch member prior to engagement or disengagement of said switch members, insulating means having a bore through which said other contact member is movable after separation from said one contact member for confining the arc drawn therebetween, a plug of insulating material adapted to follow said other contact member into said bore and to substantially fill the same for limiting the space available for said arc to that provided between the walls of the plug and bore, a rock shaft and operating means carried thereby, and lever means operatively interconnecting said rock shaft and said contact member and adapted to move the latter generally along a straight line toward the open or closed position on rocking of the former in one direction or the other; and means on said other switch member adapted to engage said operating means on said rock shaft after disengagement from said one switch member on movement to the switch open position and prior to engagement therewith on movement to the switch closed position for opening the circuit between said switch members by said load break device and for closing the circuit therebetween by the same.

22. Load break switch means comprising, in combination, a pair of relatively movable switch members; a load break device including a pair of separable contact members one connected to one switch member and the other connected to the other switch member prior to engagement or disengagement of said switch members, means enclosing the space adjacent said contact members and providing a devious path therethrough for venting the arc drawn therebetween to the atmosphere, a rock shaft and operating means carried thereby, and lever means operatively interconnecting said rock shaft and said contact member and adapted to move the latter generally along a straight line toward the open or closed position on rocking of the former in one direction or the other; and means on said other switch member adapted to engage said operating means on said rock shaft after disengagement from said one switch member on movement to the switch open position and prior to engagement therewith

on movement to the switch closed position for opening the circuit between said switch members by said load break device and for closing the circuit therebetween by the same.

23. Load break switch means comprising, in combination, a pair of relatively movable switch members; a load break device including a pair of separable contact members one connected to one switch member and the other connected to the other switch member prior to engagement or disengagement of said switch members, a cylindrical metallic extension from said one contact member, metallic means enclosing said extension and therewith providing a devious path for venting to the atmosphere the arc drawn between said contact members, a rock shaft and operating means carried thereby, and lever means operatively interconnecting said rock shaft and said contact member and adapted to move the latter generally along a straight line toward the open or closed position on rocking of the former in one direction or the other; and means on said other switch member adapted to engage said operating means on said rock shaft after disengagement from said one switch member on movement to the switch open position and prior to engagement therewith on movement to the switch closed position for opening the circuit between said switch members by said load break and for closing the circuit therebetween by the same.

24. Load break switch means comprising, in combination, a pair of relatively movable switch members; a load break device including a pair of separable contact members one connected to one switch member and the other connected to the other switch member prior to engagement or disengagement of said switch members, means enclosing the space adjacent said contact members and providing a devious path therethrough for venting the arc drawn therebetween to the atmosphere, insulating means cooperating with said contact members for confining and assisting in extinguishing said arc, a rock shaft and operating means carried thereby, and lever means operatively interconnecting said rock shaft and said contact member and adapted to move the latter generally along a straight line toward the open or closed position on rocking of the former in one direction or the other; and means on said other switch member adapted to engage said operating means on said rock shaft after disengagement from said one switch member on movement to the switch open position and prior to engagement therewith on movement to the switch closed position for opening the circuit between said switch members by said load break device and for closing the circuit therebetween by the same.

25. Load break switch means comprising, in combination, a pair of relatively movable switch members; a load break device including a pair of separable contact members one connected to one switch member and the other connected to the other switch member prior to engagement or disengagement of said switch members, a cylindrical metallic extension from said one contact member, metallic means enclosing said extension and therewith providing a devious path for venting to the atmosphere the arc drawn between said contact members, insulating means having a bore through which said other contact member is movable after separation from said one contact member for confining said arc, a plug of insulating material positioned in said extension when said contact members are closed and adapted to follow said other contact member into said bore and to substantially fill the same for limiting the space available for said arc to that provided between the walls of the plug and bore, a rock shaft and operating means carried thereby, and lever means operatively interconnecting said rock shaft and said contact member and adapted to move the latter generally along a straight line toward the open or closed position on rocking of the former in one direction or the other; and means on said other switch member adapted to engage said operating means on said rock shaft after disengagement from said one switch member on movement to the switch open position and prior to engagement therewith on movement to the switch closed position for opening the circuit between said switch members by said load break device and for closing the circuit therebetween by the same.

26. Load break switch means comprising, in combination, a pair of relatively movable switch members; a load break device including a pair of separable contact members one connected to one switch member and the other connected to the other switch member prior to engagement or disengagement of said switch members, insulating means having a bore through which said other contact member is movable after separation from said one contact member for confining the arc drawn therebetween, a plug of insulating material adapted to follow said other contact member into said bore and to substantially fill the same for limiting the space available for said arc to that provided between the walls of the plug and bore, a rock shaft and operating means carried thereby, and lever means operatively interconnecting said rock shaft and said contact member and adapted to move the latter generally along a straight line toward the open or closed position on rocking of the former in one direction or the other; means on said other switch member adapted to engage said operating means on said rock shaft after disengagement from said one switch member on movement to the switch open position and prior to engagement therewith on movement to the switch closed position for opening the circuit between said switch members by said load break device and for closing the circuit therebetween by the same, and means for holding said contact member of said load break device in the open or closed position.

27. A load break switch comprising in combination a disconnect switch having a hinge contact, a swinging blade pivoted thereto, and a stud contact engageable and disengageable by the blade, said blade being adapted to move through a series of angular positions in its opening and closing movements; a circuit interrupter having a stationary and a movable contact and snap-action actuating means, an interrupter disconnect contact connected through the interrupter to said stud contact; said blade having a contact portion for engaging and disengaging the stud contact, said blade having an operating member having lost motion engagement with said snap-action actuating means for tripping the interrupter to open position on opening movement of the blade, and having also an interrupter disconnect contact which leaves the stationary interrupter contact only after the operating member has engaged and separated from the snap-action actuating means of the circuit interrupter upon opening movement of the

blade; the stud contact engaging portion of the blade, the interrupter operating member on the blade, and the stationary interrupter disconnecting contact, respectively, lying on successively shorter radii from the hinge of the blade; and the cooperating stud contact, the interrupter actuating means, and the stationary interrupter disconnect contact, respectively, lying at successive positions angularly about the hinge point of the blade; whereby upon opening movement of the blade the blade-stud engagement is first opened and the actuating mechanism for opening the circuit interrupter is next actuated and disengaged, and finally the interrupter disconnect contacts are separated.

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