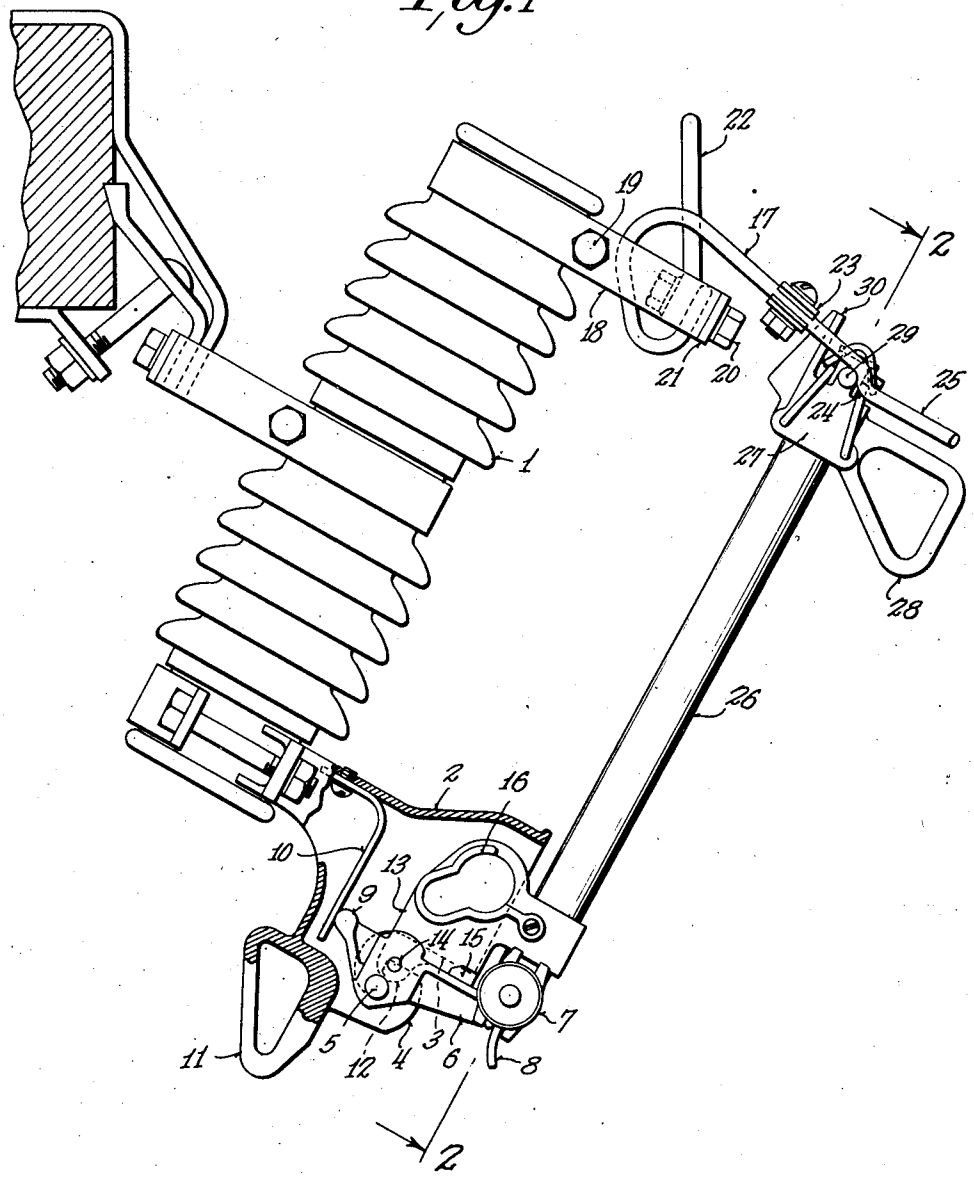
Oct. 12, 1943. W. O. SCHULTZ 2,331,848

FUSE DEVICE

Filed June 10, 1942 3 Sheets-Sheet 1

Fig. 1



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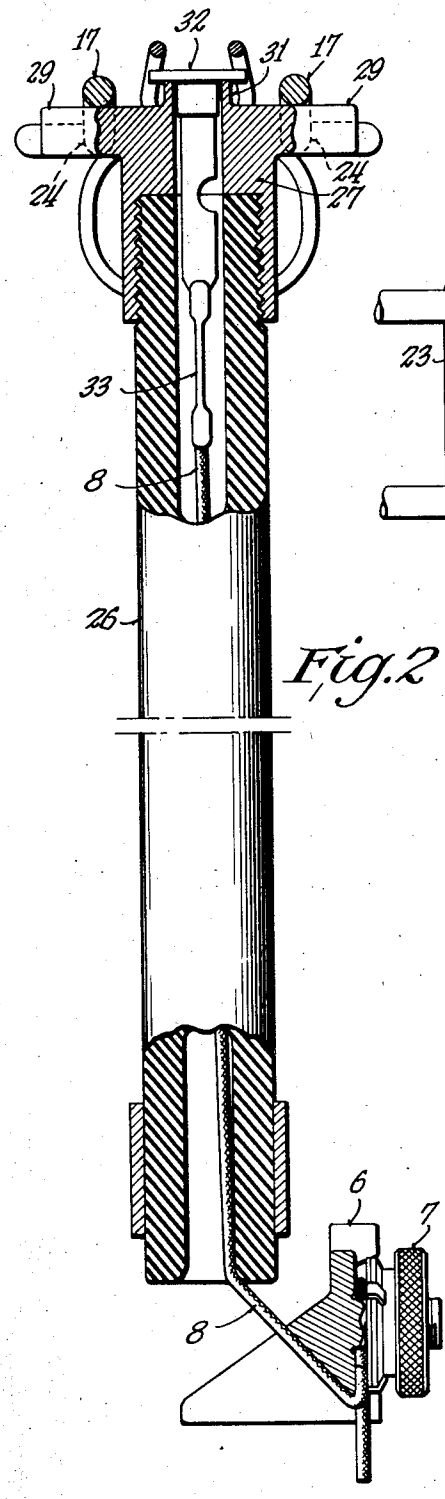


Fig. 2

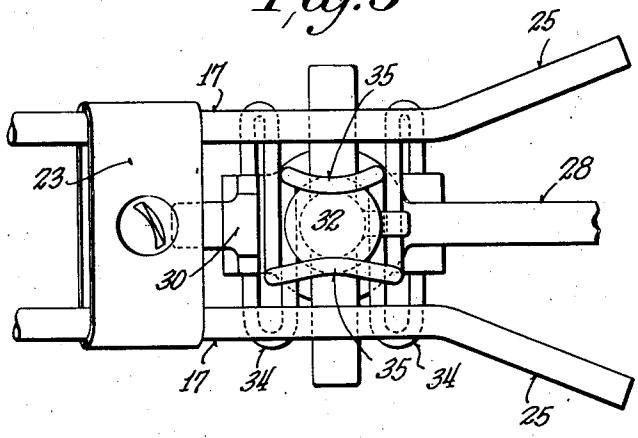


Fig. 3

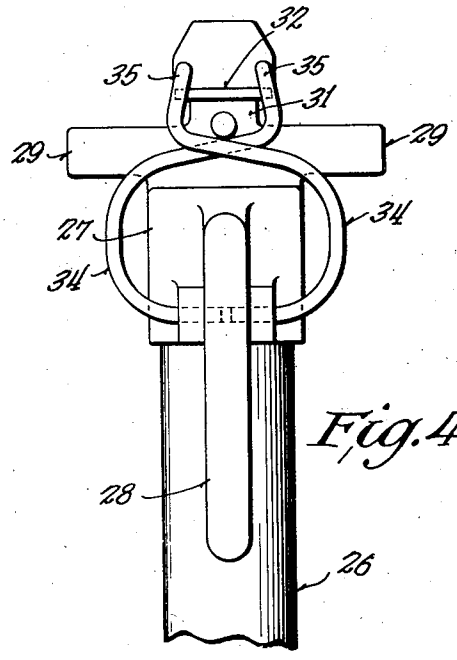


Fig. 4

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FUSE DEVICE

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Fig. 5

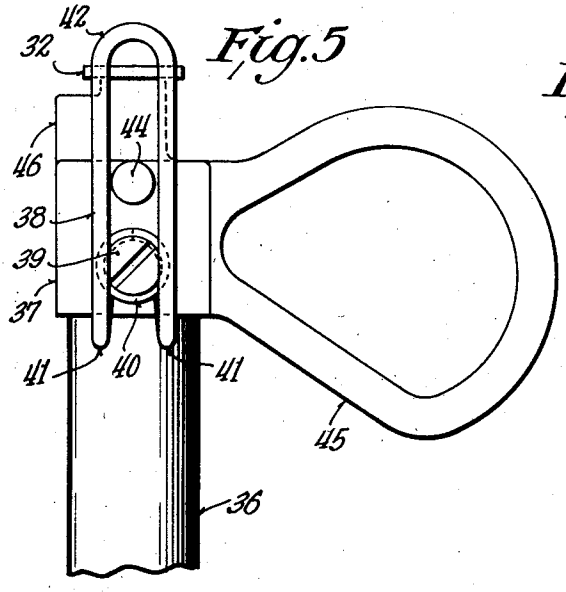


Fig. 6

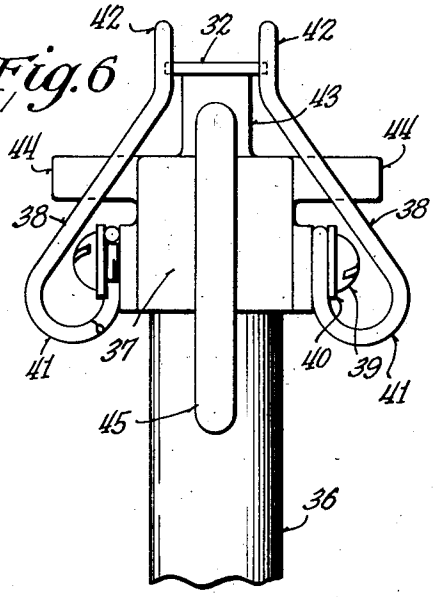


Fig. 7

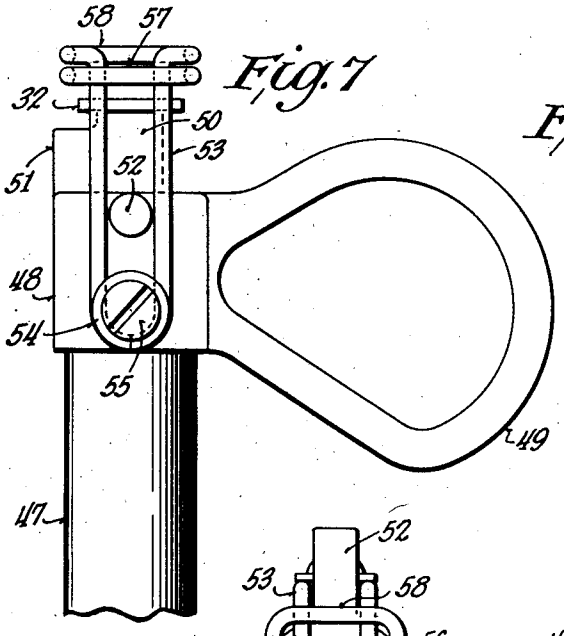


Fig. 8

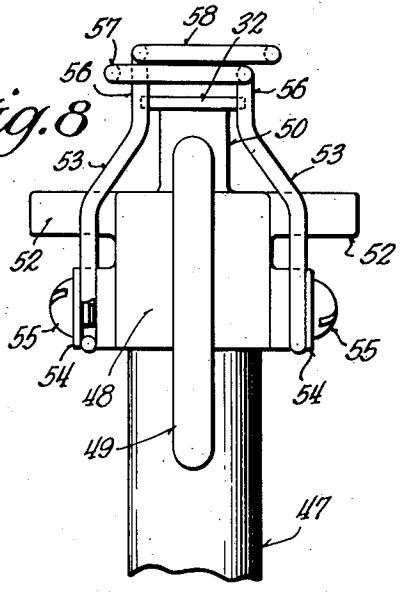
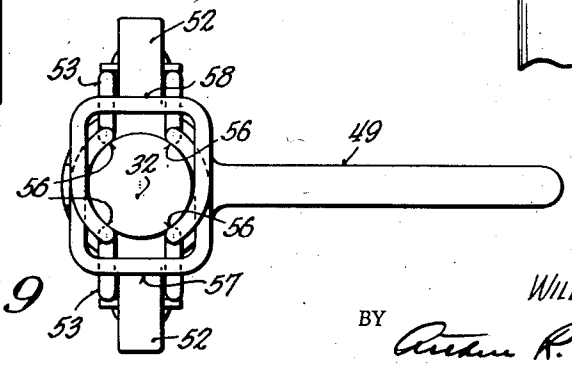


Fig. 9



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UNITED STATES PATENT OFFICE

2,331,848

FUSE DEVICE

William O. Schultz, South Milwaukee, Wis., assignor to Line Material Company, South Milwaukee, Wis., a corporation of Delaware

Application June 10, 1942, Serial No. 446,464

14 Claims. (Cl. 200—114)

This invention relates to fuse devices.

Objects of this invention are to provide a fuse device which employs a fuse tube open at both ends and which has a headed fuse link so arranged that the head of the fuse link closes one end of the fuse tube, and in which the head of the fuse link is adapted to be blown directly away from the end of the fuse tube in the event of a violent evolution of gas upon rupture of the fuse link so that the fuse tube will be vented at both ends.

Further objects are to provide an expulsion fuse device in which a fuse tube is provided which is open at both ends and in which a fuse link is positioned within the fuse tube and is provided with a head normally closing one end of the fuse tube, and in which stationary contacts are electrically connected under normal conditions by means of the fuse link, and in which provision is made for the free travel of the head of the fuse link away from the end of the fuse tube without engaging the adjacent stationary contact so that even under violent overload conditions no damage will be caused the stationary contact by the violent projection of the head of the fuse link outwardly away from the end of the fuse tube, and to provide a construction having the characteristics enumerated above in which the head of the fuse link has good and positive electrical contact with the adjacent electrically conducting portion of the fuse device.

A further specific object of this invention is to provide an expulsion fuse device in which the fuse tube is open at both ends, one end being closed by the head of the fuse link and the head of the fuse link being gripped in such a manner that under light overloads the head of the fuse link will not be blown off and the action of the fuse tube will be that of a fuse tube open at one end only to thereby assist in the speedy clearing of the circuit inside the fuse tube, the construction being such that under heavy overloads the head of the fuse link is blown from the fuse tube to thereby provide venting of the fuse tube at both ends, the device therefore having both the characteristics of an expulsion fuse tube open at one end only for light overloads and vented at both ends for heavy overloads, whereby the safe rupturing capacity of the apparatus is materially increased.

Further objects of this invention are to provide a fuse construction in which gripping fingers are carried by the terminal of the fuse tube and are arranged to grip different sized heads of fuse links, the gripping fingers being so constructed that they have a high degree of resiliency and consequently can adjust themselves to grip fuse link heads of materially different sizes.

In greater detail, objects of this invention are to provide a fuse construction in which the terminal of the fuse tube is provided with a reduced neck against which the head of a headed fuse link is adapted to bear and to provide looped gripping fingers secured on opposite sides of the terminal of the fuse tube and having gripping portions on opposite sides of the reduced neck of the fuse tube, the looped gripping fingers in certain forms of the invention being provided with laterally projecting manipulating portions which may be squeezed towards each other to thus open the gripping portions of the gripping fingers and allow the free positioning of the head of a fuse link.

Further objects are to provide a construction in which the head of the fuse link and the fingers are positioned in spaced relation to the stationary contact so that upon violent overload the head of the fuse link will be projected from, and the blast of gases will occur at a point spaced from the stationary terminal, thereby avoiding damage to the stationary contact, the fuse tube being so arranged that it will drop outwardly from operative to inoperative position after the circuit has been interrupted within the fuse tube.

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

Figure 1 is a view of one form of the invention, such view being partly in section and partly broken away.

Figure 2 is a view, partly in section, such section being taken along the line 2—2 of Figure 1.

Figure 3 is a fragmentary top view of the structure shown in Figure 1.

Figure 4 is a view looking from the front of the fuse tube shown in Figure 1.

Figure 5 is a view of a further form of the invention.

Figure 6 is a view of the structure shown in Figure 5 looking from the front.

Figure 7 is a view of a further form of the invention.

Figure 8 is a view of the structure shown in Figure 7 looking from the front.

Figure 9 is a view looking down on the structure shown in Figure 7.

Referring to the form of the invention shown in Figures 1 to 4, it will be seen that the device is carried by an elongated insulator 1 which is supported intermediate its ends as shown in Fig-

gure 1. This insulator carries the upper and lower stationary contact adjacent its upper and lower ends. The lower contact comprises a hood like member 2 which is provided with side walls that extend down to the position shown by the dotted line indicated at 3. The lower portion of the hood like member constitutes two hook like portions 4 which removably receive the trunnions 5 of the fuse link extracting lever 6. This lever is provided with a thumb nut 7 on its side which clamps the leader 8 of the fuse link. The lever is provided with a rear transverse portion 9 which bears against the lower contact spring 10 to secure good electrical connection between the lever and such lower spring. The spring 10 is secured to the hood like portion 2 which is provided with a connector portion 11 at its lower end.

The lever 6 is provided with a pair of side flanges between which the downwardly extending ear 12 of an arm 13 is positioned and the lever is pivoted to such ear as indicated by the reference character 14. The arm 13 is rigidly secured to the fuse tube as shown and is provided with a foot 15 which acts as a stop to limit the upward motion of the lever. This arm 13 is also provided with a switch receiving eyelet portion 16.

It is to be noted that when the fuse tube is in its operative position as shown in Figure 1, the fuse link holds the lever 6 against releasing motion. Upon rupture of the fuse link the lever 6 rocks downwardly extracting any remaining portion of the fuse link and lowering the fuse tube so that it detaches itself from the upper stationary contact as will hereinafter appear, thereby allowing the tube to rock downwardly and outwardly to inoperative position.

It is to be noted that the arm 13 is mounted within the hood 2 under normal conditions and that this hood prevents the inadvertent detachment of the trunnions 5 from the hook like members 4 until the fuse tube has swung downwardly. Thereafter the device may be removed from the hook like portions by a switch stick which is adapted to engage the eyelet portion 16 to lift the fuse tube out of and into position.

It is to be noted from an examination of Figure 2 that the outer end of the lever 6 is positioned laterally of the fuse tube so as to leave the lower end of the fuse tube wholly unobstructed. The upper stationary contact comprises a pair of spring arms 17 which are clamped to a strap 18, the strap in turn surrounding the upper end of the insulator 1 and being clamped in place by means of the bolt 19. The spring arms 17 may be roughly of U-shape and their looped portion may be clamped by means of the bolt 20 to the inwardly turned ends 21 of the strap 18, the bolt also clamping the connector 22 in place. The spring arms 17 are prevented from separating by means of the bracing member 23 and are provided with a downwardly depressed portion 24 and with outwardly flaring end portions 25 which act as guides to guide the fuse tube into place when it is rocked upwardly.

The fuse tube 26 is provided with an upper contact 27 which has a manipulating eyelet 28 integral therewith and which is provided with outwardly projecting pins 29 which normally engage behind the downwardly depressed portions 24 of the spring arms 17. If desired a guiding tongue and also a stop tongue 30 may be formed integrally with the upper contact 27, the tongue 30 acting to guide the upper end of the fuse tube into place between the outwardly flared portions 25 of the spring arms 17 and acting to arrest the inward rocking motion of the fuse tube by engaging the brace member 23.

The upper contact 27 of the fuse tube has a reduced neck portion 31 upon the top of which the button head 32 of the fuse link rests. The fuse link is, as stated, provided with the flexible leader 8 and with a reduced fusible section 33.

A pair of gripping spring arms are provided for gripping opposite sides of the button head 32 of the fuse link. These spring arms may take the shape shown particularly in Figures 1 to 4, and are provided with the rounded portions 34 and with inwardly slanting looped upper portions 35. The arms of the looped upper portions 35 engage opposite sides of the button head 32 of the fuse link and securely grip the button head and thus secure a firm electrical contact with the button head. In addition to this, they hold the button head down against the top of the reduced neck 31 of the upper contact 27 of the fuse tube.

Upon rupture of the fuse link the button head 32 remains in place under small overloads and a straight expulsion action occurs as the upper end of the fuse tube remains closed. However, on heavy overloads the button head 32 is blown upwardly from between the gripping portions 35 of the spring arms 34 and thus allow the tube to be vented at both its upper and lower ends. It is thus possible for the device to handle larger overloads with safety than would be the case had the upper end of the fuse tube been permanently closed. In addition to this, it is to be noted that the button head when projected outwardly from the fuse tube does not strike or damage any portion of the stationary contact and the blast of gases from the fuse tube does not contact the upper contact. Consequently there is no damage to the upper contact even under violent overload conditions.

After the fuse link has ruptured and the circuit has cleared within the fuse tube, the lever 6, see Figure 1, rocks downwardly and lowers the fuse tube, thus allowing the pins 29 to detach themselves from behind the depressed portions 24 of the spring arms 17 and the fuse tube then drops outwardly and downwardly to inoperative position.

It is to be noted that the hood portion 2 houses the spring contact 10 and the lever 6 and the associated mechanism and prevents the accumulation of snow and ice in this portion of the apparatus.

In refusing the device the fuse tube is removed from the hook like members 4 by means of a switch stick which engages the eyelet portion 16. Thereafter while the fuse tube is detached from the remainder of the apparatus, a new fuse link is inserted and the head is positioned between the members 35, see Figure 4. This is readily accomplished as the lineman can press the portions 34 towards each other and thus spread the portions 35 and allow the free positioning of the button head 32 of the fuse link. Thereafter the fuse link is secured by means of the thumb nut 7 to the lever 6 and the fuse tube is replaced and rocked back into operation position, as shown in Figure 1.

In the form of the invention shown in Figures 5 and 6 the fuse tube is indicated at 36. It is provided with an upper terminal 37 and a pair of spring arms 38 are secured on opposite sides of the upper fuse tube terminal 37. They may

be secured by means of screws **39** provided with washers **40**, the ends of the spring arms **38** being inturned and clamped beneath the washers. These spring arms have a downwardly looped portion as indicated at **41** to provide additional resiliency and have relatively straight upper portions **42** positioned on opposite sides of the reduced neck **43** of the upper terminal **37** of the fuse tube. These arms may extend vertically upwardly as shown or may be slightly inwardly tapererd if desired. They grip opposite sides of the button head **32** of the fuse link.

The upper contact **37** of the fuse tube is provided with outwardly projecting pins **44** which are adapted to engage beneath depressed portions of the spring arms of the upper contact. A manipulating eyelet portion **45** is formed integrally with the upper contact **37** of the fuse tube and such upper contact may have an inwardly projecting rib **46**, see Figure 5, which acts as a stop to engage the bracing members for the upper spring arms of the stationary contact.

Upon rupture of the fuse link the button head **32** of the fuse link is retained in place for light overloads and a straight expulsion action occurs. However, under heavy overloads the button head blows driectly upwardly away from the fuse tube.

In the form of the invention shown in Figures 7, 8 and 9 the fuse tube is indicated at **47** and its upper contact at **48**. This upper contact is provided with a manipulating eyelet portion **49** and a reduced neck portion **50** and with a stop portion **51** located on the inner side thereof and corresponding to the stop portion **46** of Figure 5. The upper contact **48** of the fuse tube is also provided with a pair of outwardly projecting pins **52** which are adapted to be positioned beneath the spring arms of the upper contact, as previously described.

The fuse gripping means comprises a pair of spring arms **53** which have their ends secured beneath the washers **54** by means of screws **55**. These spring arms **53** extend upwardly and inwardly and are provided with portions **56** which engage opposite sides of the button head **32** of the fuse link. The arms **53** extend laterally as indicated at **57** and **58** with the portion **57** located below the plane of the portion **58**.

These portions **57** and **58**, as shown most clearly in Figure 9, constitute laterally projecting, looped, manipulating portions which are adapted to be pressed inwardly by the operator when it is desired to clamp the button head of a new link in place. It is to be noted that the portions of the spring arms which engage the button head **32** are located at spaced points around the button head. The looped portions **57** and **58** have their parallel side portions spaced sufficiently far apart to allow the free passage therethrough of the button head **32** of the fuse link.

When the fuse link is ruptured under light overloads, the button head is retained in place and the device operates as a straight expulsion fuse tube. However, when a heavy overload occurs, the button head **32** is blown directly outwardly from the fuse tube without damage to the upper stationary contact and the fuse tube is thus vented at both ends.

In all forms of the invention it is intended that the spring arms which engage the button head of the fuse link have sufficient resiliency to allow fuse links with different sized button heads to be employed, the larger size of the button heads having been shown in the different forms illustrated.

It will be seen that novel forms of fuse devices have been shown in which provision is made for directly gripping the side edges of the button head or other shaped head of a fuse link to retain the head in place for small overloads and to allow the head to be blown off for heavy overloads.

It will be seen further that in the first and last forms of the invention the construction is such that the operator can squeeze portions of the button head gripping members towards each other and thus spread them apart to allow the free positioning of a new fuse with a new button head. In the second form of the invention shown in Figures 5 and 6, the operator spreads the spring gripping members apart when he forces the button head of the fuse link into place.

It will be seen further that a very good electrical contact is obtained directly with the head of the fuse link and that this result is obtained through the use of a relatively simple construction.

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. In a fuse construction, stationary terminals, a fuse tube having both ends open and having a terminal adjacent one end normally electrically connected to one of the stationary terminals, a fuse link extending through the fuse tube and having a head at one end normally closing one end of said fuse tube and connecting the other stationary terminal with the terminal of the fuse tube, and resilient means carried by the terminal of the fuse tube for gripping the head of the fuse link, the gripping portion of said resilient means having a substantial range of movement to grip heads of different sizes.

2. In a fuse construction, stationary terminals, a fuse tube having both ends open and having a terminal adjacent one end normally electrically connected to one of the stationary terminals, a fuse link extending through the fuse tube and having a head at one end normally closing one end of said fuse tube and connecting the other stationary terminal with the terminal of the fuse tube, and resilient means carried by the terminal of the fuse tube for gripping the sides of the head of the fuse link, the gripping portion of said resilient means having a substantial range of movement to grip heads of different sizes.

3. In a fuse construction, stationary terminals, a fuse tube having both ends open and having a terminal adjacent one end normally electrically connected to one of the stationary terminals, a fuse link extending through the fuse tube and having a head at one end normally closing one end of said fuse tube and connecting the other stationary terminal with the terminal of the fuse tube, and resilient means carried by the terminal of the fuse tube for gripping the head of the fuse link, the gripping portion of said resilient means having a substantial range of movement to grip heads of different sizes, the gripping portion of said resilient means leaving a substantially unobstructed space beyond the head of the fuse link, whereby the head may be blown outwardly when sufficient pressure is developed in the fuse tube upon rupture of the fuse link on heavy overload.

4. In a fuse construction, stationary terminals, a fuse tube having both ends open and having a terminal adjacent one end normally electrically

connected to one of the stationary terminals, a fuse link extending through the fuse tube and having a head at one end normally closing one end of said fuse tube and connecting the other stationary terminal with the terminal of the fuse tube, and resilient gripping means having looped portions, said gripping means being carried by the terminal of the fuse tube for gripping the head of the fuse link, the looped portions of said gripping means providing increased resiliency for said gripping means.

5. In a fuse construction, stationary terminals, a fuse tube having both ends open and having a terminal adjacent one end normally electrically connected to one of the stationary terminals, a fuse link extending through the fuse tube and having a head at one end normally closing one end of said fuse tube and connecting the other stationary terminal with the terminal of the fuse tube, and resilient gripping means having looped portions, said gripping means being carried by the terminal of the fuse tube for gripping the head of the fuse link, the looped portions of said gripping means providing increased resiliency for said gripping means, the head of the fuse link being gripped on its sides by said gripping means, whereby the head of the fuse link may be blown outwardly when sufficient pressure is developed in the fuse tube upon rupture of the fuse link on heavy overload.

6. In a drop-out fuse construction, an upper and a lower stationary terminal, a fuse tube having both ends open and having a terminal adjacent its upper end normally electrically connected to and interlocking with the upper stationary terminal, a fuse link extending through the fuse tube and having a head at its upper end normally closing the upper end of said fuse tube and connecting the lower stationary terminal with the terminal of said fuse tube, said head normally bearing against the terminal of said fuse tube, resilient gripping means carried by the terminal of said fuse tube and having looped portions and having gripping portions spaced from the looped portions for gripping the head of the fuse link, and lever means normally supporting the lower end of said fuse tube, said lever means being restrained by said fuse link and releasing said fuse tube for drop-out motion upon rupture of said fuse link.

7. In a drop-out fuse construction, an upper and a lower stationary terminal, the upper stationary terminal having a pair of spaced arms, a fuse tube having both ends open and having a terminal adjacent its upper end normally positioned between the arms of said upper stationary terminal and interlocking with said arms, a fuse link extending through the fuse tube and having a head at its upper end normally closing the upper end of said fuse tube and connecting the lower stationary terminal with the terminal of the fuse tube, resilient gripping means for gripping the sides of the head of the fuse link, said resilient gripping means having looped portions for increasing the resiliency of said resilient gripping means, and means adjacent the lower end of said fuse tube controlled by said fuse link for normally holding said fuse tube in interlocking relation to said upper stationary terminal, said means releasing said fuse tube for drop-out motion upon rupture of said fuse link.

8. In a drop-out fuse construction, an upper and a lower stationary terminal, the upper stationary terminal having a pair of spaced arms, a fuse tube having both ends open and having a terminal adjacent its upper end normally positioned between the arms of said upper stationary terminal and interlocking with said arms, a fuse link extending through the fuse tube and having a head at its upper end normally closing the upper end of said fuse tube and connecting the lower stationary terminal with the terminal of the fuse tube, resilient gripping means for gripping the sides of the head of the fuse link, said resilient gripping means having looped portions for increasing the resiliency of said resilient gripping means, said looped portions being located below the arms of said upper stationary terminal, and means adjacent the lower end of said fuse tube controlled by said fuse link for normally holding said fuse tube in interlocking relation to said upper stationary terminal, said means releasing said fuse tube for drop-out motion upon rupture of said fuse link.

9. In a fuse construction, stationary terminals, a fuse tube having both ends open and having a terminal adjacent one end normally electrically connected to one of the stationary terminals, a fuse link extending through the fuse tube and having a head at one end and connecting the other stationary terminal with the terminal of the fuse tube, the head of said fuse link normally closing one end of said fuse tube, and gripping means carried by the terminal of the fuse tube for gripping the sides of the head of the fuse link, the gripping means having looped portions to provide resiliency, said gripping means holding said head in tube closed position on light overloads and said head being blown outwardly upon heavy overloads to thereby vent said fuse tube at both ends upon heavy overloads.

10. In a fuse construction, stationary terminals, a fuse tube having both ends open and having a terminal adjacent one end normally electrically connected to one of the stationary terminals, a fuse link extending through said fuse tube and having a head at one end normally closing one end of said fuse tube and connecting the other stationary terminal with the terminal of the fuse tube, and resilient gripping means carried by the terminal of the fuse tube for gripping the sides of the head of the fuse link, said means having oppositely looped projecting portions, whereby said projecting portions of said gripping means may be squeezed towards each other to open said gripping means for the free passage of the head of the fuse link.

11. In a fuse construction, stationary terminals, a fuse tube having both ends open and having a terminal adjacent one end provided with an outwardly projecting reduced neck portion, the terminal of said fuse tube being normally electrically connected to one of the stationary terminals, a fuse link extending through the fuse tube and having a head at one end normally bearing against the neck portion of the terminal of said fuse tube and connecting the other stationary terminal with the terminal of said fuse tube, and resilient gripping means having gripping portions on opposite sides of said neck portion for gripping the head of the fuse link and having looped portions and terminating in attached portions attached to the terminal of the fuse tube.

12. In a fuse construction, stationary terminals, a fuse tube having both ends open and having a terminal adjacent one end normally electrically connected to one of the stationary terminals, the terminal of said fuse tube having

a reduced neck portion projecting outwardly, a fuse link extending through the fuse tube and having a head at one end normally engaging the outer end of the neck portion of the terminal of said fuse tube, and a pair of resilient gripping means, each resilient gripping means being anchored on one side of the terminal of said fuse tube and extending across to the other side of the terminal of said fuse tube and having a gripping portion on said last mentioned side for gripping the head of the fuse link.

13. In a fuse construction, stationary terminals, a fuse tube having both ends open and having a terminal adjacent one end normally electrically connected to one of the stationary terminals, the terminal of said fuse tube having a reduced neck portion projecting outwardly, a fuse link extending through the fuse tube and having a head at one end normally engaging the outer end of the neck portion of the terminal of said fuse tube, and a pair of resilient gripping means, each gripping means being secured to the terminal of said fuse tube on one side of said terminal and having a looped portion and having a gripping portion on the same side of the terminal of the fuse tube to which it is secured for gripping the side of the head of the fuse link, the gripping portions of said gripping means being located on opposite sides of the neck of the terminal of said fuse tube.

14. In a fuse construction, stationary terminals, a fuse tube having both ends open and having a terminal adjacent one end normally electrically connected to one of the stationary terminals, the terminal of said fuse tube having a reduced neck portion projecting outwardly, a fuse link extending through the fuse tube and having a head at one end normally engaging the outer end of the neck portion of the terminal of said fuse tube, and a pair of resilient gripping means, each gripping means having a portion secured to one side of the terminal of the fuse tube and having a gripping portion on the same side of said terminal for gripping the side of the head of the fuse link and each gripping portion having a manipulating portion projecting across to the other side of the terminal of the fuse tube.

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