Oct. 21, 1941. C. E. MOSLEY 2,260,084

ELECTRICAL CUTOUT

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FIG. 1.

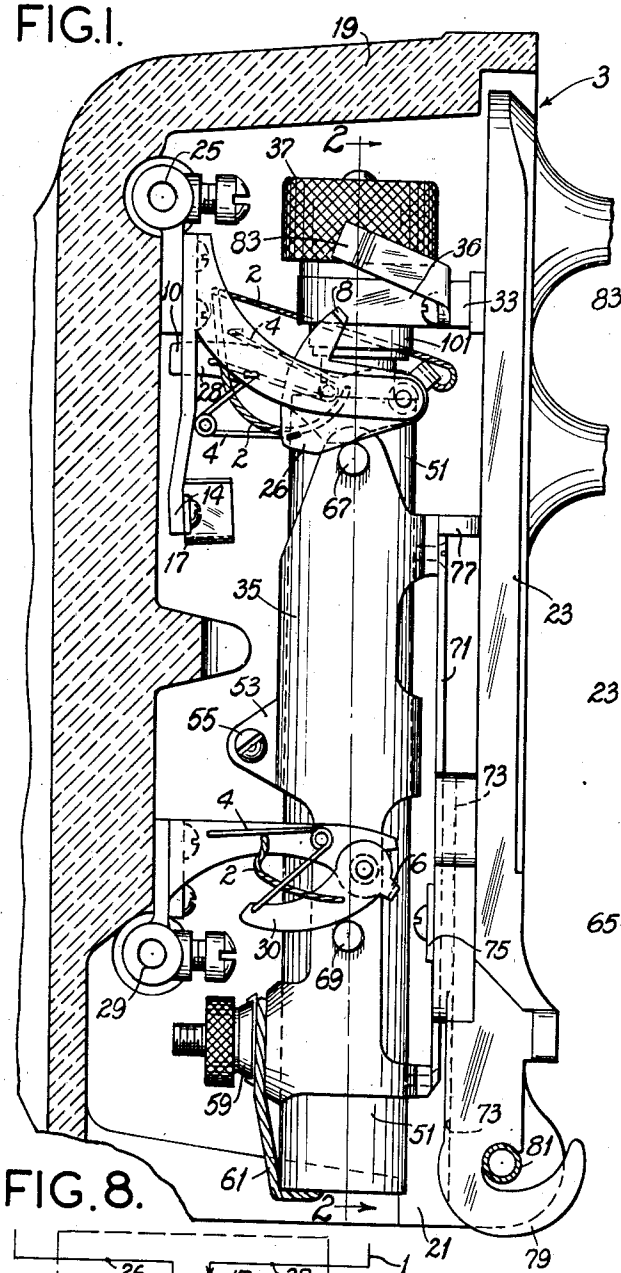


FIG. 2.

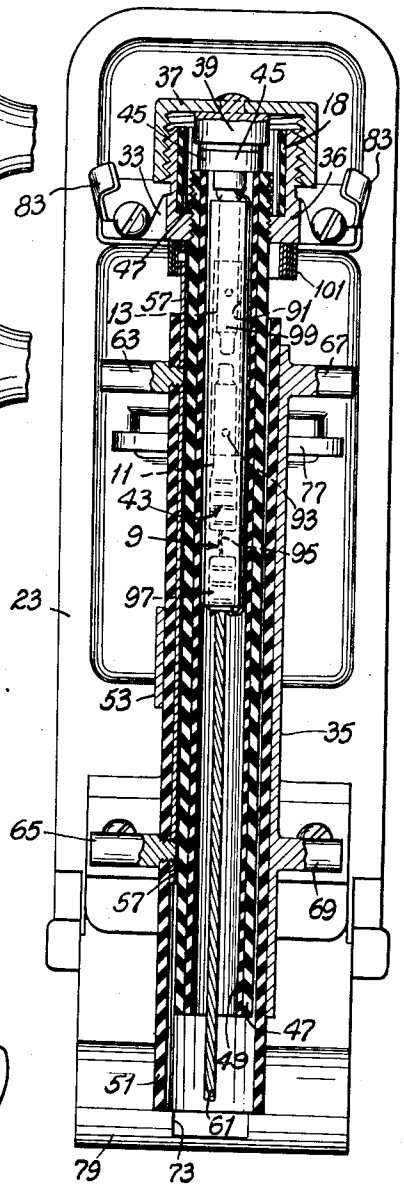
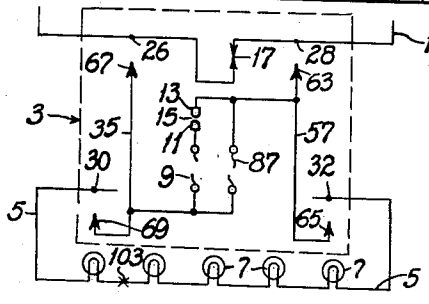


FIG. 8.



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ELECTRICAL CUTOUT

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FIG.3.

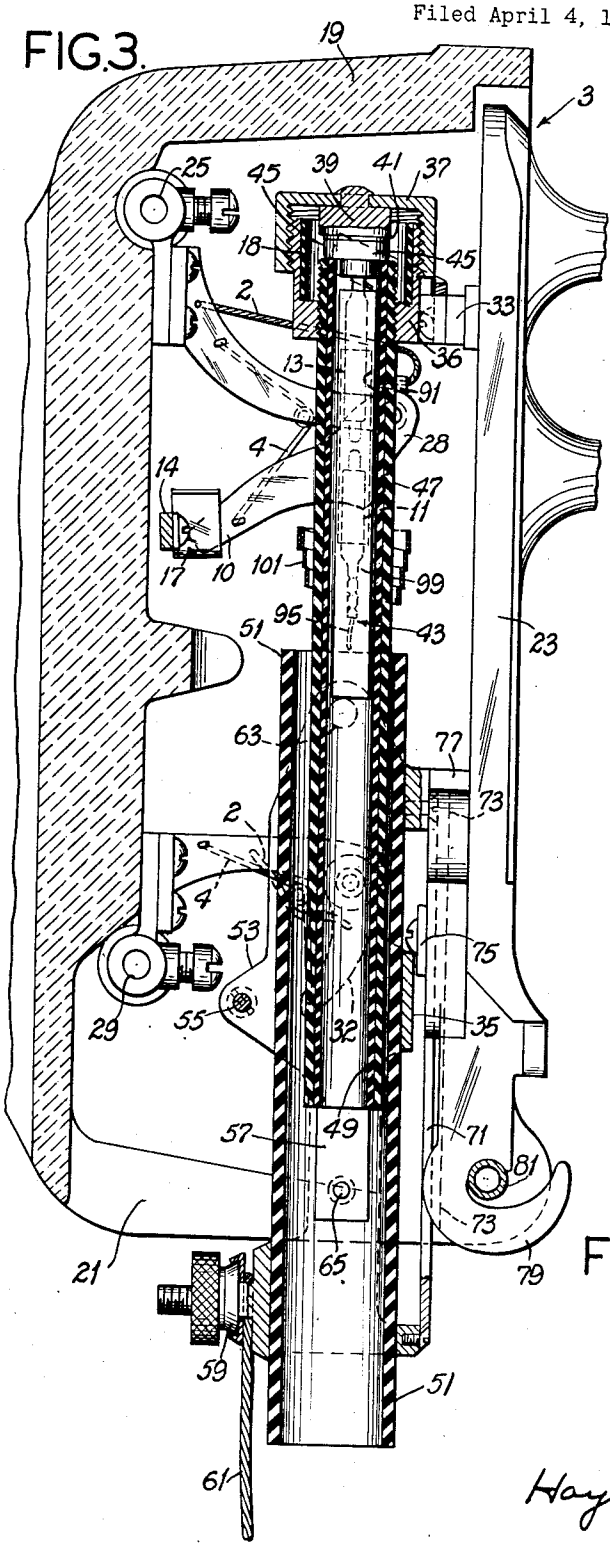


FIG.6.

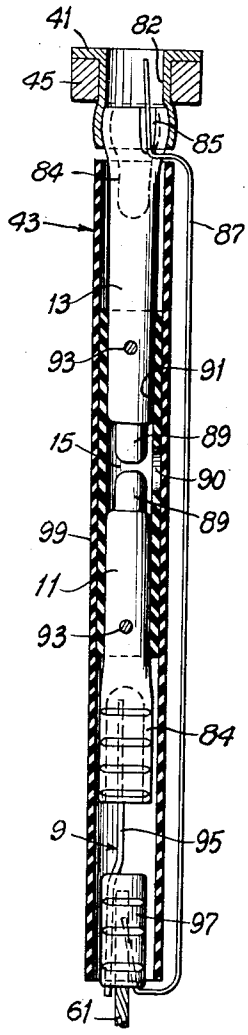
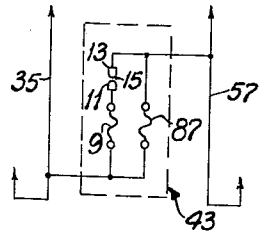


FIG.9.



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ELECTRICAL CUTOUT

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FIG.4.

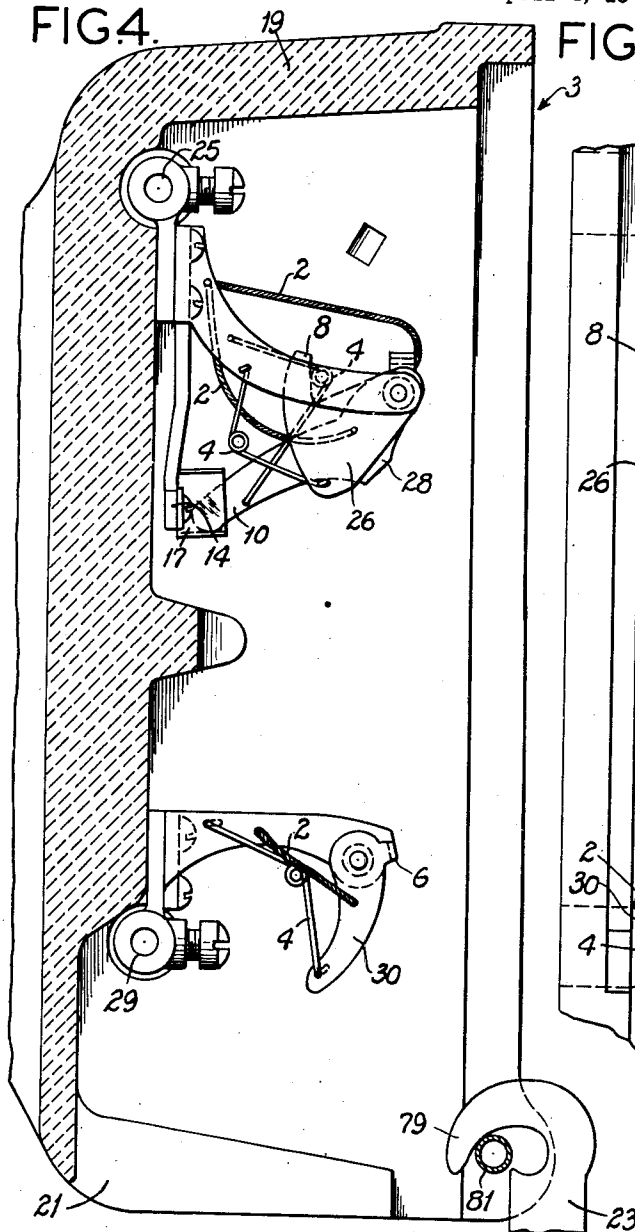


FIG.5.

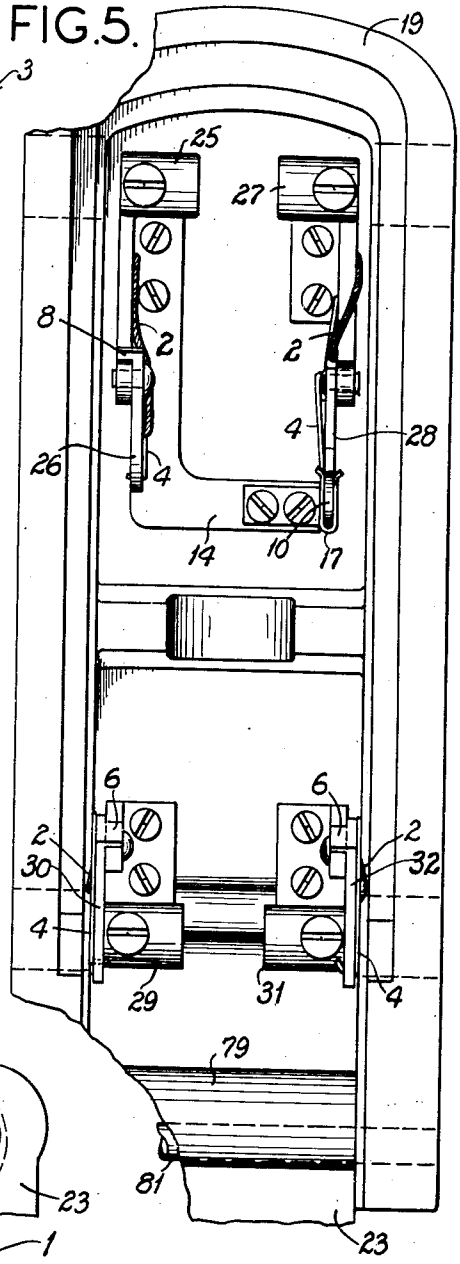
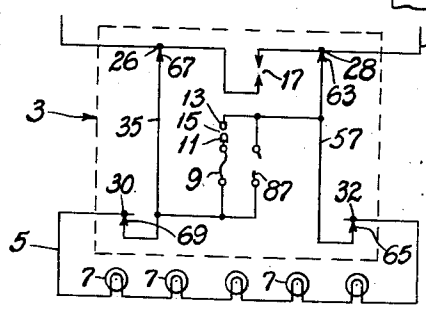


FIG.7.



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Haynes, Koenig and Wolf, Attorneys.

Patented Oct. 21, 1941

2,260,084

UNITED STATES PATENT OFFICE

2,260,084

ELECTRICAL CUTOUT

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Application April 4, 1940, Serial No. 327,775

24 Claims. (Cl. 200—118)

This invention relates to cutouts, and with regard to certain more specific features, to electrical cutouts for constant-current circuits.

The invention is an improvement over that disclosed in the United States Patent 2,068,510 of R. R. Pittman, dated January 19, 1937.

Among the several objects of the invention may be noted the provision of a cutout having improved contacts which are arranged for better operation in apparatus of this particular class, and more particularly the provision of contacts which will not arc upon reclosing; the provision of a switch of the class described which places the arc attendant upon a closing function in a location away from contacts; and the provision of apparatus of this class which will suppress the arc. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which is illustrated one of various possible embodiments of the invention,

Fig. 1 is a vertical section taken through a switch box, parts being shown in elevation;

Fig. 2 is a vertical section taken substantially on line 2—2 of Fig. 1;

Fig. 3 is a view similar to Fig. 1, but more parts being shown in section and moved into a fuse-blown position;

Fig. 4 is a view similar to Fig. 1 fragmentarily showing a cover rotated into open position and about to be removed;

Fig. 5 is a right-side elevation of Fig. 4;

Fig. 6 is an enlarged longitudinal section of a fuse link;

Fig. 7 is a wiring diagram showing conditions when the cutout is closed and normally operating;

Fig. 8 is a wiring diagram similar to Fig. 7 showing conditions when the cutout is open; and,

Fig. 9 is a wiring diagram of a fuse holder when separated preparatory to reclosing a circuit.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

As stated in said Pittman patent, it is known that loop street-lighting circuits and the like have their load elements (lamps) arranged in a series and are energized from a constant-current main supply circuit, whereby the number of load elements may be varied to meet demand, without changing the current characteristics of any load element. These are sometimes called series, street-lighting circuits.

The Pittman patent discloses a device for restoring the continuity of a main circuit, following the occurrence of a fault in a series loop circuit, by disconnecting and electrically isolating the loop circuit. Therefore a broken and fallen conductor does not remain under potential from the main circuit. This has eliminated hazard to life and property attending this condition.

The Pittman patent shows that the main line switch (17 in the patent) is opened when the loop circuit is connected or closed in. It is one of the purposes of the present invention to prevent arcing upon this re-opening of the main circuit switch under an extended range of conditions.

Referring now to the drawings (Figs. 1 and 7 in particular), there is shown at numeral 1 a main circuit which is equipped with apparatus such as a constant-current transformer or the like (not shown) for maintaining a constant current in said circuit 1.

At numeral 3 is generally indicated the type of cutout to be disclosed in detail herein, and which connects said main circuit 1 with a series, loop circuit 5, such as is used, for example, in street lighting. The series circuit 5 has connected in series therein a number of lamps or load devices 7. The number of lamps 7 is subject to variation. When the resistance of the series circuit 5 is changed, as by changing the number of lamps, the constant-current-maintaining apparatus in the main circuit 1 also maintains a constant current in the branch circuit 5. The voltage is changed according to the potential necessary for forcing current through the different resistances effected by changing the number of lamps. It will be understood that any changes made in the number of lamps should not involve leaving the circuit open.

One of the hazards associated with the circuit 5 is its opening by means of a broken wire. Under this condition current ordinarily ceases to flow around the branch circuit, but may find its way to ground over the broken wire and through agencies such as the body of one who touches the wire or otherwise undesirably. At the same time the resistance of the grounded circuit may be so high that, in order to maintain its constant current output, the main circuit applies a dangerous voltage through the ground.

The cutout 3 broadly comprises conducting means 35 and 57 for disconnecting the branch circuit 5 from the main line or circuit 1, said means 35 and 57 being releasable to disconnecting position under mechanical control of a releasing main fuse 9 or the like.

The main fuse 9 is connected across the conductors 35 and 57 and does not carry current under normal operating conditions of the branch circuit 5. This is because the fuse has in series therewith a dielectric or gap element 15 composed of adjacent electrodes 11 and 13. For the gap element, air or an insulating film of paper or the like may be used. In any event, the dielectric is calibrated, whether it consists of an air film or film of other material. The fuse 9 receives current (to cause release to disconnecting position of the conducting elements 35 and 57) if there is a breakdown of the film 15 between electrodes 13 and 11, as under a condition of predetermined voltage increase. At the same time that the disconnecting members 35 and 57 disconnect the branch circuit 5, as will be shown, the main circuit 1 is re-closed by means of a shunt switch 17 (compare Figs. 7 and 8).

A typical physical embodiment of the cutout 3 is shown in Figs. 1–6. Numeral 19 indicates a porcelain insulating box having an open bottom 21 and a door 23. Within the box 19 at its upper end are supported main line terminals 25 and 27. In the lower end of the box are supported branch line terminals 29 and 31. Each terminal 25, 27, 29 and 31 has pivoted thereto a contact member 26, 28, 30 and 32 respectively.

Between each pivoted contact member 26, 28, 30 and 32 and its respective line terminal 25, 27, 29 and 31 is a flexible pigtail conductor 2 for shunting current around the pivot means. There is also between each pivoted contact 26, 28, 30 and 32 and its respective line terminal 25, 27, 29 and 31 a spring 4 which normally forces the respective pivoted contact downward, as shown in Figs. 4 and 5.

It may be noted in connection with the lower rotary contacts 30 and 32 that they have stops 6 which prevent unlimited downward movement under action of the spring 4 (Figs. 3 and 4). Likewise, the upper rotary contact 26 has a stop 8 which prevents unlimited downward movement (Fig. 4). The rotary contact 28 has a special downward stop in blades of switch 17.

On the door 23 is a support 33 for a hollow conducting head 36, over the open upper end of which is threaded a conducting cap 37. The cap 37 includes a conducting hold-down anvil 39 which when the cap is screwed into place is adapted to contact the conducting head 41 of a fuse link which is shown in general at 43 (Fig. 6) and which will be particularized later. The head 41 of the link includes a conducting ferrule 45 which seats upon the upper end of a fiber tube 47. The head 36 is lined with insulation 18. The insulating tube 47, which is lined with horn fibre 49, is threaded into the conducting head 36. It has an inner horn fibre liner which, if an arc is drawn therein, engenders arc-extinguishing gases.

Sliding on the outside of the tube 47 is a second tube 51 to which is exteriorly clamped the conductor 35. Clamping is accomplished by a springing central belt 53 and a clamp screw 55.

The lower end of the conductor 35 carries a screw clamp 59 for holding the flexible conducting end 61 of the fuse link 43. Normally the link end 61 is given a hair-pin turn around the end of the tube 51 and after being clamped at 59 holds up the tube 51 as shown in Fig. 1.

The conductor 57 is located on the opposite side of the conductor 35 but is inside of the tube, thus providing maximum insulation between the conductors 35 and 57. This conductor 57 is fastened to the tube 51 by upper and lower conducting contact pins 63 and 65 respectively, adapted to contact with the rotary contacts 28 and 32 respectively upon the line terminals 27 and 31.

Riveted to the upper end of the conductor 57 but outside of tube 51 is a bronze, telescoping, spiral spring 101, which when the conductor 57 is an elevated position contacts the conducting head 36 and is compressed as shown in Figs. 1 and 2. The spring 101 is conducting. When the tube 51 is released, this spring 101 aids in starting the tube down and breaks contact with the head 36 as shown in Fig. 3.

Coaxial with the contact pins 63 and 65, but on the opposite side of the tube 51 and forming part of the conductor 35, are contact pins 67 and 69 which respectively are adapted to come into contact with the rotary contacts 26 and 30 (see Fig. 1).

In order additionally to guide the tube 51, it is provided with a slip shoe 71 which slides within a groove 73 and is caged therein by a cross bar 75. At the upper end of the shoe 71 is a cross-head 77, which slides on the back of the door 23. Thus it will be seen that the outer tube 51 may slide from the position shown in Figs. 1 and 2 to the position shown in Fig. 3. In moving down, the contact pins 63, 67, 65 and 69 move out of contact with their respective rotary contacts 28, 26, 32 and 30. Compare Fig. 1 with Fig. 3 and Fig. 7 with Fig. 8. The tubes 47 and 51 constitute a telescoping fuse holder, the tube 47 being rigidly held at its upper end to the door 23 by means of the support 33.

The rotary contact 28 is special in that it has the extension 10 which when the tube 51 drops falls into contact with the spring clips of switch, the latter being 17 on an extension 14 of line terminal 25. This closes the main circuit through 25, 14, 17, 28 and 27 whenever the tube 51 is down or the door open. As long as the tube 51 is up and the door shut, the switch 17 is open (Fig. 1). When the tube is down, the switch 17 is closed (Fig. 3). When the door 23 is open, the switch 17 is closed (Fig. 4).

The door 23 is provided at its lower end with a hook 79 for hooking the door when inverted over a cross pin 81. Hooking may be accomplished when the door is inverted as shown fragmentarily in Fig. 4. Thereafter the door may be rotated shut. Friction spring detents 83 which ride springingly on the inside of the box 19 hold the door shut after it is once closed.

The fuse link 43 is new both per se and in combination with the features above described (Fig. 6). It constitutes said conducting head 41 which is in the form of a tube flanged at the top and surrounded by the ferrule 45. The tubular part is shown at numeral 82. The gap members 13 and 11 are constructed as metal cylinders which are hollow at their outer end, as indicated at 84. The hollows are to permit flattening out of the ends of the cylinders for crimping purposes. Besides, the upper cylinder 31 has an outer notch 85 for receiving the end of a fusible resistance wire 87 which constitutes an auxiliary fuse. Conductive assembly at the top of the fuse link is accomplished by inserting the end

of the fusible resistance 87 into the notch 85, then inserting the hollow end of the member 13 into the then round ferrule 84. Then the organization is flattened below the ferrule, thereby holding in clamped conducting relationship the parts 84, 13 and 87. It is to be understood that the members 13 and 11 are conductors. The lower end of the member 13 is provided with a calibrating extension 89 as is the upper end of the conductor 11. A spaced calibrated relationship is maintained by an insulating tube 91 held by pins 93 through the members 13 and 11. An opening 90 in tube 91 allows the insertion of a calibrating thickness gage while the fastenings 93 are applied.

Crimped in the lower hollow end 84 of the member 11 is the end of a fusible element 95. Holding is effected by insertion of the fuse 95 in the hollow end 84 and flattening and crimping. The lower end of the fusible element 95 is crimped with the conductor 61, together with the lower end of the fusible resistance 87. This is done within a crimped ferrule 97. Prior to crimping in the lower end of the member 87 there is slipped over the tube 91 a second insulating tube 99. The diameter of the tube 99 is less than the inside diameter of the tube 49 by an amount adapted to accommodate therebetween the wire 87. It covers the opening 90.

Operation is as follows:

The door 23 is removed along with the fuse holder constituted by the tubes 47 and 51. The cap 37 is unscrewed and the flexible tail 61 of the fuse link 43 is fed through the tube 47 from the top. This seats the head 41, 45 of the fuse link on the upper end of the tube 47. Then the cap 37 is threaded into position to contact with the head 41, 45.

This places the tube 99 within the tube 47 with the wire 87 between the tubes. It also causes the flexible conductor 61 to extend downward from tube 51. After pushing up the tube 51, the lower end of the conductor 61 is turned and wrapped around a clamp 59 and held in place. The door then is inverted, applied to the pivot 81 (Fig. 4), and rotated to closed position (Fig. 1). Since the contact pins 63, 67, 65, 69 are at this time held in elevated position, they cooperate with the rotary contacts 28, 26, 32, 30 respectively, to rotate the latter into the spring tensioned positions shown in Fig. 1. In connection with the contact 28, this opens the switch 17 after a shunt circuit is established through 87, thereby opening the main line 1 (Fig. 7). At this time, the loop circuit is in series connection with the main circuit, also as illustrated in Fig. 7.

Before closing the door the electrical parts in connection with the fuse holder were as shown in Fig. 9, that is, with the fuse element 9 and the fusible resistance 87 unbroken. As soon as the door is closed, as above described, the fusible resistance 87, which by-passes the fuse 9 and the dielectric 15, is placed in shunt connection with the closed switch 17 and also with respect to the load 7. Then as the door is pressed to its final closed position and the switch 17 is opened, the voltage which would otherwise cause arcing at the switch 17 sends current through the fusible element 87 which, after the switch 17 opens, heats and breaks within the horn fibre liner 49 of tube 47, where any arc tends to be extinguished. The switch 17 opens without arcing. Finally the condition is reached shown in Fig. 7 wherein current flows from the main line to the line terminal 25, then through the contacts 26, 67, conductor 35, contacts 30, 69, loop circuit 5, contacts 32, 65, conductor 57, contacts 63, 28 and back to the main line. Thus, the normal connected condition of the parts as shown in Fig. 7 is with the wire 87 broken. Its function is to relieve the switch 17 of arcing upon reclosing.

If, as shown in Fig. 8, a break occurs in the loop circuit at a point such as 103, the voltage of the loop circuit immediately rises, in view of the tendency to keep up the flow of current by means of the current transformer. This increases the voltage on the gap 15 (between 13 and 11) which finally breaks down, thus permitting flow of current through the fuse 9 which fuses or blows. The arc due to the blowing of this fuse also tends to be extinguished in the horn fibre liner 49 of tube 47.

As soon as the fuse 95 breaks, the flexible conductor 61 is released, thereby releasing the outer tube 51 so that it is both pushed by the spring 101 and gravitates downwardly as shown in Fig. 3. Its extension from the opening 21 in the bottom of the box indicates a blown condition. At the same time it lets down all of the rotary contacts 26, 28, 30 and 32. This includes the extension 10 of the contact 28 which recloses the switch 17 to close the main circuit 1. The separation of the contact pins 63, 67, 65, 69 from the contacts 28, 26, 32, 30, respectively, results in entirely disconnecting the series loop circuit from the potential of the main circuit and making the loop circuit safe.

An example of values for various items is as follows:

Assume two, 2500 lumen lamps in the loop circuit 5 to provide a total E. M. F. of approximately 46.2 volts. At 6.6 amperes flowing through the loop circuit alone, as provided by the constant-current transformer, the resistance of the loop circuit (disregarding the IR drop of the line wires and assuming a D. C. circuit) is

$$\frac{46.2}{6.6}$$

or 7 ohms.

Assuming that the total constant current of 6.6 amperes flows over the conductor 35, it will divide, provided the resistance 87 is intact, a portion flowing through the loop and the remainder through 87 (before the switch 17 opens upon closing the door 23). The amount of current flowing through the two legs depends upon the resistance of each leg. The resistance of 87 is determined, and in the present example by measurement, is, say, 2.7 ohms. Then by calculation:

The current through the 7 ohm loop is

$$\frac{2.7}{9.7}\times 6.6 = 1.838 \text{ amperes}$$

The current through 87 is

$$\frac{7}{9.7}\times 6.6 = 4.762$$

Tests indicate that under the above conditions the resistance 87 melts in about 3 seconds, with about 2.5 amperes flowing through it. This spans the time during which the door closing operation is completed. Therefore it may be seen that fuse 87 will always burn out, because as the loop voltage increases, the resistance of the loop will also increase, while the resistance of 87 remains constant. In other words, as the loop resistance increases, the current through 87 will increase. The fuse 87 also completes burning

out only after the switch 17 opens, under operating conditions.

In the case of an open loop, all of the 6.6 amperes of line current will pass through 87 which is about twice the current necessary to melt it. When the loop is closed and after 87 has burned out, all of the 6.6 amperes of line current flow through the lamps.

It will be understood that similar computations apply to A. C. circuits if suitable corrections are made for power factor.

The lined tube 47 is an expulsion tube for all arcs that may be struck from the fuse 43, including arcs from parts 89, 95 and 87.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in carrying out the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A cutout comprising a fuse mechanism having open circuit and closed circuit positions, a fuse in said fuse mechanism adapted when unfused to prevent movement of said mechanism from closed circuit position, but when fused permitting movement of the mechanism to open circuit position, a dielectric element serially arranged with said fuse and adapted to break down to effect flow of current through the fuse only upon a predetermined voltage, and a second fusible element shunting the serial combination of said fuse and dielectric element.

2. A cutout comprising a fuse mechanism having open circuit and closed circuit positions, a fuse in said fuse mechanism adapted when unfused to prevent movement of said mechanism from closed circuit position, but when fused permitting movement of the mechanism to open circuit position, a dielectric element serially arranged with said fuse and adapted to break down to effect flow of current through the fuse only upon a predetermined voltage, and a second fusible element shunting at least the dielectric element.

3. A cutout comprising a fuse mechanism having open circuit and closed circuit positions, an expulsion tube in said mechanism, a fuse in said expulsion tube adapted when unfused to prevent movement of said mechanism from closed circuit position, but when fused permitting movement of the mechanism to open circuit position, a dielectric element serially arranged with said fuse and adapted to break down to effect flow of current through the fuse only upon a predetermined voltage, and a second fusible element shunting the serially arranged fuse and dielectric elements and located in said expulsion tube.

4. A cutout comprising a switch in a main circuit, a movable member having closed and open-circuit positions with respect to a circuit shunting said switch, said member when in closed position being adapted to open said switch and vice versa, a fuse and a dielectric element serially connected but together connected in parallel with said switch, and a fusible member shunting at least the dielectric element.

5. A cutout comprising a switch in a main circuit, a movable member having closed and open-circuit positions with respect to a circuit shunting said switch, said member when in closed position being adapted to open said switch and vice versa, a fuse and a dielectric element serially connected with one another but being together connected in parallel with said switch, and a fusible element shunting the combination of the first-named fuse and the dielectric element.

6. A cutout comprising a switch in a main circuit, a movable member having a closed and an open-circuit position with respect to a circuit shunting said switch, said member when in closed-circuit position being adapted to open said switch and vice versa, a fuse and a dielectric element serially connected but together connnected in parallel with said switch and the shunt circuit, and a fusible member shunting at least the dielectric element.

7. A cutout for connecting a main circuit with a loop circuit, comprising terminals in the main circuit, a switch in the main circuit between said terminals, a loop circuit across said terminals, a movable member operable to open and closed-circuit positions between said contacts and to connect and disconnect the loop circuit, said movable member when in loop-circuit-connecting position being adapted to open said switch and vice versa, a fuse and a dielectric element connected in series and mounted on said movable member and together shunting said switch, and a fusible resistance shunting the fuse and dielectric element.

8. A cutout for connecting and disconnecting a main circuit and a loop circuit, comprising a switch in the main circuit, movable contact means for shunt-connecting the loop circuit to the main circuit around said switch, said movable means opening the main-circuit switch when the shunt circuit is connected and vice versa, and fusible conducting means controlled by said movable means to shunt the switch as the movable means is moved into connected position, said switch opening, and the fusible means thereafter melting.

9. A cutout for connecting and disconnecting a main circuit and a loop circuit, comprising a switch in the main circuit, movable contact means for shunt-connecting the loop circuit to the main circuit around said switch, said movable means opening the main-circuit switch when the shunt circuit is connected and vice versa, fusible conducting means controlled by said movable means to shunt the switch as the movable means is moved into connected position, said switch opening, and the fusible means thereafter melting, whereby the loop circuit normally becomes the sole conducting connection across the switch, and a fusible element serially arranged with a dielectric element and connected in parallel with the switch.

10. A cutout comprising a fuse mechanism having open-circuit and closed-circuit positions to disconnect and connect respectively a loop circuit with a main circuit, a fuse in said fuse mechanism adapted when unfused to prevent movement of said mechanism from closed-circuit position but when fused permitting movement of the mechanism to open-circuit position, a dielectric element serially arranged with said fuse and adapted to break down to effect flow of current through the fuse only upon a predetermined voltage, a switch in the main circuit shunted by the loop circuit and opened when the movable member is in closed-circuit position and vice versa, and a fusible resistance carried by the movable member and shunting the switch as the

movable member moves into circuit-closing position, said fusible element melting after the switch opens.

11. A fuse link comprising a main fuse and dielectric means arranged in series and a fusible element shunting the main fuse and dielectric element.

12. A fuse link comprising a main fuse and dielectric means arranged in series, and a fusible element shunting the main fuse and dielectric element, and an insulating tube surrounding only the serial fuse and dielectric means.

13. A fuse comprising conducting ends, a fuse and dielectric element serially arranged between said ends, and a fusible element shunting both said fuse and dielectric element, and electrically connected to said ends.

14. A fuse comprising conducting ends, one of which is rigid and the other flexible, a fuse and dielectric element serially arranged between said ends, and a fusible element shunting said fuse and dielectric element and electrically connected to said ends.

15. A fuse comprising conducting ends, a fuse and a dielectric element serially arranged between said ends, and a fusible element shunting at least said dielectric element and electrically connected to said ends.

16. In a cutout, a fuse holder comprising an outer insulating tube having an inner surface which produces arc-extinguishing gases, a fuse link in said tube comprising conducting ends, a fuse and a dielectric element in series between said conducting ends, an inner insulating tube surrounding said serial elements and located within the outer tube, and a fusible element connecting said ends and located on the outside of said inner tube and within the first-named tube.

17. In a cutout, a fuse holder comprising a rigid insulating tube having an open end and inner surface which produces arc-extinguishing gases, a fuse link in said tube comprising conducting ends, one of which is flexible and extends from said open end, a fusible element and a dielectric element in series between said conducting ends, an insulating tube surrounding said serial elements and within the rigid tube, a fusible element connecting said ends and located on the outside of said inner tube and within the first-named tube, and a sliding tube outside of the rigid tube and controlled in position by said flexible end.

18. In a fuse link, a dielectric element comprising spaced electrodes of cylindric form, an insulating sleeve telescoped to said electrodes and attached thereto to predetermine the distance between electrodes.

19. In a fuse link, a dielectric element comprising spaced electrodes of cylindric form, an insulating sleeve surrounding said electrodes and attached thereto so as to predeterminately calibrate the distance between electrodes, a fuse connected to one of the electrodes, and a second sleeve surrounding the first-named sleeve and extending to surround said fuse, and a fusible element in shunt with the dielectric element and fuse.

20. In a fuse link, a dielectric element comprising spaced electrodes of cylindric form, an insulating sleeve surrounding said electrodes and attached thereto so as to predeterminately calibrate the distance between electrodes, a fuse connected to one of the electrodes, a second sleeve surrounding the first-named sleeve and extending to surround said fuse, a fusible element in shunt with the dielectric element and fuse, and conducting elements attached to the electrodes and lying substantially outside of the tubes.

21. In a cutout, a main-line switch, a movable member, contact means on the movable member connecting across said switch in certain positions and disconnecting in another position, conductive means connecting said contact means including an auxiliary fusible element, said auxiliary fusible element being adapted to burn open while said contact means is in an initial closed position across said switch, said switch being movable to open position in response to a completely closed position of the contact means across said switch and before the auxiliary fusible element has completely burned.

22. In a cutout, a main-line switch, a movable member, contact means on the movable member connecting across said switch in certain positions and disconnecting in another position, conductive means connecting said contact means including an auxiliary fusible element, said auxiliary fusible element being adapted to burn open while said contact means is in an initial closed position across said switch, said switch being movable to open position in response to a completely closed position of the contact means across said switch and before the auxiliary fusible element has completely burned, an arc-extinguishing tube surrounding said auxiliary fusible element, and a main fuse and a dielectric member serially connected in a parallel relationship with respect to the auxiliary fusible element and located in a tube which excludes said auxiliary fusible element, said last-named tube being located inside of the arc-extinguishing tube.

23. In a cutout, a main-line switch, a movable member, contact means on the movable member connecting across said switch in certain positions and disconnecting in another position, conductive means connecting said contact means including an auxiliary fusible element, said auxiliary fusible element being adapted to burn open while said contact means is in an initial closed position across said switch, said switch being movable to open position in response to a completely closed position of the contact means across said switch and before the auxiliary fusible element has completely burned, an arc-extinguishing tube surrounding said auxiliary fusible element, and a main fuse and a dielectric member serially connected in a parallel relationship with respect to the auxiliary fusible element and located in a tube which excludes said auxiliary fusible element, said last-named tube being located inside of the arc-extinguishing tube, a third moving tube outside of the first tube and movable from a position in which a loop circuit is connected and said switch is opened to a position in which the loop circuit is disconnected and said switch is closed, and a portion connected with said main fuse for holding the sliding tube in its switch-open position until said main fuse burns.

24. In a fuse link, a dielectric element comprising spaced electrodes, an insulating sleeve telescoped to said electrodes and attached thereto so as to predetermine the distance between electrodes, said sleeve having an opening adjacent to the spaced ends of the electrodes for inserting a calibrating instrument.

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