

Nov. 12, 1935.

J. D. ELLIS ET AL

2,020,935

CIRCUIT INTERRUPTER

Filed May 25, 1932

3 Sheets-Sheet 1

Fig. 1.

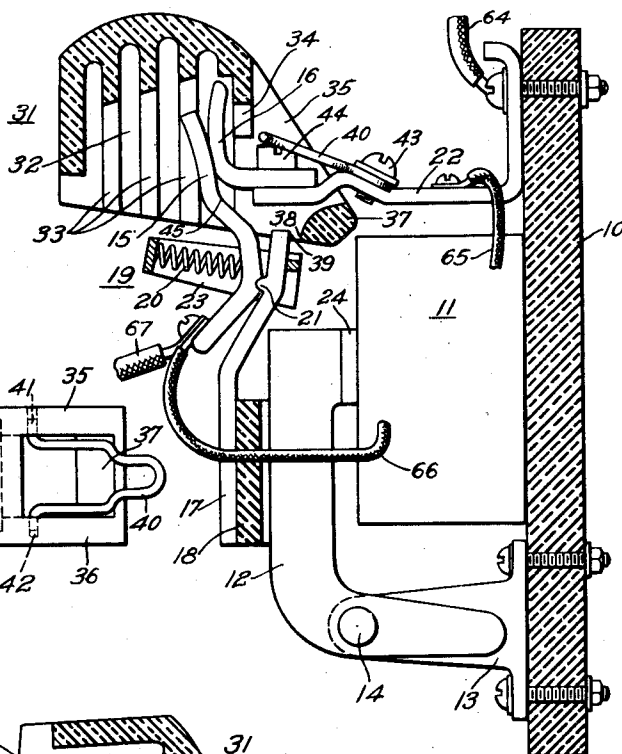


Fig. 2.

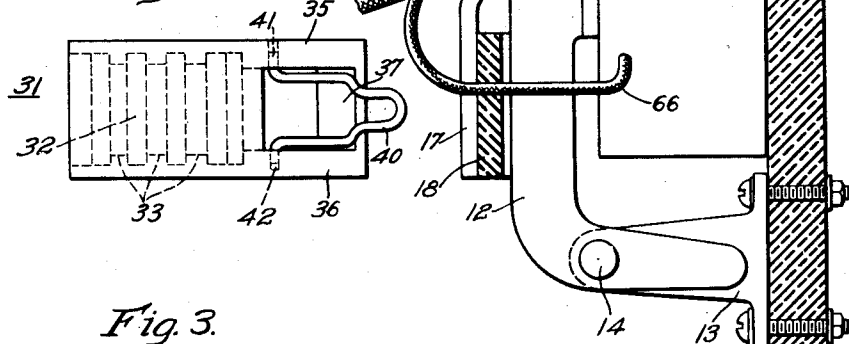
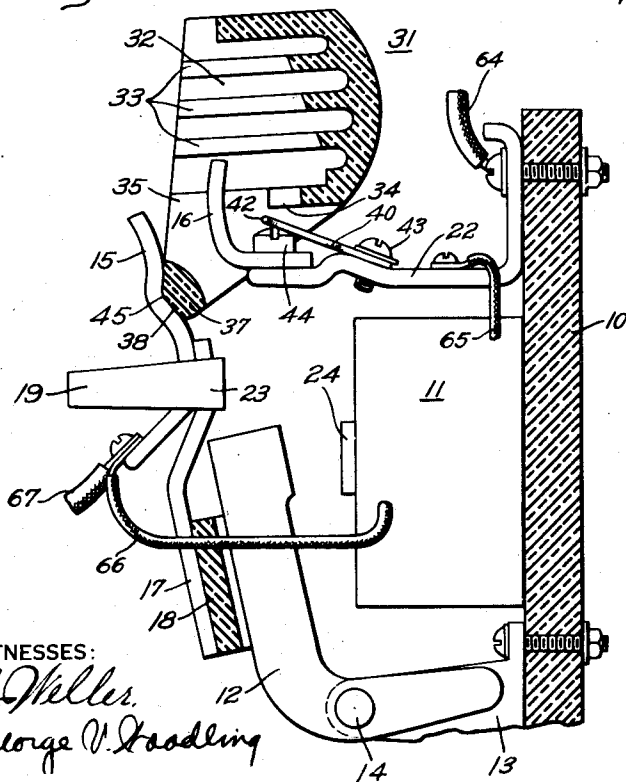


Fig. 3.



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Fig. 4.

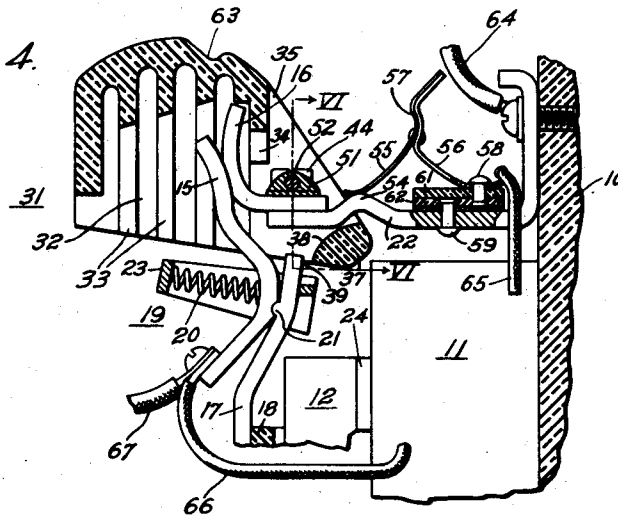


Fig. 5.

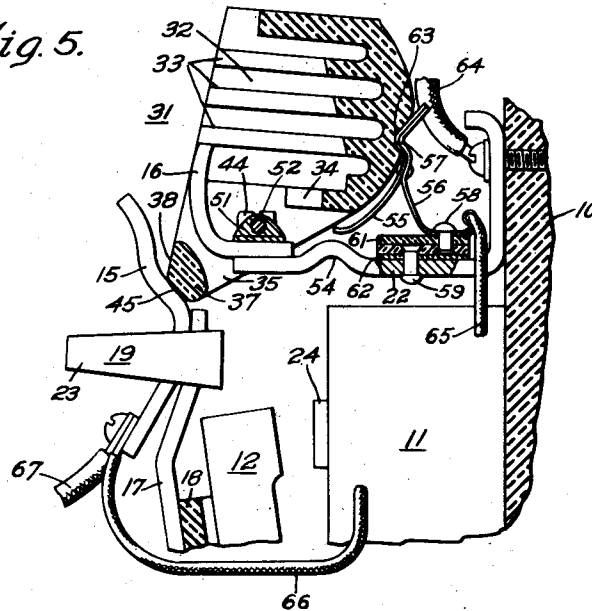
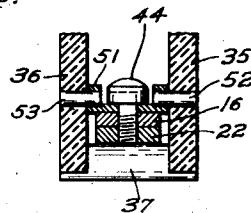


Fig. 6.



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3 Sheets-Sheet 3

Fig. 7.

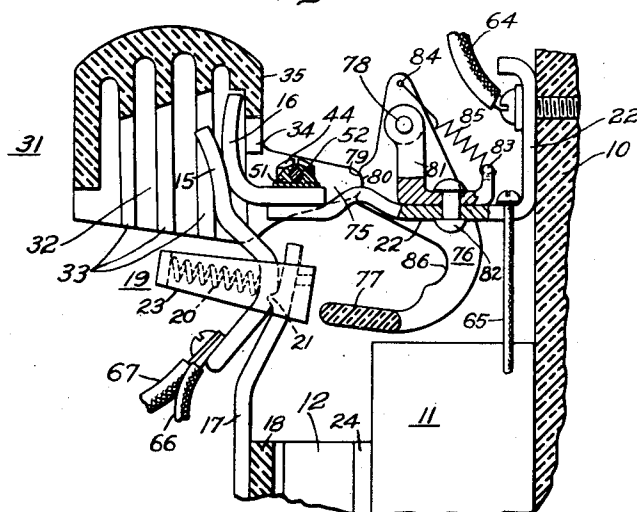
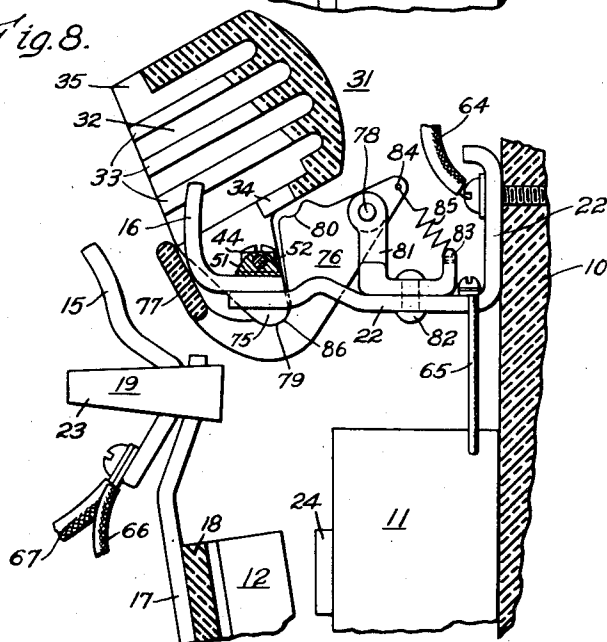


Fig. 8.



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2,020,935

CIRCUIT INTERRUPTER

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Application May 25, 1932, Serial No. 613,344

17 Claims. (Cl. 200-144)

Our invention relates, generally, to circuit interrupters and more particularly to electric switches for interrupting circuits in air.

An object of our invention is to provide for preventing the closing of the contact members of a switch when the arc chute that houses the contact members is moved from its normal operating position.

A further object of our invention is to provide for so constructing and so pivotally mounting an arc chute that houses the contact members of a switch as to cause a portion of the arc chute to prevent the closing of the contact members when the arc chute is moved from its normal operating position.

It is also an object of our invention to provide for deenergizing the magnetizing winding of a switch when the arc chute that houses the contact members is moved from its normal operating position.

Another object of our invention is to provide for actuating a member, associated with the arc chute, into the space between the engaging surfaces of the contact members of a contactor when the arc chute is removed from its normal operating position.

A still further object of our invention is to provide on the inner surface of the arc chute a plurality of ridges disposed substantially transversely to the travel of an arc passing between the contact members of the switch.

Other objects of our invention and a fuller understanding thereof may be had by a study of the following description taken in connection with the accompanying drawings, in which:

Figure 1 is a side elevational view, partly in section, of a switch embodying the features of our invention;

Fig. 2 is a plan view of the arc chute and the resilient clip by means of which it is pivotally mounted;

Fig. 3 is a side elevational view, partly in section, of the switch shown in Fig. 1, but with the arc chute shown in its lifted position;

Fig. 4 is a side elevational view, partly in section, of a switch embodying a modified form of our invention;

Fig. 5 is a side elevational view, partly in section, of the switch shown in Fig. 4, but with the arc chute shown in its lifted position, in which position certain elements prevent the closing of the contact members of the switch and deenergize the magnetizing winding of the switch;

Fig. 6 is a cross-sectional view of the arc chute

and the means by which it is mounted taken along the line VI—VI of Fig. 4;

Fig. 7 is a side elevational view, partly in section, of a switch embodying a further modified form of our invention; and

Fig. 8 is a side elevational view, partly in section, of the switch shown in Fig. 7, but the arc chute being shown in its lifted position.

With reference to Figs. 1, 2 and 3, the switch comprises, in general, a magnetizing winding 11 that surrounds a core 24, an associated armature 12, a movable contact member 15 actuated by the armature 12, a stationary contact member 16, an arc chute 31 for housing the contact members, and an upright member 10 for supporting the foregoing parts.

In accordance with the usual construction of switches, the magnetizing winding 11 and the core member 24 are suitably connected to the support 10, and the upper end of the armature 12 is disposed in cooperative relation to the core member 24, its lower end being pivotally mounted by means of a pin 14 to a supporting bracket 13 that is suitably mounted upon the support 10.

The stationary contact member 16 is carried by an outwardly extending bracket 22 secured to the support 10 and mounted above and spaced from the magnetizing winding 11. As in usual construction, the stationary contact member 16 is removably mounted on bracket 22 by means of a screw 44. By this arrangement, the stationary contact member 16, in case of failure, may be removed and replaced by a new contact member. The movable contact member 15 is disposed in operative relation to the stationary contact member 16 and is flexibly connected to the armature 12 by means of a member 17 and a retaining member 18.

The retaining member 18 comprises a frusto cone-shaped enclosure 23 having a transversely disposed aperture near its base portion through which the lower portion of the movable contact member 15 and the upper portion of the member 17 extend. As illustrated, a coil spring 20 is disposed between the movable contact member 15 and the smaller end of the enclosure 23. For the purpose of retaining the movable contact member 15 in position and of providing a pivot point about which it may rock, the upper end of the member 17 is provided with a ridge 21 and the adjacent engaging portion of the movable contact member 15 is provided with a complementary groove. By means of this construction, the movable contact member is disposed to rock about the transversely disposed ridge 21 under the bias-

ing force of the coil spring 20, thus ensuring a predetermined pressure between the contact members 15 and 16, and, in addition, providing a wiping action to give a good electrical contact as the movable contact member 15 is brought into engagement with the stationary contact member 16.

For the purpose of insulating the movable contact member 15 from the armature 12, the member 17 is connected to the armature 12 by means of an insulating block 18, which is disposed between the armature 12 and the member 17.

The arc chute 31 comprises, generally, an arc chamber 32 and rearwardly extending sides 35 and 36, connected at their rearward end by a bridging member 37. (See Fig. 2.) The inner walls of the arc chamber 32 are provided with ribs or ridges disposed substantially transversely to the travel of an arc passing between the contact members. We find that, by means of the transversely disposed ribs 33, the arc is not so apt to restrike after the arc current becomes zero at the end of a half cycle, as it would be if the inner surface of the arc chamber 32 were smooth. Note that the space occupied by the grooves between the ridges may be relatively small as compared to the remaining space of the arc chamber 32, i. e., the grooves need be of only such depth and width as to prevent the formation of a continuous conductive or incandescent path along the inner surface of the arc chamber.

As illustrated, the arc chute 31 is pivotally mounted by means of a U-shaped spring clip 40 having its open ends 41 and 42 extending outwardly and the light portion reduced to fit around a screw 43. The light portion is somewhat elongated so that the ends 41 and 42 may be adjusted relative to the securing screw 43. The outwardly extending ends 41 and 42 are disposed to fit in the illustrated openings provided in the rearwardly extending sides 35 and 36 of the arc chute.

As illustrated, that part of the supporting bracket 22 to which the U-shaped spring clip 40 is attached, is bent upwardly at a small angle so as to cause the clip 40 to be disposed at an angle to the horizontal, thus preventing access to the screw 43 by means of a screw driver when the switch is mounted into a close-fitting cabinet or enclosure (not shown). By means of this construction, it is practically impossible to remove the arc chute unless the switch is disconnected from the supply line and removed from the tight-fitting enclosure. Accordingly, in no case, will it be possible to operate the switch in the tight-fitting enclosure, with the arc chute removed.

As illustrated in Fig. 3, the pivotally mounted arc chute is so tilted or lifted to its extreme upper position that the bridging member 37 engages a depressed portion 45 of the movable contact member 15 and retains the movable contact member 15 to its maximum open position against the relatively weak attractive force of the armature 12, resulting from the wide air gap between the armature 12 and the core member 24.

For the purpose of ensuring that the force or pressure of the movable contact member 15 in the clockwise direction upon the bridging member 37 will not rotate the arc chute in a counter-clockwise direction from its full tilted position, the fulcrum point, that is, the ends 41 and 42 of the spring clip about which the arc chute rotates, is positioned below the line of action of the resultant force of the movable contact member 15 thereby tending to rotate the arc chute in a clockwise direction.

However, if the arc chute be rotated in a counter-clockwise direction to a point slightly less than its full rotated position, the direction or line of action of the resultant applied force changes. That is to say, the resultant applied force no longer tends to rotate the arc chute in a clockwise direction but in a counter-clockwise direction towards its normal operating position. As the arc chute 31 is actuated towards its normal operating position, the magnetic pull of the magnetizing winding gradually increases by reason of the reduced air gap, with the result that the increasing applied force of the movable contact member 15 rapidly swings the arc chute to its normal operating position. The path of the arc described by the bridging member 37, as the arc chute is rotated from its tilted position to its normal position, is such that the movable contact member 15 and the upper end 39 of the member 17 successively impart a force to it during the entire downward swing, except for the last few degrees of rotation, which represents the clearance between the upper end 39 of the member 17 and the adjacent surface 38 of the bridging member 37 (see Fig. 1).

Even if the arc chute 31 were slightly raised from its normal position, equal to the clearance between the upper surface 39 of the vertically disposed member 17, and the adjacent surface 38 of the bridging member 37, the arc passing between the contact members 15 and 16 would still be adequately confined within the arc chamber 32. Therefore, by the foregoing arrangement the contact members 15 and 16 can never be closed unless the arc chute is adequately housing the contact members.

However, should operating conditions arise where it is advantageous to have the applied force of the movable contact member 15 to always rotate the arc chute to its normal operating position regardless of whether or not the arc chute be tilted to its full rotated position, this may be accomplished by merely changing the fulcrum point about which the arc chute rotates.

For the purpose of gaining access to the screw 44 for changing the stationary contact member 16, without removing the arc chute, the rearmost depending barrier of the arc chamber is cut away at 34 in an arcuate manner to provide adequate room for a screw driver to engage the screw 44 when the arc chute is tilted or raised to its full rotated position (see Fig. 3).

In Figs. 4, 5 and 6, we provide auxiliary switching means for deenergizing the magnetizing winding 11, as well as provide means for preventing the closing of the contact members 15 and 16 when the arc chute is tilted or raised to its inoperative position. In this embodiment of the invention, the arc chute 31 is pivotally mounted in a slightly different manner from that disclosed in Figs. 1, 2 and 3 in order to provide available space for the auxiliary switching means. Fig. 6 thus shows the sides 35 and 36 of the arc chute fulcrumed about two transversely disposed trunnions 52 and 53 carried by the clip 51. The bearing clip 51 is secured in position by the screw 44 which connects the stationary contact member 16 to the outwardly extending bracket 22.

The auxiliary switching means comprises a contact finger 55 that is resiliently connected to the insulated blocks 61 and 62 by means of a rearwardly extending spring member 56. As illustrated, the rivet 58 which secures the spring member 56 to the insulated blocks 61 and 62 is insulated from the supporting bracket 22, and the

rivet 59 is employed to secure the insulating blocks 61 and 62 to the supporting bracket 22. Therefore, the current that energizes the magnetizing winding 11 flows from the incoming conductor 64 through the supporting bracket 22, the contact finger 55, the spring member 56, the conductor 65, the magnetizing winding 11, and the conductor 66 to the outgoing conductor 67. Therefore, so long as the arc chute 31 is in its normal operating position, the magnetizing winding 11 is energized.

However, as illustrated in Fig. 5, when the arc chute is tilted or raised to its full upper position, the curved portion 57 of contact finger 55 releasably latches the detent 63 of the arc chute 31 in its upper position, thereby disengaging the contact finger 55 from the raised portion 54 of the supporting bracket 22. Just as soon as the contact finger 55 is disengaged from the supporting bracket 22, the circuit for energizing the magnetizing winding 11 is interrupted.

Preferably, the contact finger 55 should be so disposed as to deenergize the magnetizing winding 11 substantially at the instant the resultant of the applied force of the contact member 15 tends to rotate the arc chute in a clockwise direction. In no case, therefore, can the magnetizing winding 11 be energized when the arc chute is tilted to its full rotated position.

From the foregoing discussion, it is obvious that winding 11 can be energized only when the applied force of the movable contact member 15 is in a counter-clockwise direction. The arc chute will thus be in its normal operating position whenever an arc exists between the contact members 15 and 16.

In Figs. 7 and 8, we illustrate a further modified form of our invention. In this embodiment of our invention, the rotation of the arc chute 31 is disposed to actuate a pivotally mounted sickle-like lever 76 having a barrier 77 on the remote end thereof for obstructing the path of the contact members 15 and 16 when the arc chute is in its raised position. The sickle-like lever 76 is pivotally mounted, at a point 78, on a bracket 81 that is secured to the supporting bracket 22 by means of a rivet 82.

As illustrated, one end of a coil spring 85 is inserted through an opening 84 in the upper end of the sickle-like lever 76, and the other end is connected to a projection 83 at the rear end of the bracket 81. The biasing force of the spring 85 is such as to rotate the arc chute in a clockwise direction when the arc chute is raised, but in a counter-clockwise direction when the arc chute is in its normal position. When the arc chute is in its normal operating position, the force applied at the arcuate surface 80 of the sickle-like lever 76 upon the complementary arcuate surface 79 of the rear end of the extending portion 75 of the arc chute 31 is such that the arc chute is retained in its normal operating position. Just as soon as the arc chute 31 is raised a predetermined small amount, the applied force at the surfaces 80 and 79 changes relative to the trunnions 52 and 53 and rotates the arc chute in a clockwise direction. Movement of the arc chute 31 causes the surfaces 79 and 80 to become disengaged and allows the spring 85 to bias the barrier 77 of the sickle-like lever 76 upwardly between the contact members 15 and 16. The full raised position of the arc chute is illustrated in Fig. 8, and in this position the arcuate surface 79 of the rear end of the extending portion 75 of the arc chute 31 engages a suitable arcuate recess

86 of the sickle-like lever 76. In this embodiment of the invention the barrier 77 positively obstructs the path of the contact members 15 and 16, even though the arc chute 31 may be totally removed.

Therefore, we have disclosed in the preferred and in the modified forms of our invention, means for preventing the closing of the contact members of a switch, as well as for deenergizing the magnetizing winding of the switch, when the arc chute 10 that houses the contact members is moved from its normal operating position.

Since certain changes may be made in our invention without departing from the spirit and scope thereof, it is intended that all matters contained in the foregoing description and shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

We claim as our invention:

1. In a circuit interrupter, in combination, a 20 pair of relatively movable contact members, a pivotally mounted arc chute disposed in cooperative relation with said contact members, and means actuated by a movement of the arc chute to an inoperative position to positively prevent 25 the closing of the contact members.

2. In a circuit interrupter, in combination, a pair of relatively movable contact members, an arc chute for housing the contact members, and means for so mounting the arc chute that it may 30 be moved to expose and to positively prevent the closing of the contact members when in the position to expose the contact members.

3. In a circuit interrupter, in combination, a pair of relatively movable contact members, an arc chute disposed in cooperative relation with 35 the contact members, said arc chute including a chamber and an obstructing portion, and means for so pivotally mounting the arc chute so as to cause the chamber to expose, and the obstruct- 40 ing portion to prevent the closing of, the contact members when the arc chute is rotated.

4. In a circuit interrupter, in combination, a pair of relatively movable contact members, an arc chute disposed in cooperative relation with 45 the contact members, said arc chute including an obstructing portion, means for pivotally mounting the arc chute, and means controlled by the obstructing portion to prevent the closing of the contact members when the arc chute is 50 rotated.

5. In a circuit interrupter, in combination, a pair of relatively movable contact members, an arc chute disposed in cooperative relation with 55 the contact members, and means for pivotally mounting the arc chute, the arc chute being so shaped that a portion of it prevents the closing of the contact members when said arc chute is rotated.

6. In a circuit interrupter, in combination, a 60 pair of relatively movable contact members, an arc chute disposed in cooperative relation with the contact members, said arc chute being so shaped that the sides thereof extend rearwardly, means for interconnecting the rearward ends of 65 said sides, and means for so pivotally mounting the arc chute as to cause the interconnecting means to prevent the closing of the contact members when the arc chute is rotated.

7. In a circuit interrupter, in combination, a 70 stationary and a movable contact member, an arc chute disposed in cooperative relation with the contact members, said arc chute being so shaped that the sides thereof extend rearwardly, means interconnecting the rearward ends of said 75

- sides, and means for so pivotally mounting the arc chute as to cause the interconnecting means to prevent the closing of the contact members when the arc chute is rotated from its normal operating position, said interconnecting means being also so shaped and so positioned that, in the event the arc chute is not fully rotated to its normal position, the movable contact member engages, and imparts a force upon the interconnecting means in such manner as to rotate the arc chute to its normal operating position.
8. In a circuit interrupter, in combination, a stationary and a movable contact member, an arc chute disposed in cooperative relation with the contact members, means for pivotally mounting the arc chute, and means so associated with the arc chute that, in the event the arc chute is not fully rotated to its normal operating position, the movable contact member engages, and imparts a force upon, said associated means in such manner as to rotate the arc chute to its normal operating position.
9. In a circuit interrupter, in combination, a pair of relatively movable contact members, an arc chute for housing the contact members, means for mounting the arc chute whereby it is free to be moved to expose the contact members, and means introduced upwardly between the contact members for preventing the closing of the contact members.
10. In a circuit interrupter, in combination, a pair of relatively movable contact members, an arc chute for housing the contact members, means for mounting the arc chute whereby it is free to be moved to expose the contact members, and means introduced upwardly between the contact members, and controlled by the arc chute, for preventing the closing of the contact members.
11. In a circuit interrupter, in combination, a pair of relatively movable contact members, an arc chute having a chamber and a projecting portion therefrom, said chamber being disposed to house the contact members, means for mounting the arc chute whereby it is free to be moved to expose the contact members, and means introduced between the contact members and controlled by the projecting portion for preventing the closing of the contact members.
12. In a circuit interrupter, in combination, a stationary and a movable contact member, an arc chute disposed to house the contact members, means for actuating the movable contact member, said means including a magnetic circuit and an energizing winding, means for pivotally mounting the arc chute, means governed by the rotation of the arc chute for controlling the energization of the said winding and for opposing the attractive force of the movable contact member, thus constraining the movable contact member for engaging the stationary contact member,

means for causing the opposing force of the movable contact member to rotate the arc chute and means for causing said winding to be energized only when the opposing force of the movable contact member tends to rotate the arc chute to its normal operating position.

13. In a circuit interrupter, in combination, a stationary and a movable contact member, an arc chute disposed to house contact members, means for attracting the movable contact members towards the stationary contact members, means for pivotally mounting the arc chute about a fulcrum, means governed by the arc chute for opposing the attractive force of the movable contact member, thus constraining the movable contact member from engaging the stationary contact member, means for causing the opposing force of the movable contact member to rotate the arc chute and means for adjusting the position of the fulcrum.

14. In a circuit interrupter, in combination, a pair of relatively movable contact members, an arc chute when in normal position for housing said contact members, said chute having an inner surface provided with a plurality of ridges disposed substantially transversely to the travel of the arc passing between the contact members and a projecting portion adapted to prevent the closing of said contact members when said chute is moved from its normal contact-member-housing position.

15. In combination with a switch structure including a stationary contact member and a movable contact member, a pivotally mounted arc chute having such configuration that when in one position said chute will cooperate with the contact members and when in another position said chute will positively prevent closing of said contact members.

16. In combination with a switch structure including a stationary contact member and a movable contact member, a pivotally mounted arc chute adapted when in one position to cooperate with said contact members and a barrier actuated by said chute and adapted to move between the contact members when said chute is actuated to a non-cooperating position with reference to the contact members.

17. In a circuit interrupter, in combination, a pair of relatively movable contact members, an arc chute having a chamber and a portion projecting therefrom, means for pivotally mounting said chute, said chamber being disposed to house said contact members when said chute is in one position and to expose said contact members when in another position, said projecting portion being adapted to prevent relative movement of said contact members when said chute is in the position exposing the contact members.

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