

June 11, 1940.

W. O. SCHULTZ

2,203,928

FUSE CONSTRUCTION

Filed Aug. 12, 1937

3 Sheets-Sheet 1

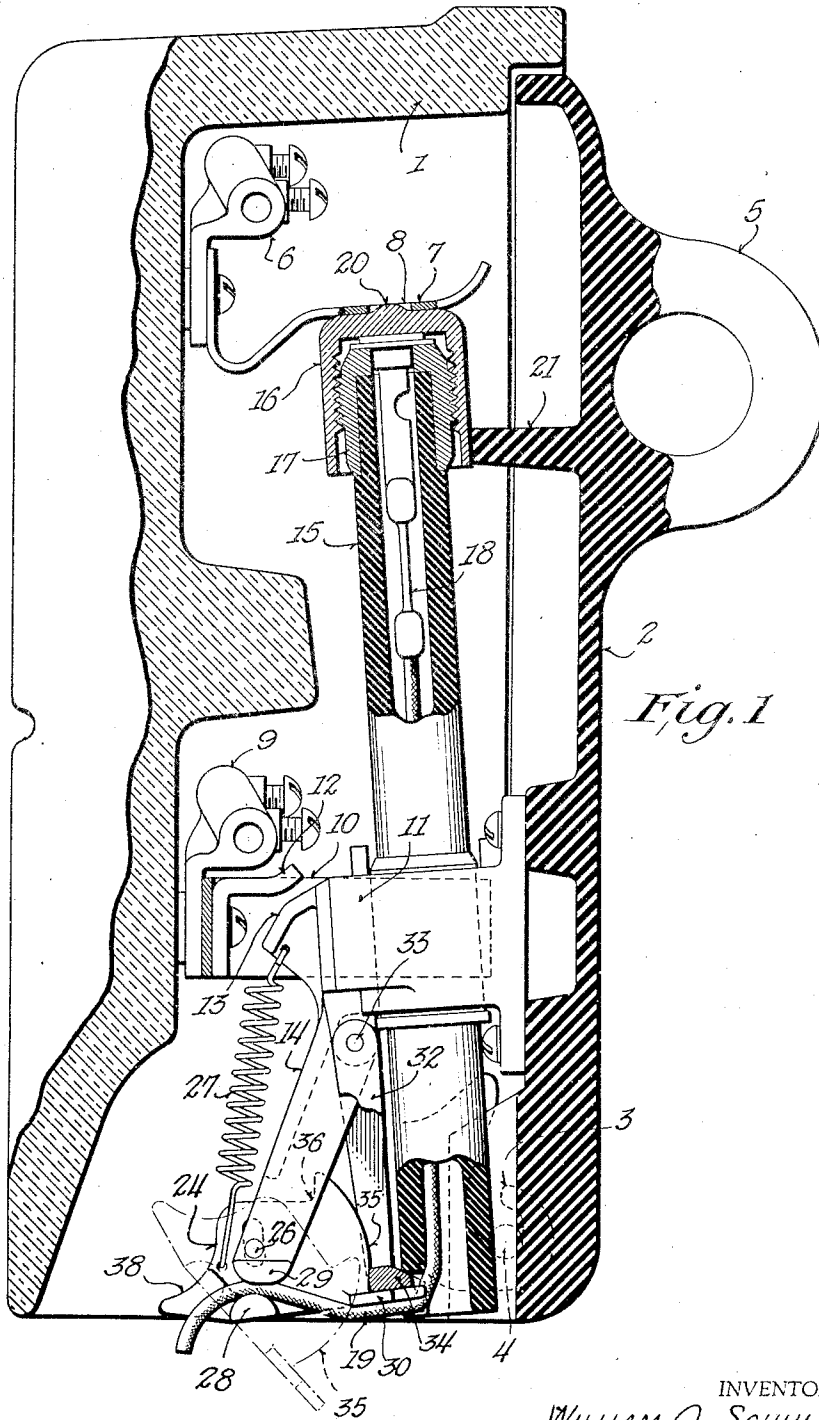


Fig. 1

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Fig. 2

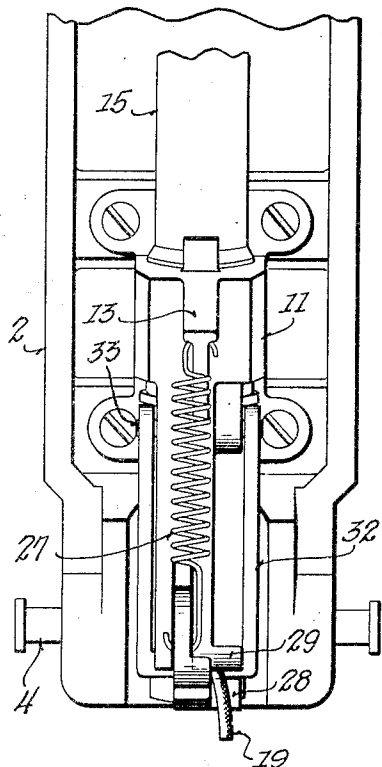


Fig. 4

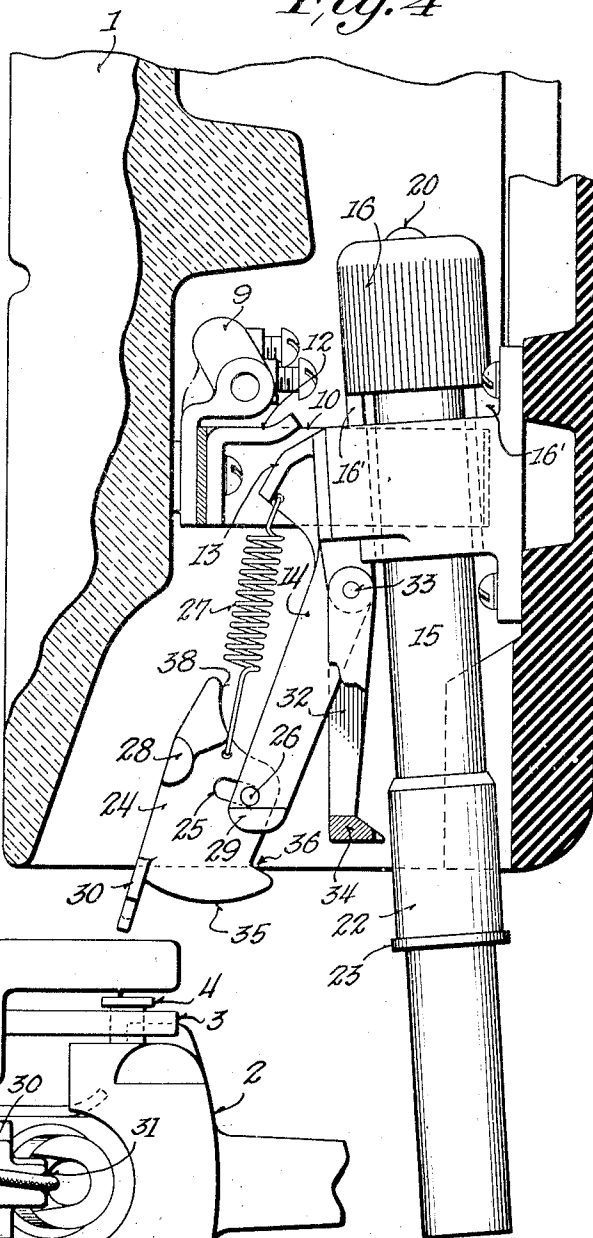
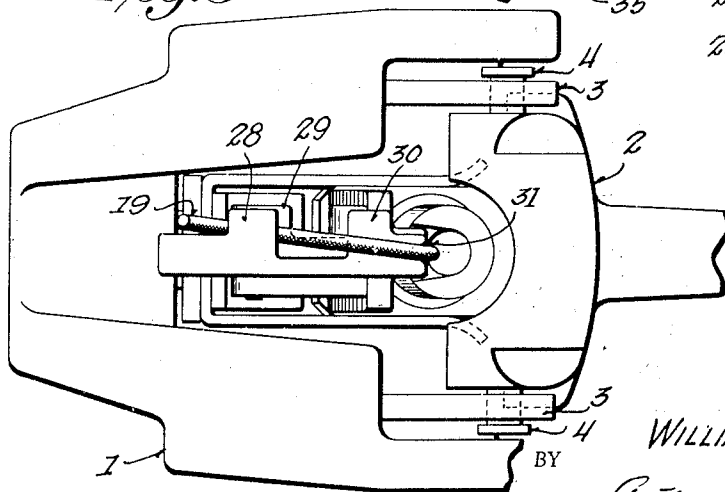


Fig. 3



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Fig. 5

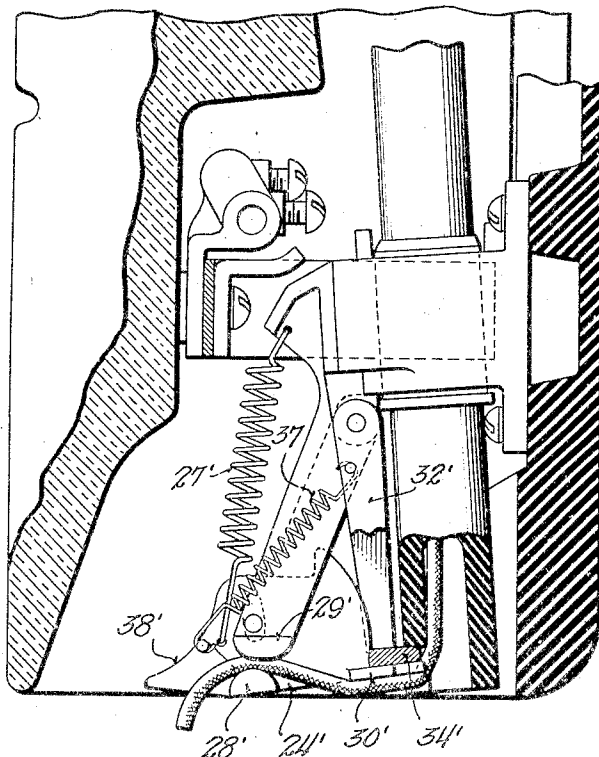
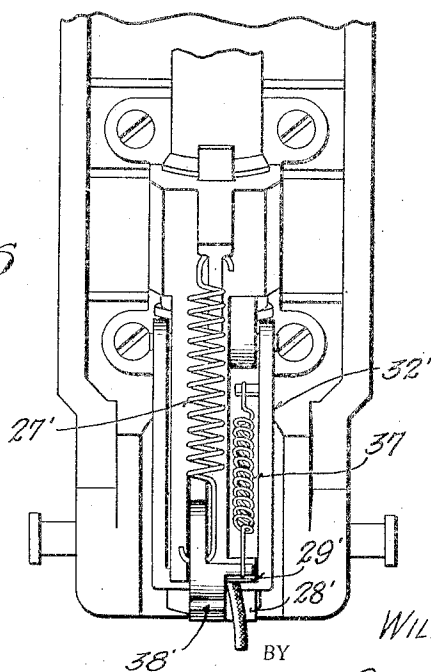


Fig. 6



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FUSE CONSTRUCTION

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Application August 12, 1937, Serial No. 158,654

19 Claims. (Cl. 200—114)

This invention relates to fuse constructions and is particularly directed to a drop-out type of fuse.

Objects of this invention are to provide a novel form of fuse, preferably a housed type of expulsion fuse, in which the fuse tube is biased towards motion axially thereof downwardly and outwardly from the housing and is normally restrained from motion by the fuse link but which, upon blowing of the fuse link, acts first in the manner of an expulsion fuse and thereafter moves downwardly and projects from the lower portion of the housing, thus increasing the gap in the circuit as the contact carried by the fuse tube is moved away from the stationary contact carried by the housing.

Further objects are to provide a construction in which although the fuse link restrains the sliding motion of the fuse tube, nevertheless the fuse link is not subjected to excessive strain due to the fact that the sliding motion of the fuse tube is restrained by the fuse link, but instead in which mechanical means controlled by the fuse link relieve the fuse link of the majority of the strain and yet operate in a very positive manner when the fuse link is severed to release the tube for sliding motion.

Further objects are to provide a construction in which the fuse link is mechanically pulled out of the tube in a direction in line with the end of the tube, as distinguished from being pulled around the end of the tube, whereby links of less flexibility may be used and whereby a positive extraction of any remaining portion of the fuse link is provided by mechanical means so that in addition to the expulsion action of the fuse tube there is the mechanical clearing of the fuse tube.

Further objects are to provide a construction in which the fuse tube is held stationary during the initial portion of the withdrawing of the fuse link, in which the fuse link is free or released after partial withdrawal has occurred so that there are no hanging live parts of the fuse link, even if there are any remaining portions, for although the construction provides means for mechanically withdrawing the fuse link, the construction nevertheless is such that it discharges any remaining portion of the fuse link.

Further objects are to provide a drop-out fuse construction in which a housing is provided with a door, in which the door stays closed after the operation of the device, in which the fuse tube moves or falls to indicating position projecting from the housing to thus apprise the line-

man or other operator of the fact that the fuse has blown and needs re-fusing.

Further objects are to provide a construction in which the mechanical means for withdrawing any remaining portion of the fuse link is supported from the door, in which the entire assembly of fuse tube, door and mechanical link withdrawing means may be removed from the casing for re-fusing so that the device may be re-fused while completely detached from the remaining portion of the apparatus.

Further objects are to provide a novel form of construction in which the re-fusing may be done in a very simple manner, a portion of the mechanical fuse link withdrawing means acting in the form of a clamp to clamp the free end of the fuse link in place, in which this clamping action is automatically removed after any remaining portion of the fuse link is withdrawn, in which a separate member is provided for normally holding the fuse tube in its operative or uppermost position, and in which this restraining member is prevented from operating until the mechanical fuse link withdrawing means has functioned to withdraw any remaining portion of the fuse link.

Embodiments of the invention are shown in the accompanying drawings, in which:

Figure 1 is a view, partly in vertical section, showing one form of the device with the fuse tube in operative position.

Figure 2 is a fragmentary view of the lower inner portion of the door with the fuse tube in its uppermost position.

Figure 3 is a bottom view of the construction shown in Figure 1.

Figure 4 is a fragmentary view corresponding to Figure 1 showing the position of the parts after the fuse has blown.

Figure 5 is a view corresponding to the lower portion of Figure 1 showing a modified form of construction.

Figure 6 is a view of the lower portion of the door and associated parts of the construction shown in Figure 5.

Referring to Figures 1 to 4, it will be seen that the device comprises a housing 1 provided with a door 2 which may be removably hinged to the housing, as by means of the open hook like members 3 which receive the trunnions 4 carried by the door, so that when the door has been rocked downwardly about the trunnions, it may be readily detached from the housing in a well known manner. The door is preferably provided with a manipulating eyelet or handle portion 5.

The upper terminal member 6 is adapted to receive one of the line conductors and this terminal member includes an upper contact 7 which may take the form of a leaf spring with an upwardly curved outer end and with an aperture 8.

The lower terminal member is indicated at 9 and is adapted to receive one of the line wires and it includes the lower stationary contact which may consist of a U-shaped spring member 10 or contact member adapted to engage on opposite sides against the flat side faces of the combined contact block and guiding sleeve 11, which latter is rigidly mounted on the door. This construction, therefore, holds the door closed even when the fuse tube hereinafter described has slid downwardly to inoperative position. However, the door may be pulled outwardly to open position by inserting the hooked end of a switch stick in the eyelet 5 or by manually engaging the member 5. Preferably the lower terminal member includes a stop 12 which is positioned just above a corresponding stop 13 rigid with the contact block 11 so that if there is any tendency for the door to be carried upwardly as a unit with the fuse tube upon recoil, these two members will abut and resist such upward motion. The contact block 11 carries an arm 14 which is integral therewith and which projects downwardly and rearwardly.

The fuse tube 15 is formed of insulating material and provided with an upper contact or cap member 16 screwed upon the fitting 17 carried by the upper end of the fuse tube and clamping the button head of a fuse link between itself and the fitting. This fuse link includes the reduced readily fusible portion 18 and the leader 19. This leader is preferably flexible, though as the description proceeds, it will be seen that a much more rigid leader can be used than was heretofore possible with expulsion type fuses.

The upper contact cap 16 is preferably provided with a projecting portion 20 which fits within the hole 8 in the upper contact 7 so that when the door is moved to closed position, the projection 20 snaps into place and insures definite and full closing of the door.

Preferably the door is provided with a projecting portion 21 formed integrally therewith and loosely bearing against the upper contact cap 16 to afford a bracing member for such cap. The fuse tube is preferably provided with an intermediate sleeve 22 rigid therewith which normally loosely fits within the guiding sleeve or block 11. However, as soon as the fuse tube moves downwardly a short distance, the sleeve 22 clears the contact block or stationary sleeve 11 and there is considerable free play between the fuse tube and such stationary sleeve or contact block 11. This sleeve 22 is formed of metal and thus any swelling of the fuse tube will not result in binding, as the free sliding of the metal sleeve 22 within the stationary sleeve 11 is always assured, and as soon as the tube has moved downwardly so that the sleeve 22 is free of the stationary guiding member or sleeve 11, there is a considerable amount of play between the fuse tube and the guiding member 11.

Preferably the sleeve 22 is provided with a lower shoulder or flange 23 which acts as a stop or limit to limit the upward recoil of the fuse tube with reference to the door and also to act as a stop in re-fusing the tube so that the upward motion of the fuse tube will be arrested at the proper point during re-fusing. The upper end of the sleeve 22 may be bevelled, as shown in

Figures 1 and 2, to facilitate its entry into the guiding member 11.

The lower end of the arm 14, see Figures 1, 2 and 4, is bifurcated and receives the fuse link clamping and fuse link extracting member or lever 24. This member is provided with an elongated slot 25 which receives a pivot pin 26 rigidly carried by the arm 14. The lever or member 24 is urged in a clockwise direction about the pivot pin 26 by means of the spring 27 which is attached to the contact block or guiding member 11 at its upper end and to the rear portion of the lever or member 24. Normally, when the parts are in the position shown in full lines in Figure 1, this spring not only tends to rock the member 24 in a clockwise direction, but also pulls the member 24 upwardly. The member 24 is provided with a projecting lug 28 which has a rounded upper face and is normally positioned below the rounded lower face of a lug 29 carried by the arm 14. These two parts constitute clamping means for clamping the leader 19 of the fuse link, as shown in Figures 1 and 3.

The member 24 is provided with a projecting lug 30 which is positioned above the leader 19 and also is provided with a notched outer end 31 within which the leader 19 is received. It is obvious that if the fuse link is ruptured upon the occurrence of an overload, that the member 24 will rock in a clockwise direction and that the fuse link will be drawn downwardly substantially in line with the fuse tube.

During at least the initial portion of the withdrawal of any remaining portion of the fuse link after the fuse has blown, the fuse tube remains in its uppermost position, as it is retained in such position by means of a U-shaped lever 32 whose opposite arms are pivoted, as indicated at 33, upon the arm 14. This U-shaped lever 32 is a retaining or locking lever for the fuse tube and is provided with a locking foot 34 which fits beneath the lower end of the fuse tube or within a notch formed in such lower end, the latter construction being shown.

Preferably the upper surface of the locking foot or lug 34 is bevelled so that the downward pressure of the fuse tube, due to its own weight and to the action of the spring or upper contact 7 which presses downwardly and urges or biases the fuse tube in a downward direction, will tend to rock the locking lever towards releasing position.

The rear portion of the transverse part of the lever 32 bears against the rounded cam face 35 of the member 34 under normal conditions and is thus prevented from rocking to fuse tube releasing position. However, the member 24 is provided with an abrupt shoulder or recessed portion 36 so that when this part of the cam member 35 is opposite the transverse part of the locking lever 32, such lever is free to rock in a clockwise direction and thus release the fuse tube.

Figures 5 and 6 will now be described. The construction of the parts in Figures 5 and 6 is substantially the same as that previously described, except that in addition to all of the parts hereinabove described, the lever 32', which corresponds to the lever 32, is urged towards releasing position by means of the spring 37, which is attached to the member 24' and to the lever 32'. The spring 27', corresponding to the spring 27, may be employed and is so shown in Figures 5 and 6. However, it is also clear that the spring 27' may be dispensed with and the spring 37 alone

relied upon. The lever 32' differs from the lever 32 in the previously described form of the invention in that the upper face of the locking foot 34' of such lever is not bevelled as the lever 32' is withdrawn to fuse tube releasing position by means of the spring 37. Aside from these differences, however, the operation of the two forms of the invention are identically the same.

It is clear that when an overload occurs, the fuse link will be ruptured and any remaining portion of the fuse link will be mechanically withdrawn substantially in line with the fuse tube, as during at least the initial portion of the withdrawal motion, the fuse link extracting member 24 pulls substantially directly downwardly upon the fuse link. The leaders, therefore, do not have to be made as flexible as usual as they are not drawn around the lower end of the fuse tube but are drawn, as stated, substantially directly downwardly. After any remaining portion of the leader has been set in motion by the downward withdrawal, the clamping action between the clamping lugs 28 and 29 of Figure 1 or the corresponding clamping lugs 28' and 29' of Figure 5 ceases as the lugs have been moved apart due to the rocking motion of the member 24 or 24' respectively.

When the fuse tube slides downwardly, it will be noted from Figure 4 that the upper cap 16 strikes the supports 16', which are in reality lugs cast integrally on the contact block or guiding member 11, and thus the cap is prevented from striking the spring contact jaws or gripping jaws 10 of the lower stationary contact.

The re-fusing of the device is very simple. The operator removes the door from the housing and removes the upper cap, places a new fuse in the fuse tube, and replaces the upper cap, thus clamping the button head of the fuse in place and allowing the leader to project freely from the lower end of the fuse tube. Thereafter he places his thumb on the rearwardly projecting foot or ear of the member 24 or 24', such ear being indicated at 38 and 38' respectively in Figures 1 and 5, while he holds the assembly, consisting of the door and fuse tube, in the same hand. Thereafter, with the other hand, he grasps the projecting leader and hooks it over the end of the member 24 or 24' and leads it between the projections 28 and 29 or 28' and 29' of Figures 1 and 5 respectively, and then allows the leader to be clamped in place by relieving the pressure of his thumb. Thus the re-fusing may be very quickly and easily done.

It will be seen that a construction has been provided by this invention in which any remaining portion of the fuse link is mechanically pulled outwardly from the lower end of the fuse tube substantially in line with the fuse tube and thus does not require a great amount of flexibility in the leader as the leader is not drawn around a sharp bend. Additionally this mechanical action supplements the expulsive action of the fuse tube and does not in any way hinder the expulsive action.

Any remaining portion of the fuse link which is withdrawn from the fuse tube is released and dropped clear of the device so that there are no hanging live parts that might give trouble. Additionally, the fuse tube, during the initial withdrawal operation, is held against sliding motion and is only allowed to slide after any remaining portion of the fuse link has been either wholly withdrawn or substantially withdrawn from the fuse tube, the withdrawal of the fuse

link imparting momentum thereto and the release of the fuse link in no way interfering with this motion of the fuse link but merely letting go of the fuse link at the appropriate time so that it will continue in its travel away from the fuse tube.

The mechanical fuse link extracting mechanism is not carried by the fuse tube itself but is supported from the lower contact of the door and thus a simple construction of fuse tube may be employed, and additionally this sliding or moving portion of the structure is not massive but instead is only of moderate weight.

In the construction disclosed, the door stays closed after operation while the fuse tube falls or moves downwardly to indicating position. However, if it is desired to open the door at any time, it may be readily pulled open for inspection or for any other purpose desired without breaking the fuse link.

Although this invention has been described in considerable detail, it is to be understood that such description is intended as illustrative rather than limiting, as the invention may be variously embodied and is to be interpreted as claimed.

I claim:

1. A fuse construction comprising a stationary support having stationary contacts, a fuse tube slidably supported from said stationary support and having an open end, a fuse link within said fuse tube projecting from said open end and normally electrically connecting said stationary contacts, and means controlled by said fuse link and located adjacent the open end of said fuse tube for normally holding said fuse tube against sliding motion and for extracting said fuse link when said fuse link is ruptured, said means having a portion for drawing said fuse link outwardly substantially in line with said fuse tube.

2. A fuse construction comprising a stationary support having stationary contacts, a fuse tube slidably supported from said stationary support and having an open end, a fuse link within said fuse tube projecting from the open end of said fuse tube and normally electrically connecting said stationary contacts, and means biased towards releasing motion normally holding said fuse tube against sliding motion and controlled by said fuse link, said means including a movable member located adjacent the open end of said fuse tube and having motion substantially directly away from the open end of said fuse tube and substantially in line with said fuse tube, said member engaging said fuse link for withdrawing said fuse link from said fuse tube upon rupture of said fuse link.

3. A fuse construction comprising a stationary support having stationary contacts, a fuse tube slidably supported from said stationary support and having an open end, a fuse link within said fuse tube and projecting from the open end thereof, fuse link extracting means having one portion thereof located adjacent the open end of said fuse tube and movable substantially directly outwardly from the open end of said fuse tube in approximate line with said fuse tube for a part of the motion of said fuse link extracting means, said fuse link extracting means engaging the projecting portion of said fuse link, and means for automatically clamping said fuse link to said fuse link extracting means.

4. A fuse construction comprising a stationary support having stationary contacts, a fuse tube slidably supported from said stationary support and having an open end, a fuse link within said

fuse tube and projecting from the open end thereof, fuse link extracting means having one portion thereof located adjacent the open end of said fuse tube and movable substantially directly outwardly from the open end of said fuse tube in approximate line with said fuse tube for a part of the motion of said fuse link extracting means, said fuse link extracting means engaging the projecting portion of said fuse link, and means for automatically clamping said fuse link to said fuse link extracting means, said last mentioned means automatically releasing said fuse link when said fuse link extracting means has moved a predetermined distance, whereby said fuse link is thrown from said fuse link extracting means.

5. A fuse construction comprising a support having stationary contacts, a fuse tube movably supported from said support and having an open end, a fuse link within said fuse tube projecting from said open end, and means restrained by said fuse link and normally holding said fuse tube against motion with reference to said support, said means including latching means biased to releasing position and separate fuse link extracting means having a part located in proximity to the open end of said fuse tube and movable when said fuse link is ruptured, said part executing a portion of its motion in a direction substantially outwardly in line with said fuse tube to withdraw said fuse link substantially directly outwardly with respect to said fuse tube.

6. A fuse construction comprising supporting means having contacts, a fuse tube slidably supported from said supporting means, a fuse link within said fuse tube normally electrically connecting said contacts, said fuse tube being movably mounted with respect to said supporting means, latching means for holding said fuse tube against motion, and fuse link extracting means separate from said latching means and connected to said fuse link and restraining said latching means against releasing motion until said fuse link extracting means has operated, said fuse link extracting means being controlled by said fuse link.

7. A fuse construction comprising supporting means having contacts, a fuse tube slidably supported from said supporting means, a fuse link within said fuse tube normally electrically connecting said contacts, said fuse tube being movably mounted with respect to said supporting means, latching means for holding said fuse tube against motion, and fuse link extracting means separate from said latching means and connected to said fuse link and restraining said latching means against releasing motion until said fuse link extracting means has operated, said fuse link extracting means being controlled by said fuse link, said fuse tube being biased towards motion with respect to said supporting means and said latching means being biased towards releasing motion by said fuse tube.

8. A fuse construction comprising supporting means having contacts, a fuse tube slidably supported from said supporting means, a fuse link within said fuse tube normally electrically connecting said contacts, said fuse tube being movably mounted with respect to said supporting means, latching means for holding said fuse tube against motion, and fuse link extracting means connected to said fuse link and restraining said latching means against releasing motion until said fuse link extracting means has operated, said fuse link extracting means being con-

trolled by said fuse link, said fuse tube being biased towards motion with respect to said supporting means and said latching means being independently biased towards releasing motion.

9. A fuse construction comprising a support having spaced contacts, a fuse tube slidably supported from said support and having an open end, a fuse link within said fuse tube projecting from the open end thereof and normally electrically connecting said contacts, a latching member having means laterally movable with respect to said fuse tube and normally restraining said fuse tube against releasing motion, and fuse link extracting means separate from said latching member and controlling the operation of said latching member, said fuse link extracting means being connected to and controlled by said fuse link and being biased towards fuse link extracting motion.

10. A fuse construction comprising a housing having a pair of stationary contacts, a door for said housing, said door having a contact normally engaging one of said stationary contacts, a fuse tube slidably carried by the contact of said door and having a contact adjacent one end normally in engagement with the other of said stationary contacts, a fuse link within said fuse tube normally electrically connecting the contact of said fuse tube with the contact of said door, and means normally restraining said fuse tube against sliding motion and including fuse link extracting means carried by the contact of said door and controlled by said fuse link, said fuse link extracting means having a part located adjacent one end of said fuse tube and engaging the fuse link, and biased for motion away from and substantially in line with said fuse tube.

11. A fuse construction comprising a housing having a pair of stationary contacts, a door for said housing, said door having a contact normally engaging one of said stationary contacts, a fuse tube slidably carried by the contact of said door and having a contact adjacent one end normally in engagement with the other of said stationary contacts, a fuse link within said fuse tube normally electrically connecting the contact of said fuse tube with the contact of said door, and means normally restraining said fuse tube against sliding motion and including fuse link extracting means carried by the contact of said door and controlled by said fuse link, said fuse link extracting means having a part located adjacent one end of said fuse tube and engaging the fuse link, and biased for motion away from and substantially in line with said fuse tube, said means releasing said fuse tube after said fuse link extracting means has operated and restraining said fuse tube against motion during the initial portion of the motion of said fuse link extracting means.

12. A fuse construction comprising a housing having a pair of stationary contacts, a door for said housing, said door having a contact normally engaging one of said stationary contacts, a fuse tube slidably carried by the contact of said door and having a contact adjacent one end normally in engagement with the other of said stationary contacts, a fuse link within said fuse tube normally electrically connecting the contact of said fuse tube with the contact of said door, and means normally restraining said fuse tube against sliding motion and including fuse link extracting means carried by the contact of said door and controlled by said fuse link, said fuse link extracting means having a part located ad-

jacent one end of said fuse tube and engaging the fuse link, and biased for motion away from and substantially in line with said fuse tube, said means releasing said fuse tube after said fuse link extracting means has operated and restraining said fuse tube against motion during the initial portion of the motion of said fuse link extracting means, said fuse link extracting means having fuse link clamping means normally clamping said fuse link and automatically releasable when said fuse link extracting means has moved a predetermined distance.

13. A fuse construction comprising a housing having a pair of spaced contacts, a door for said housing having a contact normally engaging one of said spaced contacts, a fuse tube closed at one end and having a contact at such closed end normally engaging the other of said stationary contacts and having its other end open, a fuse link electrically connecting the contact of said fuse tube with the contact carried by said door, said fuse tube being slidable within the contact carried by said door and biased towards sliding motion, latching means normally restraining said fuse tube against sliding motion, and fuse link extracting means independent of said latching means normally holding said latching means against releasing motion and releasing said latching means when said fuse link extracting means has operated, said fuse link extracting means being mechanically connected to said fuse link, whereby said fuse link extracting means is controlled by said fuse link.

14. An automatic circuit interrupting switch comprising supporting means having spaced contacts, an arcing tube slidably supported from said supporting means, an expulsive conductor within said tube normally electrically connecting said spaced contacts, mechanism including latching means for latching said tube in closed circuit position and including an extracting member independent of said latching means for extracting said expulsive conductor, and current controlled means for releasing said extracting member and said latching means.

15. An automatic circuit interrupting switch comprising an insulating housing having spaced contacts, a door for said housing, an arcing tube slidably supported from said door and normally held against sliding motion, an expulsive conductor within said arcing tube normally electrically connecting said spaced contacts, means for holding said door closed irrespective of the sliding motion of said tube, mechanism for restraining said tube against sliding motion and for extracting said expulsive conductor, said mechanism including a part having motion directly outwardly substantially in line with said tube, and current controlled means controlling said mechanism.

16. An expulsion fuse construction comprising a housing having an upper stationary contact and a lower stationary contact, a door for said housing having a lower contact normally engaging the lower stationary contact, an expulsion fuse tube slidably mounted within the contact of said door and having an open lower end, a fuse link within said fuse tube projecting from the lower end thereof and normally electrically connecting the upper and lower stationary contacts, a latching lever pivotally mounted on the contact of said door and normally holding said tube against downward sliding motion, a fuse link extracting lever pivotally supported from the contact of said door and having a cam face contact-

ing with said latching lever and preventing release of said latching lever until said fuse link extracting lever has operated, and a spring urging said fuse link extracting lever towards fuse link extracting motion, said fuse link extracting lever having vertical motion adjacent the point at which it is pivoted, clamping means carried jointly by the contact of said door and said fuse link extracting lever, said fuse link engaging said fuse link extracting lever and being clamped by said clamping means and held clamped by said spring.

17. An expulsion fuse construction comprising a housing having an upper stationary contact and a lower stationary contact, a door for said housing having a lower contact normally engaging the lower stationary contact, an expulsion fuse tube slidably mounted within the contact of said door and having an open lower end, a fuse link within said fuse tube projecting from the lower end thereof and normally electrically connecting the upper and lower stationary contacts, a latching lever pivotally mounted on the contact of said door and normally holding said tube against downward sliding motion, a fuse link extracting lever pivotally supported from the contact of said door and having a cam face contacting with said latching lever and preventing release of said latching lever until said fuse link extracting lever has operated, and a spring urging said fuse link extracting lever towards fuse link extracting motion, said fuse link extracting lever having vertical motion adjacent the point at which it is pivoted, clamping means carried jointly by the contact of said door and said fuse link extracting lever, said fuse link engaging said fuse link extracting lever and being clamped by said clamping means and held clamped by said spring, the lower of said stationary contacts gripping the contact of said door, whereby said door is held in closed position after said fuse tube has moved downwardly.

18. A fuse construction comprising a support having stationary contacts, a fuse tube movably supported from said support and having an open end, a fuse link within said fuse tube projecting from said open end and electrically connecting said stationary contacts, latching means normally holding said fuse tube in operative position and restraining said fuse tube against motion, and fuse link extracting means independent of said latching means and biased towards fuse link extracting motion, said fuse link extracting means normally restraining said latching means against releasing motion, said latching means being released by said fuse link extracting means when said fuse link extracting means has moved a predetermined distance.

19. A fuse construction comprising a support having stationary contacts, a fuse tube movably supported from said support and having an open end, a fuse link within said fuse tube projecting from said open end and electrically connecting said stationary contacts, latching means normally holding said fuse tube in operative position and restraining said fuse tube against motion, and fuse link extracting means independent of said latching means and biased towards fuse link extracting motion, said fuse link extracting means having a cam portion normally restraining said latching means against releasing motion, said cam portion releasing said latching means after said fuse link extracting means has moved a predetermined distance.

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DISCLAIMER

2,203,928.—*William O. Schultz*, South Milwaukee, Wis. FUSE CONSTRUCTION. Patent dated June 11, 1940. Disclaimer filed September 2, 1941, by the assignee, *Line Material Company*.

Hereby enters this disclaimer to claims 1, 10, and 15 in said specification.

[*Official Gazette September 30, 1941.*]

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[*Official Gazette September 30, 1941.*]