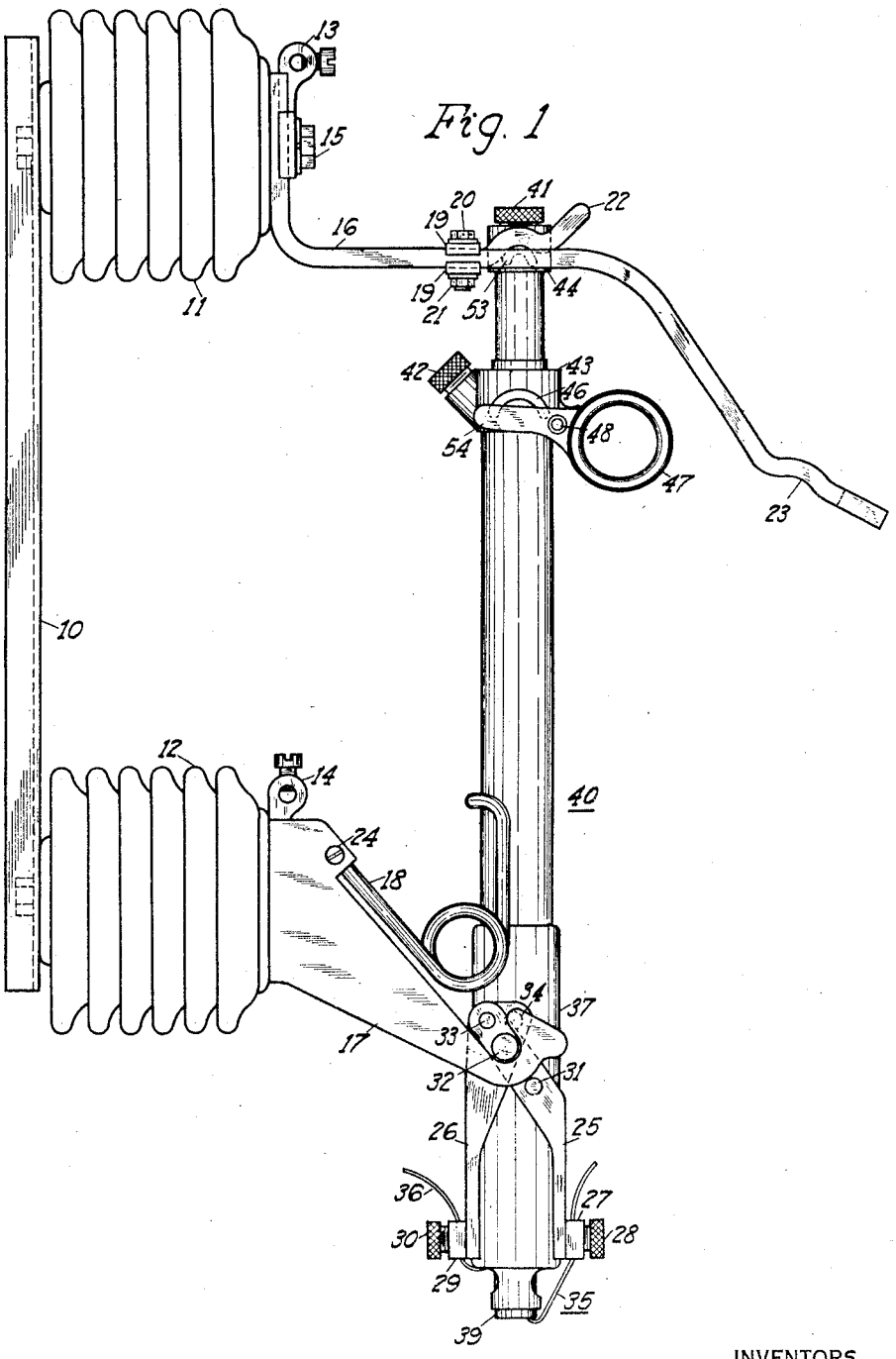
July 3, 1934. R. R. PITTMAN ET AL 1,965,391

MULTIPLE FUSE DISCONNECTING SWITCH

Filed Sept. 29, 1933 4 Sheets-Sheet 1

Fig. 1



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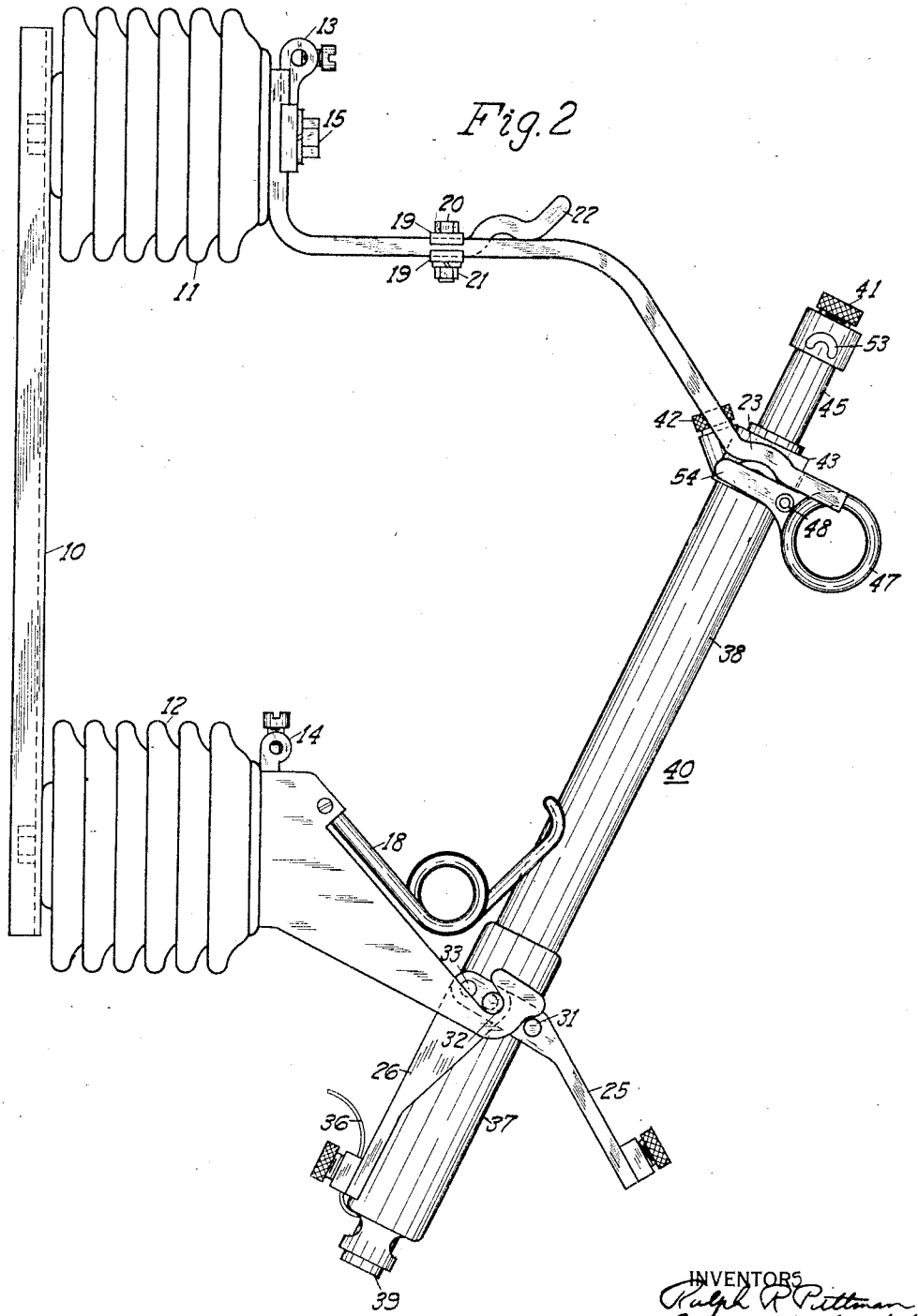
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MULTIPLE FUSE DISCONNECTING SWITCH

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Fig. 2



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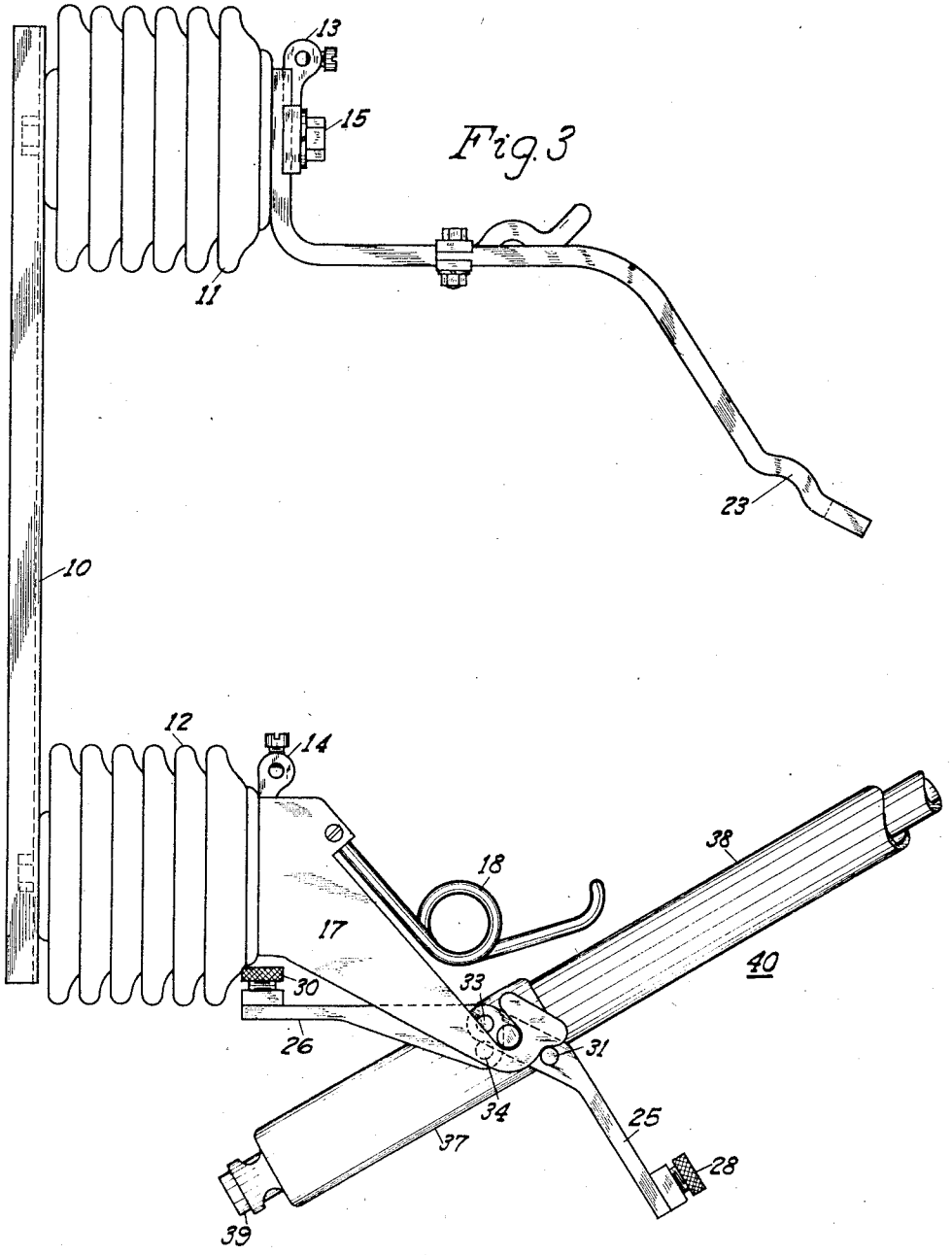
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MULTIPLE FUSE DISCONNECTING SWITCH

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Fig. 3



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MULTIPLE FUSE DISCONNECTING SWITCH

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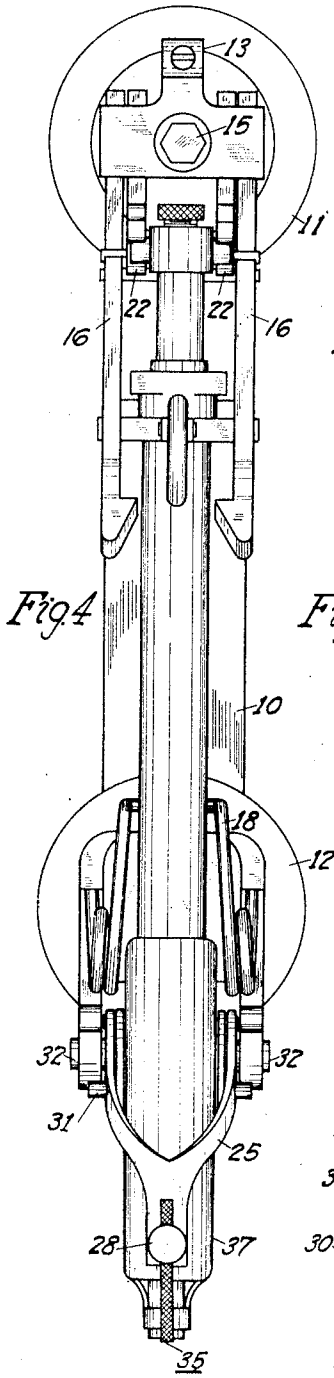


Fig.4

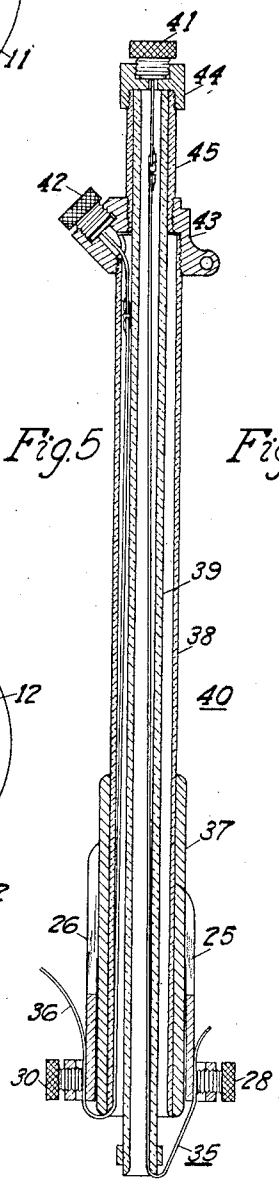


Fig.5

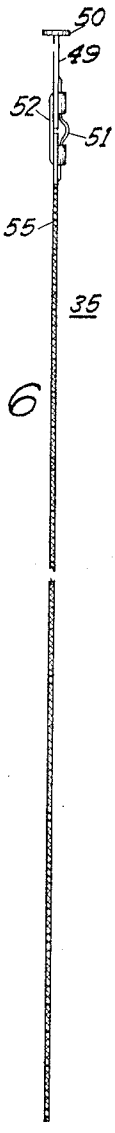


Fig.6

Fig.7

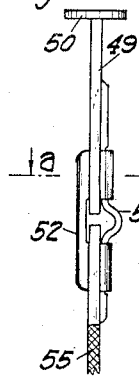


Fig.8

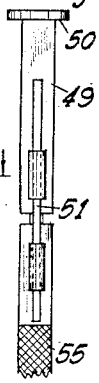
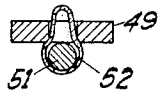


Fig. 9



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UNITED STATES PATENT OFFICE

1,965,391

MULTIPLE FUSE DISCONNECTING SWITCH

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Application September 29, 1933, Serial No. 691,496

16 Claims. (Cl. 200—126)

This invention relates generally to protective devices for electrical circuits, and particularly to fusible devices used to prevent the passage of excessive currents through said circuits.

An object of the invention is the provision of means for automatically restoring the continuity of a circuit interrupted by the operation of a fuse through the replacement in the circuit of the blown fuse by an auxiliary fuse.

A further object of the invention is a novel arrangement of parts whereby a plurality of fusible elements are disposed in a unitary structure, together with means depending upon the operation of one of the fusible elements for reclosing the circuit thus interrupted through an additional fusible element.

A further object is to provide an arrangement for automatically removing the fuse-containing structure from the circuit following the operation of all of the fusible elements contained therein.

A yet further object is the provision of a novel fuse link for use in the device, so arranged that the fusible element of the fuse link is relieved of all tension tending to pull it apart.

A further object is to provide a simple, inexpensive and effective device for the purpose described.

With the above and other objects in view which will appear as the description proceeds, our invention resides in the novel construction, combination and arrangement of parts as hereinafter described and more particularly defined in the appended claims, it being understood that such changes as come within the scope of the claims may be made in the embodiment herein disclosed.

In the drawings:

Figure 1 is a side elevational view of the device, in the service position.

Figure 2 is also a side elevational view of the device, in another service position.

Figure 3 is a fragmentary side elevational view of the device, illustrating the device in the open-circuit position.

Figure 4 is a front elevational view of the device, in the same service position as that illustrated by Figure 1.

Figure 5 is a side elevational view of the fuse housing employed in the device, shown in section.

Figure 6 is a side elevational view of a fuse link adapted for use in the device.

Figure 7 is a fragmentary side elevational view of the upper portion of the fuse link.

Figure 8 is a fragmentary front elevational view of the upper portion of the fuse link.

Figure 9 is a sectional view of the fuse link as seen from the plane indicated by the line *a—a* in Figure 7.

Referring now more in detail to the drawings, and particularly to Figures 1 and 5, the device includes the movable fuse housing 40, and a suitable support therefor. The latter comprises the metal base 10, near the respective ends of which are suitably attached the insulators 11 and 12. By any suitable means, as by the cap screw 15, a pair of forwardly and downwardly extending resilient metal arms 16 are mounted on the upper insulator 11, and a terminal 13 provided for attaching an electrical conductor thereto. A contact-engaging member 22 is supported near the midpoint of the arms 16 by means of the clips 19, the bolt 20, and the nut 21. Near the outer end of the members 16, an arcuate portion 23 provides a second contact-engaging portion. In this manner the upper insulator 11 supports a resilient contact member provided with two contact-engaging portions, and arranged for connection to an electrical conductor.

The lower insulator 12 supports in any suitable manner a pair of downwardly and forwardly extending metal members 17, each of these members being provided with hooked end portions in axial alignment. A terminal 14 is electrically connected to the members 17 to make possible their convenient connection to an electrical conductor. Near the upper end of the members 17 an integral portion of each member is bent to form a hollow cylindrical portion, and the openings thus provided are arranged to receive the respective ends of the spring 18, the latter being held in place by the set screws 24.

We will now describe the fuse housing 40, which is illustrated more in detail in Figure 5. The embodiment here illustrated includes two tubes of hard fiber, or any other suitable insulating material, which are assembled in coaxial relation one within the other. The outer tube 38 has an internal diameter somewhat greater than that of the outside diameter of the inner tube 39, in this manner providing an annular space between the outer surface of the inner tube 39 and the inner surface of the outer tube 38. The lower end of the inner tube 39 extends downwardly below the end of the outer tube 38, and is held rigidly in coaxial relation with the latter by means of the metal cylindrical casing 37, the latter being rigidly attached to the outer surface of the outer tube 38, and provided with a coaxial downwardly extending portion arranged to embrace the outer surface of the inner tube 39. To avoid closing

the annular space near the lower ends of the tubes, the downwardly extending portion of the casing 37 is fixed thereto by integral spaced connecting members.

The upper end of the inner tube 39 extends somewhat above the end of the upper end of the outer tube 38, and at its uppermost portion has secured thereto by means of cooperating threads the metal member 44. The latter, together with the plug 41, which is arranged to be screwed into the member 44, forms a convenient means for connecting a fuse link at the upper end of the inner tube. The metal member 43 is rigidly attached near the upper end of the outer tube 38 by means of cooperating threads, and is arranged to entirely close the opening formed by the annular space between the inner tube 39 and the outer tube 38. A threaded opening is provided through the member 43 to permit the insertion of a fuse link into the abovementioned annular space, and the plug 42 is adapted, by means of threads cooperating with threads provided in the abovementioned opening, to close the opening, and to assure proper electrical contact with the upper terminal of the fuse link.

It will be seen that, except for an electrical connection through the fuse links, the members 43 and 44 are electrically insulated from each other by the length of insulating tube 45 interposed therebetween. As shown in Figure 1, the member 44 is provided with the laterally extending portions 53 adapted to engage the contact surface 22, and the member 43 with the laterally extending portions 46 adapted to engage the contact surface 23.

Referring further to Figure 1, and also to Figure 4, it will be seen that the fuse housing 40 is provided at the lower end thereof with a pair of levers 25 and 26, each of which is provided at the lower end with the respective fuse terminals 27 and 29, the latter being provided with threads for cooperating with similar threads on the respective plugs 28 and 30 for the purpose of securing the lower ends of the fuse links 35 and 36 respectively. The lever 25 is provided with a pair of pivots 32, extending outwardly and rigidly attached to the lever 25. These pivots are arranged to cooperate with the hooked end portions of the members 17. In addition, the lever 25 is also pivotally connected to the lever 26 by means of the pivots 33. The lever 26 is in turn pivotally connected to the metal casing 37, by means of the pivots 34.

It will be seen that the fuse housing 40 is arranged to accommodate two fuse links; one within the inner tube 39 having its respective ends connected to the laterally extending portions 53 and the lever 25; and the other between the tubes in the abovementioned annular space having its respective ends connected to the laterally extending portions 46 and the lever 26.

Assuming that the fuse links have been installed within the fuse housing 40 as above described, and the housing installed in its mounting, the device will appear as illustrated in Figure 1. If the device is now connected in series relation with a circuit to be protected, it will be seen that the current will be transmitted through the device by the fuse link 35, which is within the inner tube 39.

In case an over-current condition causes the fuse link 35 to rupture, the lever 25, under the downward force of both the resilient members 16 and the weight of the fuse housing 40, rotates about the pivots 33, this action causing the fuse housing 40 to move downward a sufficient distance to disengage the contact surface 22, at which point the downward movement of the housing 40 is stopped by the engagement of the pins 31, which are rigidly fixed on the lever 25, with the ends of the hook members 17. The housing is then caused to rotate about the pivots 32 under the bias of the spring 18. The resilient contact-carrying arms 16 are spaced apart for a distance greater than the diameter of the upper end of the housing 40 to avoid frictional engagement between these parts.

The housing 40 is thus rotated in a clockwise direction about the pivot 32 until the member 43 engages the hooked end portions of the resilient contact-carrying members 16; the latter engagement stopping the movement of the housing 40. Substantially simultaneous of the stopping of the housing 40 above described, the outwardly extending portions 46 of the member 43 engage the contact surface 23 to reclose the circuit through the fuse link 36. This condition is illustrated in Figure 2.

Should an over-current condition of a character to rupture the fuse link 36 be present, the lever 26, under the downward force of both the contact-carrying arms 16 and the weight of the fuse housing 40 rotates about the pivot 33, this action causing the housing 40 to again move downward, in this case a sufficient distance to release it from the contact surface 23 and the hooks at the ends of the contact-carrying members 16, at which time the spring 18 urges the housing 40 to an open-circuit position. This condition is illustrated by Figure 3.

For convenience in manually removing the housing 40, the eye 47, pivoted on the member 43 by means of the pin 48, is provided with a yoke 54. Upon a downward movement of the eye 47, the yoke 54 urges the resilient members 16 in an upward direction, thus disengaging the housing 40 at the upper end, thereby permitting its rotation about the pivots 32 and subsequent removal from the support.

It will be seen that our device provides a housing for a plurality of fuse links, adapted to be installed or removed as a unit, and that the direction of movement is in a plane normal to the mounting structure. The device thus occupies much less space than those multiple-fuse devices employing a plurality of separate tubes mounted side by side, each tube being individually pivoted in its respective mounting. The device herein illustrated and described embodies a mounting common to all the tubes. It will be apparent that such a mounting may be provided in an arrangement in which the tubes are not necessarily in nested relation.

As mentioned above, the downward force due to the engagement of the contacts on the housing 40 with those of the resilient members 16 is transmitted in part through the fuse link 35 or 36 to the lever 25 or 26 respectively, thereby placing one of these fuse links continuously under tension. Such stress is undesirable on the fusible element of the fuse link, especially in the lower amperage sizes, as it may cause the link to fail mechanically after a certain period of time. We therefore provide the novel structure illustrated in Figures 6, 7, 8 and 9, in which the fusible element of the fuse link is relieved of tension.

Referring in detail to the abovementioned figures, 55 and 49 represent the usual conductors employed in fuse links generally, the latter member being provided in the usual manner with a

terminal-engaging button 50. The adjacent ends of the members 49 and 55 are provided with slots extending laterally therethrough, and a flexible loop of suitable insulating material, such as celluloid, mica, cambric or fiber, extends through the slots and between the members 49 and 55. The fusible element 51, preferably of some alloy melting at a relatively low temperature as compared to an unalloyed metal, extends through the loops of insulating material on the side of the members 49 and 55 opposite the connecting insulating member, and electrically connects the members. A small amount of slack is preferably left in the fusible element between the ends of the members 49 and 55, so that any tension applied to the fuse link is impressed upon the flexible insulating material 52 instead of the fusible element 51; the latter being only in compression within the loops. It will be seen that that portion of the fusible element 51 enclosed within the loops of insulating material will be at the highest temperature, since the radiation of heat due to the current through this portion of the element is restricted; therefore this portion of the element is the first to melt. The arc following the melting of the fusible element 51 may destroy the loop of insulating material by burning it, or, if the material of the loops is not inflammable, may vaporize or melt the portion of the element within the loop; either of these occurrences allowing the member 55 to move away from the member 49.

The fuse-link herein disclosed is separately claimed in our divisional application, Serial No. 698,778, filed Nov. 20, 1933.

From the above description it will be seen that our device provides several advantages not found in devices heretofore available for a similar purpose, among them being a more compact and simpler structure, a reduction in the number of parts required, and a less expensive device to construct. It will therefore be apparent to those skilled in the art that we provide a novel and improved multiple fuse disconnecting switch for the purpose described.

What we claim as our invention is:

1. A repeating fuse adapted for installation in an electrical circuit comprising insulating means supporting a swingably mounted unitary housing of insulating material, a plurality of fuse links disposed within said housing, means adapted to close said circuit through only one of said fuse links, means including another of said fuse links arranged to reclose said circuit in response to the parting of the fuse link closing the circuit, and means including a spring biasing said housing adapted to actuate said housing to an open circuit position in response to the parting of all of said fuse links.

2. In a repeating fuse, a pivoted movable member including two tubes of insulating material rigidly supported one within the other in coaxial relation, a contact common to one end of each of said tubes, additional contacts normally insulated from each other individual to the other ends of each of said tubes, fusible elements connecting said common contact with each individual contact, insulating means supporting a resilient contact member having contacts adapted to engage each of said individual contacts, means tending to swing said movable member to an open-circuit position, and means responsive to tension on either of said fusible elements for restaining the movement of said movable member to said open-circuit position.

3. A multiple-fuse disconnecting device adapted for installation in an electrical circuit comprising a mounting base, insulating means fixed to said base, a fuse housing of insulating material pivotally supported by said insulating means, said housing containing a first fuse and a second fuse, means positioning said first fuse in said circuit and said second fuse out of said circuit, means responsive to the rupturing of said first fuse for actuating said housing to a position to reclose said circuit through said second fuse and means responsive to the rupturing of said second fuse for actuating said housing to an open-circuit position, the direction of motion of said housing being swingably away from and in a plane normal to the plane of said mounting base.

4. In a switching device for an electrical circuit, a swingably mounted fuse housing containing a first fuse link and a second fuse link, means adapted to position said first fuse link in said circuit and said second fuse link out of said circuit, and means responsive to an excess-current condition in said circuit for sequentially reclosing said circuit through said second fuse link and removing said fuse housing from said circuit, said last-named means including a single pair of pivotally mounted levers on said housing having one end of each of said fuse links connected thereto and thereby restraining the movement of said levers.

5. The combination in a disconnecting device, of insulating means supporting a pivotally mounted movable member containing a first fuse link and a second fuse link, a resilient contact-carrying member supported by said insulating means, means including a first contact on said contact-carrying member arranged to close a circuit through said first fuse link, a second contact on said contact-carrying member, means responsive to the rupturing of said first fuse link adapted to close said circuit through said second fuse link and said second contact, said contact-carrying member including a pair of substantially parallel bars having inwardly folded ends whereby the motion of said movable member is stopped without increasing the tension on second fuse link.

6. A multiple-fuse disconnecting device adapted for installation in an electrical circuit, comprising a support for a movable member containing a first fusible element and a second fusible element, means positioning said first fusible element in said circuit and said second fusible element out of said circuit, means responsive to an excess-current condition in said circuit adapted to sequentially reclose said circuit through said second fusible element and to remove said movable member from said circuit, and means including a pair of hooks on said support and a cooperating pivot on said movable member adapted for rotation in said hooks whereby said movable member may be manually removed from said support.

7. An expulsion fuse comprising hollow tubes of insulating material, said tubes differing in both length and diameter, an electrode common to one end of all of said tubes supporting said tubes in nested relation one to the other, electrodes normally insulated from each other individual to each tube adjacent the other end of said tubes, and a fusible element within each tube electrically connecting said individual electrodes and said common electrode.

8. In a multiple-fuse disconnecting switch, a unitary housing for a plurality of fuse links, com-

prising a plurality of hollow tubes of insulating material of differing diameters and differing lengths rigidly supported in coaxial spaced relation one within the other, an electrode of conducting material common to one end of each of said tubes rigidly secured adjacent to the ends thereof, individual electrodes of conducting material rigidly secured adjacent to the other ends of each of said tubes, said individual electrodes being normally insulated both from each other and from said common electrode, and means including a fuse link within each of said tubes arranged to electrically connect each of said individual electrodes to said common electrode.

9. In a multiple-fuse disconnecting device, a unitary housing for a plurality of fuse links, comprising a plurality of concentrically mounted hollow tubes of insulating material of different diameters and different lengths rigidly supported in coaxial spaced relation to each other, an electrode of conducting material common to one end of each of said tubes rigidly secured adjacent the ends thereof, an additional electrode of conducting material rigidly secured to and closing the other ends of each of said tubes, said additional electrodes being insulated both from each other and from said common electrode except for means including a fuse link within each tube arranged to electrically connect each of said additional electrodes to said common electrode.

10. A multiple-fuse disconnecting switch, comprising insulating means supporting a swingably mounted unitary housing for fuse links, said housing including a first tube of insulating material and a second tube of insulating material, the said first tube having an outside diameter less than the inside diameter of said second tube, and a length greater than the length of said second tube, the said first tube being coaxially mounted within said second tube and extending therein for a distance substantially equal to the length of said second tube, an electrode of conducting material common to one end of each of said tubes rigidly secured adjacent the ends thereof, an individual electrode of conducting material rigidly secured adjacent the other ends of said tubes, said individual electrodes being insulated from each other and from said common electrode, a first fuse link extending through said first tube and connecting the individual electrode of said first tube with said common electrode, and a second fuse link extending through the annular space between said first and second tubes and connecting the individual electrode of said second tube with said common electrode.

11. In a multiple-fuse disconnecting switch, a unitary housing for fuse links, comprising a first tube of insulating material and a second tube of insulating material, the said first tube having an outside diameter less than the inside diameter of said second tube and a length greater than the length of said second tube, the said first tube being coaxially mounted within said second tube and extending therein for a distance substantially equal to the length of said second tube, an electrode of conducting material common to one end of each of said tubes rigidly secured adjacent the ends thereof, an individual electrode of conducting material rigidly secured adjacent the other ends of said tubes, said individual electrodes being insulated from each other and from said common electrode, a first fuse link extending through said first tube and connecting the individual electrode of said first tube with said common electrode, and a second fuse link extending through the annular space between said first and second tubes and connecting the individual electrode of said second tube with said common electrode.

12. The structure recited in claim 11, the opening formed by the annular space between said first tube and said second tube being entirely closed adjacent the individual electrode of said second tube.

13. The structure recited in claim 11, the opening formed by the annular space between said first tube and said second tube being entirely closed adjacent the individual electrode of said second tube, and the opening through said first tube being entirely closed adjacent said individual electrode of said first tube.

14. The structure recited in claim 11, the said common electrode being provided with an opening through which the arc products incident to the blowing of the fuse in said second tube may be vented.

15. The combination in a circuit switching device of a swingably mounted fuse housing inclosing a first fusible element normally in a circuit and a second fusible element normally out of said circuit, means biasing said housing toward an open-circuit position, and means including either of said fusible elements restraining the movement of said housing.

16. The combination in a circuit switching device of a swingably supported fuse housing inclosing a first fusible element of a first fuse link normally in a circuit and a second fusible element of a second fuse link normally out of said circuit, means biasing said housing toward a position to close said circuit through said second fuse link, and means including said first fuse link under tension restraining the movement of said housing.

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