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REPEATING FUSE DEVICE

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This invention relates to a repeating fuse device, and more particularly to a repeating fuse device of the high voltage type adapted for use in transmission lines for the distribution of electrical power.

The main object of my invention is to provide a fuse device for electrical power lines which is capable of interrupting an established circuit through a particular fuse unit, and of automatically re-establishing the circuit through another fuse unit within a short period of time following the rupture of the first fuse unit.

Another object of my invention is the provision of a fuse device of the repeating type which is completely enclosed in a weather-proof housing.

A further object of my invention is the provision of means for indicating a fuse operation in a repeating fuse construction.

Other objects and advantages relate to the particular structural arrangement of my repeating fuse construction and will appear more fully in the following description when taken in connection with the accompanying drawings, in which:

Figure 1 is a front elevational view of the fuse device of my invention;
Fig. 2 is a sectional view of the fuse device shown in Fig. 1, taken along the line II—II;
Fig. 3 is a front elevational view of the housing of my fuse device with the doors removed but showing the position of the fuse tubes with respect to the housing when the doors are in place.
Fig. 4 is a cross-sectional view of the housing taken along the line IV—IV of Fig. 3;
Fig. 5 is a side elevational view of one door of the fuse device showing a fuse unit mounted thereon;
Fig. 6 is a side elevational view of the other door of my fuse device showing a fuse unit mounted thereon;
Fig. 7 is a rear elevational view of both doors of my repeating fuse device, showing the respective fuse units in operative position;
Fig. 8 is a sectional view taken through the doors shown in Fig. 7 along the line VIII—VIII of that figure;
Fig. 9 is an enlarged sectional view of the upper portion of one of the fuse tubes or holders employed in my invention; and,
Fig. 10 is a sectional view of the fuse holder shown in Fig. 9, taken along the line X—X.

Referring to the drawings, the reference character 11 designates a weather-proof housing preferably of porcelain, or other suitable insulating material. The housing 11 is provided with doors 13 and 15 preferably hinged at their lower end to the housing 11 by means of pins 17 passing transversely through the lower ends of the doors, which pins respectively pivot in the hook-shaped hinge members 18 molded in the housing 11, as shown more clearly in Fig. 2.

The doors 13 and 15 are preferably constructed of a plastic insulating material and are provided with eyelets 21, whereby manipulation to open and closed position is facilitated. The rear side of the door 13 carries a fuse tube 23 having an upper metallic contact ferrule 25 screw threaded thereon. The fuse tube 23 is provided with a fuse link 27 the upper portion of which has a button 29 secured to between the upper edge of the fuse tube 23 and the ferrule 25. The lower end of the fuse link 27 extends exterically of the lower or open end of the fuse tube 23, and is secured to a terminal 31 carried by the stationary contact 33. The stationary contact 33 is of general sleeve-like construction through which the lower end of the fuse tube 23 extends and is preferably rigidly secured to the door 13 by screws 35.

The fuse tube 23 is maintained in position with respect to the contact 33 by means of a transverse bar 37 preferably molded or otherwise secured to an enlarged portion 39 of the fuse tube. The bar 37 rests upon the upper edge of the contact 33, thereby permitting a limited amount of both rocking and sliding movement of the fuse tube 23 in a counter-clockwise direction, as viewed in Fig. 5. Movement of the fuse tube 23 to the right as viewed in Fig. 5 is prevented by stops 41 projecting upwardly from the contact 33, and by a stop member 43 positioned adjacent the upper end of the fuse tube. The stop member 43 is preferably of insulating material and is secured as by screws 45 to the ends of two spaced guide rods 47, the other ends of which may be screw threaded into the door 13.

The fuse tube 23 is normally maintained in engagement with the stop member 43 by means of a hook 49, one end of which is fastened in an eyelet 51 provided in the fuse link 27 and which passes through a slot 53 in the upper end of the fuse tube and has its other end seated in an opening through the bar 43. Thus, while the fuse link 27 is in a normal or operative current-carrying condition, the fuse tube 23 will be held adjacent the stop member 43.

As more clearly shown in Figs. 2 and 5, the fuse tube 23 is spring biased towards the door 13 by means of a pair of springs 55 enclosed within a pair of telescopic tubular members 57, the left-
hand ends of which are preferably screw threaded into the door 13 and the right-hand ends of which are tapped for a screw 59 for securing a transverse bar 61, preferably of insulating material, thereto. It will thus be seen that these springs 53 blending means, the purpose of which will appear more fully hereafter, will move the upper end of the fuse tube 23 towards the door 13 when the fuse link 27 is ruptured due to abnormal current conditions.

The door 13 is provided with a fuse tube 63 which is similar in all respects to the fuse tube 23 except that the close 63 at the upper end has been omitted. The fuse link 27 within the tube 63 also need not have a projecting eyelet 51. The method of mounting fuse tube 63 to the door 15 is similar to that previously described in connection with the mounting of the fuse tube 23, except that the spring blending means comprising springs 55, guide telescoping tubes 57 and the bar 61, are omitted. Furthermore, the tube 63 is held in operative position against the stop bar 43 by a stationary barrier 65 which may be formed integrally with the door 15.

When the doors 13 and 15 are in the closed position, the lower stationary contacts 33 are the quiet spring pressed contact fingers 67 comprising the lower stationary contact within the housing 11. The contact fingers 67 may be mounted as shown in Figs. 2, 3 and 4 to a common terminal strip or member 69 recessed within the housing 11 as shown. One end of the contact strip 69 is provided with a terminal member 71 having screws 73 for making a line connection 75 thereto. It will thus be seen that when the doors 13 and 15 are in the closed position, connection to the lower ends of the fuse links 27 is made to one side of the line through the stationary contacts 33, the contact fingers 67, the terminal strip 69 and the connector 11. The spring pressed contact fingers 67 also serve to maintain the doors in the closed position.

Connection to the other line 71 is made to the upper ends of the fuse tubes by means of a switching arrangement, generally indicated at 79, which successively connects the fuse tube 23 to the power circuit. The switching arrangement as more clearly shown in Figs. 2 and 3, comprises a metallic contact block 81 secured in any suitable manner to an insulating block or support 83. The block 83 may be of porcelain or other suitable insulating material and is provided with a projection 85 of reduced width adapted to slide in a groove 87 provided in the rear wall of the housing 11. The projection 85 also has a triangular opening therethrough through which a triangular metallic rod 89 extends. The rod 89 preferably extends transversely of the housing 11, passing through the side walls thereof having either end threaded for the reception of nuts 91.

The contact block 81 is provided at its lower end with a laminated brush type contact 93 adapted to contact the upper end of the ferrules 25 of the fuse tubes 23 and 63 as the contact block 81 is moved from one fuse tube to the other. Movement of the contact block 81 from the right-hand side of the housing 11 to the left is automatically provided for by means of a spring 85 to the right-hand end of which may be secured to the block and the left-hand end being secured to the guide rod 89. In order to maintain the contact block 81 in engagement with either ferrule 25 of the fuse tubes 23 or 63, the contact block 81 is provided with a downwardly extending projection 97 which is adapted to extend below the upper end of the ferrules 25, and engage the right-hand side thereof, thereby resisting the tension of the spring 85 in moving the contact 93 out of engagement with the fuse tube 25. Connection from the contact block 81 to the line terminal 71 is made by means of a flexible metallic conductor 99 preferably of such length that the contact block 81 has a free movement from side to side within the housing 11. Manual movement of the contact block 81 from the left-hand side of the housing 11 to the right against the tension of spring 85 is accomplished by means of an operating rod 101, the left-hand end of which is secured to the support block 83 and the right-hand end of which extends through the side of the housing 11 and is preferably provided with a manual operating handle 103 of insulating material.

The operation of my repeating fuse device is as follows. Assuming that the fuse tubes 23 and 63 are in the operative position, as shown in Figs. 2, 5 and 6, and that the switching mechanism 79 is in the position as shown in Figs. 3, the circuit will be established from the line terminal 71 through the fletch contacts 99, slidng contact block 81, contact 93, ferrule 25, fuse link 27, stationary contact 33, contact fingers 67, contact strip 69, terminal 71 and line 75. Upon rupture of the fuse link 27 at the reduced portion above the hook 45, the fuse tube 23 will be released, permitting the biasing springs 65 to draw the upper end of the fuse tube 23 towards the door 13. In so doing, the ferrule 25 of tube 23 will clear the projection 97 of the contact block 81, thereby permitting the spring 85 to draw the contact block and its cooperating contact 93 into engagement with the ferrule 25 of the fuse tube 63, thereby establishing the circuit through the latter fuse tube. In order to decrease the frictional resistance between the ferrule 25 and the projection 97, the latter may be provided with small roller bearings 105 as shown in Figs. 2 and 3.

Upon operation of the fuse tube 23 and establishment of the circuit through the fuse tube 63, in response the fuse tube 23 of the contact 93 into engagement with the ferrule 25 of fuse tube 63, the actuating rod and the handle 103 carried thereby will be moved, the latter in a direction towards the casing 11, thereby giving a visible indication from the ground that a fuse tube operation has taken place.

When the fuse tube 23 has moved from its operative to its inoperative position, as shown in dot and dash lines in Fig. 5, and the circuit has been established through the fuse tube 63, the door 13 may be opened and removed from the housing 11 by lifting the same and clearing the pin 17 from the hinge hooks 19. The fuse link 27 may then be replaced and the tube 23 reset in its operative position.

The door 12 is now ready to be replaced upon the housing 11. In order to accomplish this, door 15 is first opened, thereby permitting movement of the contact block 81 to the extreme right side of the housing 11 by means of the operating handle 103. When the contact block 81 is in the extreme right-hand position, door 13 may be closed and the handle 103 released so as to permit the contact 93 to engage the ferrule 75 of the fuse tube 23, thereby reestablishing the circuit through the latter fuse tube. The door 15 may then be closed to place the device in readiness for a further automatic fuse operation.

In order to prevent any possible strain upon
the fuse link 27 during the closing operation of the door 13, I have provided a hinged fuse tube guide 103 which is pivotally supported on the back of the door 13 at 105, as shown in Figs. 3, 4 and 5. The inner end of the guide member 107 is adapted to maintain the fuse tube 23 in its operative position when the guide members is in the horizontal position, as shown in Fig. 5. In this position, it is readily seen that any tension upon fuse link 27 is relieved due to tendency for the fuse tube 23 to move towards the door 13. As soon as the door 13 is closed, the guide member 107 is moved to the vertical position as shown in the dotted lines in Fig. 5, thereby permitting the fuse tube 23 to rock towards the door 11 when the fuse link 27 is ruptured. From the foregoing description, it will be apparent that any number of fuse tubes may be employed so as to provide for automatically re-closing the circuit any number of times as is deemed desirable. In practice, however, it has been found that two or three fuse tubes will meet the average operating requirements since if a fault or short circuit is of such a severe nature that it will not have cleared within the time the last of either two or three fuse tubes has blown, considerable damage would be done if the circuit were not allowed to remain open until the fault has been removed. Although the specific arrangement shown merely provides for indicating the operation of the first fuse tube, it is clearly apparent that by making the second fuse tube movable from its operative to an inoperative position in a manner similar to that provided for the first fuse tube, the handle 103 and its operating rod 101 would also serve as an indicator for the operation of the second fuse tube. It is further to be understood that the foregoing description is merely illustrative of my invention and changes and modifications may be made by those skilled in the art without departing from the spirit and scope of the appended claims.

I claim as my invention:

1. In a repeating fuse device, a plurality of fuse tubes, a fuse link in each of said fuse tubes, a common connection for said fuse tubes and switching means for successively making electrical connection to the other end of said fuse tubes, said switching means including a contact member normally engaging the first fuse tube and movable in a predetermined path, said fuse tubes having their said upper ends positioned in the path of movement of said contact member when said fuse tubes are in the operative position, at least all except the last of said fuse tubes being movable from said operative to an inoperative position out of the path of movement of said contact member when its corresponding fuse link is blown, and means for moving said contact member into engagement with a subsequent fuse tube as the fuse tubes are moved to inoperative position in turn.

2. In a repeating fuse device, a plurality of fuse tubes, a fuse link in each of said fuse tubes, at least all except the last of said fuse tubes being movable from an operative to an inoperative position, at least all except the last one said fuse links restraining at least all except the last one of said fuse tubes to their in-operative positions, means connecting the lower ends of said fuse tubes to an electric circuit, the upper ends of said fuse tubes being in alignment when in the operative position, and a movable contact member biased to move in a path across the upper ends of said fuse tubes from a position in engagement with the first one of said fuse tubes for connecting said upper ends to said circuit in turn as a preceding fuse tube is moved to inoperative position following rupture of its fuse link.

3. In a repeating fuse device, a plurality of fuse tubes, a fuse link in each of said fuse tubes, means for pivotally supporting at least all except the last one of said fuse tubes, means biasing at least all except the last one of said fuse tubes from an operative to an inoperative position, means cooperating with at least all except the last one of said fuse links for restraining said fuse tubes against movement about their pivotal supports to the inoperative position, means connecting the lower ends of said fuse tubes to an electric circuit, and switching means for sequentially connecting the upper ends of said fuse tubes to said electric circuit, said switching means including a sliding contact biased from a position at which it engages the first fuse tube to make successive engagement with the upper ends of said fuse tubes as a preceding fuse tube is moved to its inoperative position.

4. In a repeating fuse structure, a housing, at least two doors for said housing, a fuse device supported on each of said doors within said housing, at least the first of said fuse devices having a part thereof movable from an entrance to an inoperative position, a movable contact member normally engaging the first fuse device and biased towards the second fuse device, said movable contact member being held in engagement with said first fuse device when said movable part of said first fuse device is in its operative position and released to move into engagement with said second fuse device when said movable part of said first fuse device is moved to inoperative position.

5. In a repeating fuse device, a housing, a plurality of doors for said housing, a fuse tube carried by each of said doors and having an upper contact, a fuse link carried within each of said fuse tubes and connected at one end to said upper contact, contact means within said housing normally connected to the other end of each fuse when said doors are in the closed position, at least all except the last of said fuse tubes being movable from operative to inoperative position independently of the movement of said doors, means contacting at least all with said fuse links except the last link for holding the corresponding fuse tube in the operative position, a moving contact member supported within said housing adapted to normally engage the upper contact of the first of said fuse tubes and to be moved into engagement with the upper contact of an adjacent fuse tube when the first or preceding fuse tube is moved to inoperative position following the rupture of its fuse link.

6. In a repeating fuse device, a housing, a plurality of doors for said housing, a fuse tube carried by each of said doors and having an upper contact member, a fuse link carried within each of said fuse tubes and connected at one end to said upper contact member, contact means within said housing adapted to be connected to an electric circuit and normally connected to the other end of each fuse link when said doors are in the closed position, at least all except the last of said fuse tubes being movable from operative to inoperative position independently of the movement of said doors, means contacting at least all with said fuse links except the last link for holding the corresponding fuse tube in the operative position, a contact slidably supported within said housing.
adapted to be moved across the ends of said upper contact member, means for automatically moving said contact to connect the said fuse tubes in the electric circuit in turn as a preceding fuse tube is moved to inoperative position, and manual means for resetting said automatic means after a fuse tube operation.

7. In a repeating fuse device, a housing, a plurality of doors for said housing, a fuse tube carried by each of said doors and having an upper contact member, a fuse link carried within each of said fuse tubes and connected at one end to said upper contact member, contact means within said housing adapted to be connected to an electric circuit and normally connected to the other end of each fuse link when said doors are in the closed position, at least all except the last of said fuse tubes being movable from operative to inoperative position independently of the movement of said doors, means coating at least with all of said fuse links except the last link for holding the corresponding fuse tube in the operative position, a contact slidably supported within said housing adapted to be moved across the ends of said upper contact members, means for automatically moving said contact to connect the said fuse tubes in the electric circuit in turn as a preceding fuse tube is moved to inoperative position, and an operating handle associated with said contact extending exteriorly of said housing for resetting said contact after a fuse tube operation, said operating handle being movable with said contact to serve as an indicator for a fuse tube operation.

8. In a repeating fuse structure, a housing, at least two doors for said housing, a fuse tube having an upper contact terminal supported upon each of said doors within said housing, a fuse link within each of said fuse tubes connected at its upper end to said contact terminal, at least the first of said fuse tubes being movable with respect to its supporting door from operative to inoperative position, means cooperating with the fuse link of said first fuse tube for restraining said first fuse tube from movement to the inoperative position, means normally connecting the lower ends of said fuse links to an electric circuit, switching means for normally connecting the contact terminal of said first fuse tube to the electric line for completing the circuit through said first fuse tube, said switching means comprising a movable contact mounted for sliding movement within said housing across the upper ends of said contact terminals, means biasing said movable contact toward the second fuse tube, said movable contact being held in engagement with said first fuse tube while said first fuse tube is in the operative position and released to move to the second fuse tube when the fuse link in the first fuse tube is ruptured for transferring the electric circuit to the second fuse tube.

9. In a repeating fuse structure, a housing, at least two doors for said housing, a fuse tube having a fuse element therein supported upon each of said doors within the housing, guide means extending between the side walls of said housing adjacent the upper end thereof, a contact member slidably mounted on said guide means and movable from side to side in a path across the ends of said fuse tubes, said fuse tubes extending in the path of movement of said contact member when the latter are in their operative position, at least the first of said fuse tubes being movable from said operative position out of said path of movement of said contact member upon rupture of the fuse element therein for releasing said contact member, and means for automatically sliding said contact member into engagement with the second fuse tube when released by the first fuse tube.

10. In a repeating fuse structure, a housing, at least two doors for said housing, a fuse tube having a fuse element therein supported upon each of said doors within the housing, guide means extending between the side walls of said housing adjacent the upper end thereof, a contact member slidably mounted upon said guide means and movable from side to side in a path across the ends of said fuse tubes, said fuse tubes extending in the path of movement of said contact member when the former are in their operative position, at least the first of said fuse tubes being movable from said operative position out of said path of movement of said contact member upon rupture of the fuse element therein for releasing said contact member, means for automatically sliding said contact member into engagement with the second fuse tube when released by the first fuse tube, and an actuating rod associated with said contact member having a portion thereof extending exteriorly of said housing for manually resetting said contact member after a fuse tube operation.

11. In a repeating fuse structure, a housing, at least two doors for said housing, a fuse device supported on each of said doors within said housing, at least the first of said fuse devices being movable from an operative to an inoperative position, a movable contact member normally engaging the first fuse device and biased toward the second fuse device, said movable contact member being held in engagement with said first fuse device when said movable part of said first fuse device is in its operative position and released to move into engagement with said second fuse device when said movable part of said first fuse device is moved to inoperative position, and means actuated by said movable contact member for indicating a fuse tube operation.

12. In a repeating fuse structure, a housing, at least two doors for said housing, a fuse device supported on each of said doors within said housing, at least the first of said fuse devices being movable from an operative to an inoperative position, a movable contact member normally engaging the first fuse device and biased toward the second fuse device, said movable contact member being held in engagement with said first fuse device when said first fuse device is in its operative position and released to move into engagement with said second fuse device when said first fuse device is moved to inoperative position, means actuated in response to movement of at least said first fuse device to the inoperative position for indicating a fuse tube operation.

13. In a repeating fuse structure, a housing, at least two doors for said housing, a fuse device supported on each of said doors within said housing, at least the first of said fuse devices being movable from an operative to an inoperative position, a movable contact member normally engaging the first fuse device and biased toward the second fuse device, said movable contact member being held in engagement with said first fuse device when said first fuse device is in its operative position and released to move into engagement with said second fuse device when said first fuse device is moved to inoperative position, and means for releasing said movable contact member to reestablish engagement
thereof with said first fuse device upon movement of said first fuse device from the inoperative to the operative position.

14. In a repeating fuse structure, a housing, a plurality of doors for said housing, a fuse device including a fuse link carried by each of said doors, at least all except the last of said fuse devices having a portion thereof movable from operative to inoperative position independently of the movement of said doors, means coacting at least with all of said fuse links except the last link for holding the corresponding movable portions of said fuse devices in the operative position, and a moving contact member supported within said housing adapted to normally engage the first fuse device and to be moved into engagement with an adjacent fuse device when the movable portion of the first or preceding fuse device is moved to inoperative position following the rupture of its fuse link.

15. In a fuse, a fuse tube member, a supporting member on which said fuse tube is movably mounted, resilient means for biasing said fuse tube for movement in one direction relative to said supporting means, a fuse link in said tube and normally preventing movement of said tube under the influence of said biasing means, and means movably mounted on one of said members and manually movable independently of said fuse link into and out of engagement with the other of said members for relieving said fuse link of the stress exerted by said biasing means.

16. In a fuse, a fuse tube member, a cutout housing door member on one side of which said fuse tube is movably mounted, resilient means for biasing said fuse tube for movement in one direction relative to said door means, a fuse link in said tube and normally preventing movement of said tube under the influence of said biasing means, and means movably mounted on one of said members and movable independently of said fuse link into and out of engagement with the other of said members for relieving said fuse link of the stress exerted by said biasing means.

17. In a fuse, a fuse tube member, a cutout housing door member on one side of which said fuse tube is movably mounted, resilient means for biasing said fuse tube for movement in one direction relative to said door means, a fuse link in said tube and normally preventing movement of said tube under the influence of said biasing means, and means movably mounted on one of said members and movable into and out of engagement with the other of said members for relieving said fuse link of the stress exerted by said biasing means, said last mentioned means having an operating part extending through an aperture in said door member so as to be operable from the other side of said door member.

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