Sept. 26, 1944. H. L. RAWLINS 2,359,153

CIRCUIT INTERRUPTER

Filed May 3, 1941 3 Sheets-Sheet 1

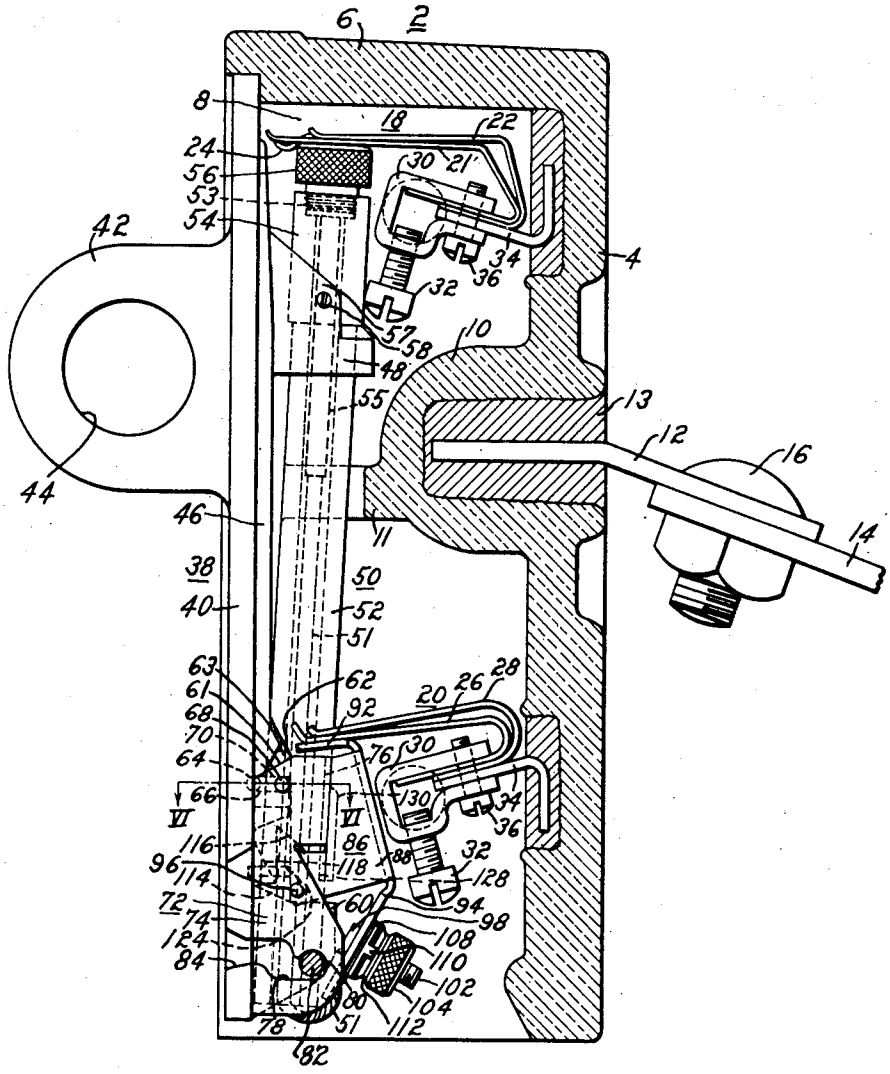


Fig. 1.

WITNESSES:
Wm. B. Sellers.
A. T. Stratton

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Sept. 26, 1944. H. L. RAWLINS 2,359,153

CIRCUIT INTERRUPTER

Filed May 3, 1941 3 Sheets-Sheet 2

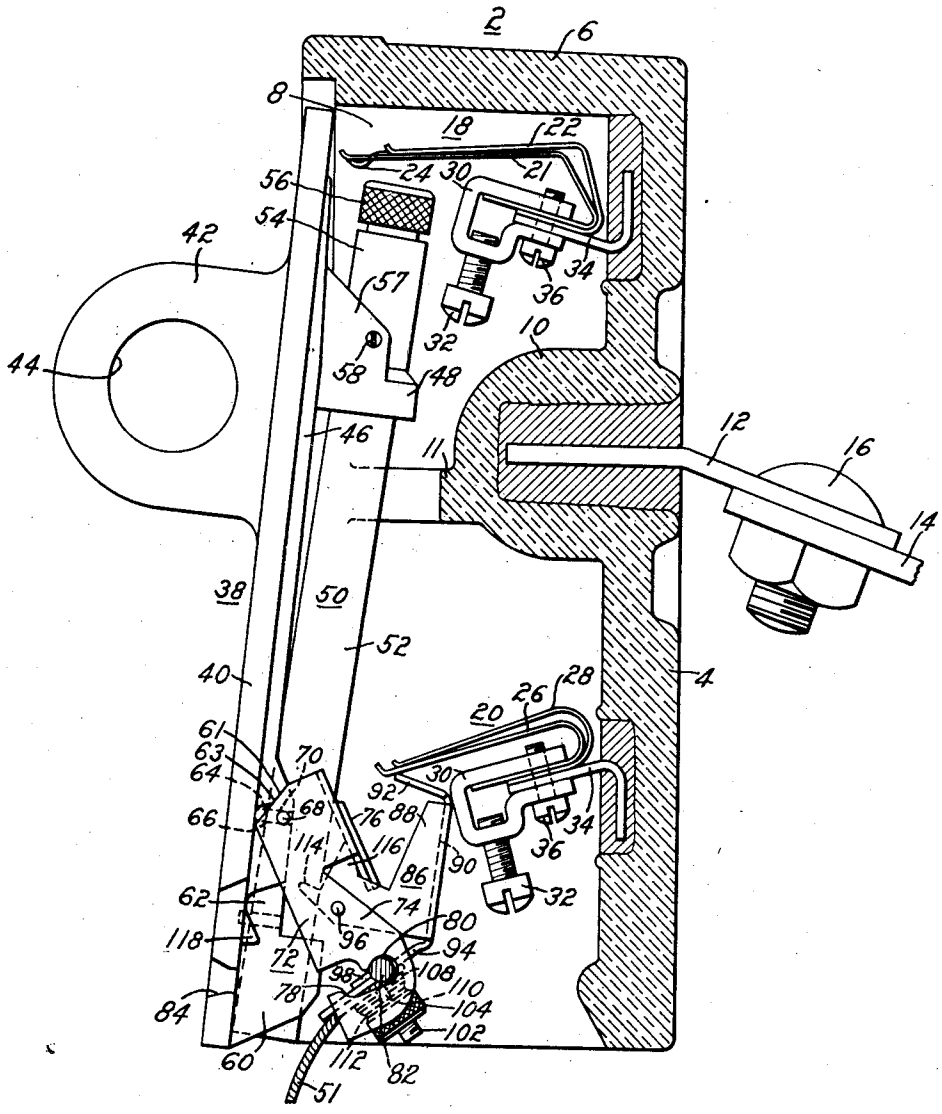


Fig. 2.

WITNESSES:

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CIRCUIT INTERRUPTER

Filed May 3, 1941 3 Sheets-Sheet 3

Fig. 3.

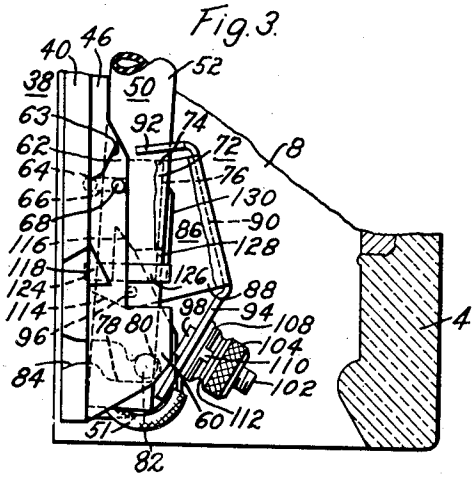


Fig. 4.

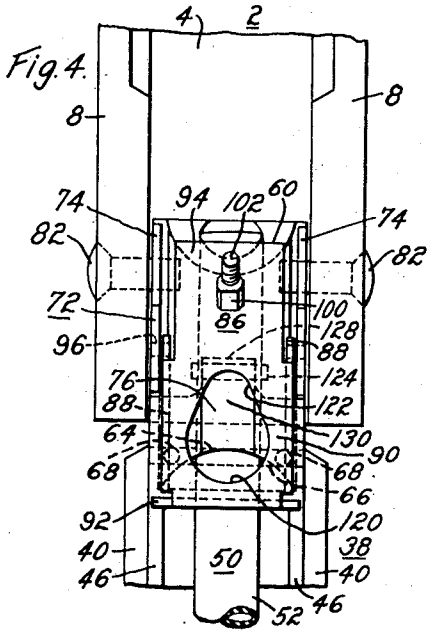


Fig. 5.

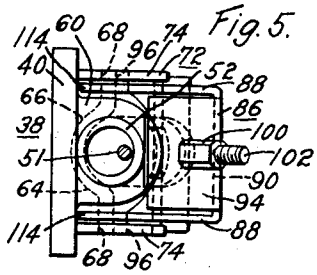


Fig. 6.

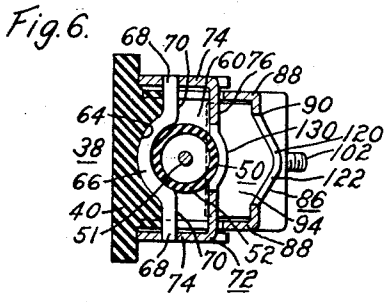


Fig. 7.

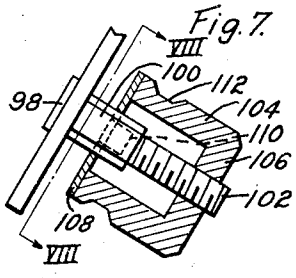
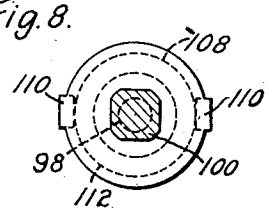


Fig. 8.



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Patented Sept. 26, 1944

2,359,153

UNITED STATES PATENT OFFICE

2,359,153

CIRCUIT INTERRUPTER

Herbert L. Rawlins, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application May 3, 1941, Serial No. 391,644

33 Claims. (Cl. 200—114)

This invention relates, in general, to electric circuit interrupters, and more specifically, to drop-out fuse cutouts.

One object of this invention is to provide a novel type of drop-out fuse which is of relatively simple construction and capable of ready and easy assembly and is efficient in operation.

Another object of this invention is to provide a novel drop-out fuse construction especially adapted for use with an enclosed fuse structure.

Another object of this invention is to provide a fuse of the type described which is especially adapted for ready attachment or detachment with respect to supporting means and which may be attached or detached by means of a hook stick.

Another object is to provide a novel assembly of a fuse and housing door.

Another object of this invention is to provide novel means for securing a fuse link to a fuse terminal.

These and other objects of this invention will become more apparent upon consideration of the following detailed description of a preferred embodiment thereof, taken in connection with the accompanying drawings, in which:

Figure 1 is a longitudinal sectional view through an enclosed fuse coutout embodying this invention, with the fuse shown in the closed circuit position;

Fig. 2 is a view like that of Fig. 1 but showing the fuse in an initial stage of its automatic drop-out movement;

Fig. 3 is a partial sectional view of the lower end of a fuse like that shown in Figs. 1 and 2, and certain parts being broken away to illustrate an attachment for preventing movement of the fuse when it blows;

Fig. 4 is a partial front view of the fuse shown in Figs. 1 and 2, with the fuse in an open depending position with respect to its housing;

Fig. 5 is a bottom view of the fuse and door assembly shown in Figs. 1, 2 and 4;

Fig. 6 is a transverse sectional view taken substantially on the line VI—VI of Fig. 1;

Fig. 7 is an enlarged elevational view partially in section, of the fuse link securing means shown in Figs. 1 to 6; and

Fig. 8 is a sectional view of the fuse securing means looking substantially in the direction of the arrows VIII—VIII of Fig. 7.

In the embodiment of the invention illustrated in the drawings, the fuse is preferably provided with an insulating housing 2 which may be of any desired insulating material, preferably die-pressed porcelain. The housing 2 comprises a rear wall 4, a top wall 6 and opposite side walls 8. The rear wall 4 is provided with an inwardly extending protuberance 10 forming with the integral flange 11 a transverse baffle intermediate the ends of insulating casing 2. The protuberance 10, as shown, is provided with a cavity opening to the outer side of wall 4 adapted to receive one end of a mounting bracket 12 for supporting the casing, for example, from a cross-arm hanger 14 adapted to be secured to the bracket 12 by bolt 16. Supporting bracket 12 is preferably secured in the cavity of protuberance 10 by cementing material 13 which may be any well known type of cementing material, or may be a metal cast in the cavity around bracket arm 12.

Within casing 2 there is provided upper and lower contact assemblies 18 and 20, respectively, secured in cavities in the inner surface of rear wall 4 of the casing. The upper contact assembly 18 includes a forwardly projecting contact strip 21 of any desired conducting material, such for example, as copper or the like, with a resilient backing strip 22 overlying conducting strip 21. The outer end of conducting strip 21 is preferably bifurcated, and the outer end of resilient backing strip 22 is preferably formed with three spaced tine portions, the outer ones of which overlie the furcations of contact strip 21, and the middle one of which is formed with a downwardly projecting end portion 24 adapted to project downwardly between the furcations of contact strip 21, to form a latch means for engagement with the upper end of a fuse. Similarly, the lower contact assembly 20 includes a contact strip 26 and resilient backing strip 28 overlying contact strip 26, and the outer ends of these strips are preferably provided with an arcuate cutout portion for receiving the fuse when in operative position within casing 2.

The contact and backing strips of both the contact assemblies 18 and 20 are mounted in position in casing 2 by a substantially U-shaped clamp member 30 having an enlarged bight portion for the reception of a line conductor, with a screw 32 threaded through an aperture in one wall of the bight portion to clamp the conductor therein. The contact and backing strips are received between the outer ends of U-shaped clamp 30, as is one leg of an angled supporting bracket 34. Securing means, such for example, as screws 36, are adapted to extend through the legs of U-shaped clamp 30 and through apertures in the contact and backing strips, and each angled supporting bracket 34 is provided with

slots in the outer edge thereof for receiving intermediate portions of screws 36 so that the entire contact assemblies may be slipped on or off brackets 34 when screws 36 are loosened, and may be secured to the brackets merely by tightening screws 36 when the assemblies are in position. The other legs of angled brackets 34 are secured in depressions formed in the inner surface of rear casing wall 4, preferably in the same manner that supporting bracket 12 is secured in the cavity of protuberance 10.

The above-described structure has not been described in great detail because this structure is more particularly disclosed and claimed in the copending application of H. L. Rawlins and E. H. Fischer, Serial No. 379,076, filed February 15, 1941, entitled Electrical apparatus, and assigned to the same assignee as this invention. Accordingly, for a more complete description of the details of insulating casing 2 and contact assemblies 18 and 20, and their association with casing 2, reference is hereby made to the aforesaid copending application.

The open front of casing 2 is adapted to be closed by a door 38 of insulating material, such for example, as porcelain, a synthetic resin or the like. Door 38 comprises a door panel 40 having at the outer surface thereof an integral projection 42, extending outwardly and apertured as at 44, for the reception of a hook stick operating member, or the like, for manipulation of the door to open and closed positions with respect to casing 2. The inner surface of door panel 40 is provided intermediate the ends thereof with spaced, longitudinally extending integral flanges 46, adjacent the upper ends of which, as viewed in Figs. 1 and 2, there is provided an integral projection 48 apertured for the reception of a fuse 50.

The fuse 50 may be of a conventional form which includes a fuse tube 52 of any desired insulating material, such as fiber or a synthetic resin. The upper end of the fuse tube has secured thereto in any desired manner, such for example, as by threaded engagement, an upper metal terminal ferrule 54 provided with a terminal cap 56 threadedly engaged with the outer end of the ferrule, for securing the head contact 53 of a fuse link in conductive relation with respect to ferrule 54 and cap 56. The lower end of fuse tube 52 is left open so that the tail 51 of the fuse link may extend out of the lower end of the fuse tube to be fastened to a lower terminal. The fuse link also may be of any conventional structure, and that illustrated includes a terminal head 53 and tail 51 connected by a fusible means contained within an insulating tube 55 adjacent the upper end of fuse tube 52. This specific fuse link structure is more particularly disclosed and claimed in the copending application of James M. Wallace, Serial No. 294,073, filed September 9, 1939, on Circuit interrupters now Patent No. 2,343,723, issued March 7, 1944, and assigned to the same assignee as the present application.

As shown in the drawings, fuse 50 is assembled with door 38 by threading fuse tube 52 downwardly through the aperture in projection 48, until terminal ferrule 54 is seated on the upper side of projection 48. Integral upstanding flanges 57 are provided connected with door panel 40 and projection 48, and are joined by a curved wall portion to conform to the curvature of fuse terminal ferrule 54. Also, one of the flanges 57 is provided with a threaded aperture for receiving a set screw 58 to prevent removal of the fuse from projection 48, and set screw 48 is preferably adapted to be received in a side aperture in terminal ferrule 54.

Door panel 40 is also provided at the inner side thereof with a second integral projection 60 adjacent the lower end thereof, which is apertured for reception of the lower end of fuse tube 52. That is, when fuse tube 52 is threaded through aperture in projection 48 until ferrule 54 engages the upper side of projection 48, the lower end of the fuse tube will then be received in the aperture provided in lower projection 60. Extending upwardly from lower projection 60 and integral therewith and with door panel 40, are spaced flanges 62 similar to upper flange 57, and like these flanges, are joined by a curved connecting wall portion adapted to conform with the curvature of fuse tube 52. Flanges 62 are provided below flanges 46 and are spaced slightly inwardly of flanges 46, for a purpose which will hereinafter become apparent.

A supporting lower terminal assembly is adapted to be readily removably associated with the door and fuse assembly, and this is accomplished by the provision of a transverse slot or groove 64 in the inner surface of door panel 40 intermediate lower flanges 62, for the reception of a curved rod-like member 66, having oppositely outwardly extending end portions 68 to form pintles adapted to extend outwardly through notches 70 formed in flanges 62. The rod-like member 66 is maintained in position in groove 64 by fuse tube 52, and may be readily assembled in position merely by withdrawing fuse tube 52 from the apertures in projections 48 and 60, placing the rod-like member 66 in groove 64 and then inserting the fuse tube in position, without the necessity of any other securing means or special tools. The pintle portions 68 on member 66 are adapted to pivotally support a supporting link 72 for the fuse and door assembly. As shown in the drawings, supporting link 72 comprises spaced side walls 74 apertured adjacent the upper ends thereof for the reception of pintle portions 68, respectively, and an integral connecting wall 76 also located adjacent the upper ends of side walls 74 for rigidly connecting the sides of supporting link 72. Connecting wall 76 has the upper end thereof provided with an arcuate cutout portion to permit counter-clockwise movement of the supporting link about pintles 68 by receiving fuse tube 52 during such movement.

The lower portion of supporting link 72 is provided with a slot 78 opening to one edge of the link and having a reentrant portion 80 at the inner end thereof for receiving pivot pins 82 supported on side walls 8 of insulating casing 2. By the provision of such a slot in the supporting link, it will be apparent that the link may be readily attached and detached with respect to supporting pivots 82 by movement of the link to cause entrance or exit of supporting pins 82 into slot 78. In the position of the parts shown in Fig. 1 of the drawings, it will be noted that slot 78 in the supporting link lines up with notches 84 provided in opposite side edges of door panel 40 to permit the link, when assembled with the fuse and door, to be engaged or disengaged with pivot pins 82. Notches 84 in door panel 40 preferably are flared outwardly to facilitate easy entrance of pivot pins 82 into the notches and slots 78 in the supporting link.

A contact lever 86 of any desired conducting material, such for example, as copper or the like.

is preferably formed with side plate portions 88 connected adjacent their upper ends, as viewed in Fig. 1, by an integral connecting plate portion 90. The upper end of the connecting plate portion 90 is preferably extended beyond side plates 88 and bent substantially at right angles to form a contact terminal portion 92 for engagement with contact strip 26 of lower contact assembly 20, when the fuse is in operative position. Preferably, the contact terminal portion 92 also has an arcuate cutout portion in the outer end thereof similar to that in the outer ends of contact strip 26 and resilient backing strip 28, to receive fuse tube 52. The other end of connecting plate 90 of contact lever 86 is extended beyond the other ends of side plates 88 and bent angularly, for example, approximately at an angle of 45° to form a terminal portion 94 to which the fuse link tail 51 may be secured. Contact lever 86 is pivotally associated with supporting lever 72, by pivot means 96 extending through corresponding sides of the supporting link and contact lever and may comprise rivets or the like. Preferably, the sides 88 of contact lever 86 are spaced apart a distance less than the sides 74 of supporting link 72, so that the sides 88 of the contact lever will fit between sides 74 of the supporting link.

Referring particularly to Figs. 7 and 8 of the drawings, it can be seen that the terminal portion 94 of contact lever 86 is apertured adjacent the outer end thereof for the reception of a headed stud 98 having an inner portion 100 projecting through terminal portion 94 of the contact lever, with the inner portion 100 being non-circular in form. The stud 98 also includes an outer threaded portion 102 for cooperation with a cup-shaped nut 104, the base portion 106 of which is provided with a threaded aperture for cooperation with the outer threaded portion 102 of the stud. Preferably stud 98 is made from square rod stock which is turned to cut threads 102 and to cut off the corners of portion 100 in a single operation. A washer member 108 is interposed between terminal portion 94 of the contact lever and nut 104, and is preferably rotatably secured to nut 104 by integral tab portions 110 on the washer being bent over the open end of nut 104 and into peripheral groove 112 on the outer surface of the nut in a loose manner to prevent relative separating movement of the washer and nut while permitting relative rotative movement thereof. Washer 108 is provided with an aperture also non-circular in form, similar to the form of inner portion 100 of stud 98, so that upon rotation of nut 104, washer 108 is moved longitudinally of stud 98 but is maintained against rotation on the stud.

As stated before, the purpose of nut 104 is to secure tail 51 of the fuse link to contact lever 86, and the purpose of the specific structure of nut 104, stud 98 and washer 108, is to prevent capstan action on the fuse link tail upon tightening of nut 104. In other words, it has been the practice in the past to secure a fuse link tail to a lower fuse terminal by some sort of rotatable clamping means, so that when the fuse link tail is wrapped about the clamping means in the direction of rotation thereof to clamp the tail in position, tightening of the clamping means results in a certain amount of rotation of the fust link tail with the clamping means and causes undue tension being placed upon the fusible portion of the fuse link, which even though it may not be sufficient to break the relatively fragile fusible portion of the link, often is enough to stress the fuse link in a manner to appreciably alter the rating thereof. Even where fuse links are provided with strain relief wires, as in the fuse link of the aforementioned patent of James M. Wallace, these are necessarily limited in strength not only because of space limitations, but because it is essential that they be fused instantly upon fusion of the fusible portion of the link and consequently cannot withstand much tension. Fuse links at present are designed to withstand a pull of about ten pounds, and this may readily be exceeded by the capstan action and resulting relatively great mechanical advantage obtained, for example, by securing the tail of the fuse link with the aid of a pair of pliers beneath a rotatable clamping means, such as an ordinary bolt and nut. However, with the clamping means of this invention, it is obvious that washer 108 which directly engages the fuse link tail to clamp it to terminal portion 94 of contact lever 86, cannot rotate and, therefore, can assert no rotative effort on the portion of the fuse link tail in engagement therewith. This is an important feature because considerable difficulty has been experienced because of damage to fuse links caused by too much tension being exerted thereon.

With the tails 51 of the fuse link secured to terminal portion 94 of contact lever 86, it is believed apparent that the contact lever will be prevented from rotating counter-clockwise about its pivot 96. The sides 88 of contact lever 86 are provided with integral forwardly extending locking projections 114 adapted to engage beneath integral stop lugs 118 provided on door panel 40 when the contact lever is maintained in the position shown in Fig. 1 of the drawings by fuse link tail 51, so that supporting link 72 is positively locked by engagement of projection 114 and stop lug 118 against rotative movement in a counter-clockwise direction about its pivot 68 on the door and fuse assembly or about pivot pin 82 on casing 2. Consequently, it can be seen that when a fuse link is inserted in fuse tube 52 and secured at one end by terminal cap 56 and at the other end to contact lever 86 by nut 104, the contact lever and supporting link are positively locked against movement with respect to the fuse or door by inter-engagement of locking projection 114 on the contact lever and locking lug 118 on the door. This enables handling of the door and fuse assembly when disassembled with respect to casing 2 without any danger whatsoever of placing any undue strain on the fuse link, and when the door and fuse assembly are associated with the casing by slipping the notches in the lower end of the door over pivot pins 82, the door may then be rotated in a clockwise direction about pivot pins 82 to bring fuse terminal cap 56 into engagement with upper contact assembly 18, and contact portion 92 of contact lever 86 into engagement with lower contact assembly 20 with a wiping action until latch portion 24 of a resilient backing strip 22 engages over the outer side of terminal cap 56 to maintain the door closed and the fuse in closed circuit position with respect to terminal assemblies 18 and 20. As the door and fuse are moved to the closed position shown in Fig. 1, the fuse terminal cap 56 and terminal portion 92 of contact lever 86 engage the contact strips of the respective terminal assemblies which, as shown, have upwardly deflected outer ends so that the fuse terminals may be operative to move the contact

strips upwardly against the bias exerted by backing strips 22 and 28, respectively, to thereby provide both a wiping engagement and final contact of the contact strips and fuse terminals under considerable pressure.

In the closed position of the fuse and door illustrated in Fig. 1 of the drawings, it will be observed that both terminal assemblies 18 and 20, by virtue of the bias exerted by their backing strips 22 and 28, respectively, will exert a force substantially longitudinally of fuse tube 52, with the upper contact assembly exerting this force along the axis of fuse tube 52, which it will be noted is displaced outwardly of pivot pins 82 so as to tend to cause movement of supporting link 72 in a counter-clockwise direction about pivot pins 82 and therefore tend to break the toggle comprising fuse tube 52 and supporting link 72 outwardly, and cause movement of the lower end of the fuse tube and door outwardly and downwardly to release the upper end of the fuse from latch 24. Similarly, lower contact assembly 20 exerts a force on supporting link 72 at its pivot 96 therewith, which is also offset outwardly relative to link pivot supporting pins 82 to also tend to cause movement of the supporting link in a counter-clockwise direction about pivot pins 82 and cause movement of the door and fuse outwardly of casing 2. Therefore, when the fuse link blows and fuse link tail 51 is no longer operative to maintain terminal portion 94 of contact lever 86 adjacent the lower end of fuse tube 52, the forces exerted by both contact assemblies will cause movement of the lower end of the fuse tube and door in the direction stated above with supporting link 72 pivoting in a counter-clockwise direction about pivot pins 82 until the fuse terminal cap 56 clears latch portion 24, whereupon the fuse tube and door will be free to pivot with supporting link 72 in a counter-clockwise direction out of casing 2 to depend therefrom in the manner shown in Fig. 4.

It should be especially noted that initial movement of fuse 50 when the fuse blows, is produced by pressure exerted by both backing strips 22 and 28 of contact assemblies 18 and 20, respectively. After fuse terminal cap 56 disengages upper contact assembly 18, pressure will continue to be exerted on contact lever 86 by contact assembly 20 until the parts reach the position shown in Fig. 2, because the lever arm from pivot pins 82 to supporting lever pivot 68 being longer than the lever arm from pivot pins 82 to contact lever pivot 96, will cause greater movement downwardly of the fuse and its terminal cap 56 than of contact lever 86. This action may be further enhanced by causing backing strip 28 of contact assembly 20 to be stressed a greater amount than the backing strip of contact assembly 18 so that even when the fuse has moved downwardly an amount sufficient to clear latch projection 24, backing strip 28 will still exert pressure on contact lever 86, tending to move supporting link 72 in a counter-clockwise direction and cause pivoting thereof, together with the door and fuse, out of casing 2. It will be noted also that the upper edge of supporting link 72 has the corner adjacent door 38 cut off to form an angularly extending edge 61 engageable with an angular stop surface 63 on the door to cause movement of the door and fuse with the supporting link after predetermined relative movement of the door and link has caused sufficient downward movement of the fuse to clear terminal cap 56 from latch projection 24. In the position of the parts shown in Fig. 2 of the drawings, it will be noted that substantially all of the door and fuse parts are positioned outwardly of a vertical plane extending through pivot pins 82 and that an integral stop projection 116 on each side plate 88 of the contact lever has engagement with connecting wall 76 of supporting link 72, so that continued movement of the door and fuse assembly with supporting link 72 in a counter-clockwise direction about pivot pins 82 under the push given these parts by the force exerted by contact assemblies 18 and 20, will forcibly move contact portion 92 of contact lever 86 from engagement with contact assembly 20. This will not take a great deal of force because in this position of the parts, contact assembly 20 has substantially assumed its normal position so that little force is exerted thereby against contact lever 86. When the fuse blows, of course, contact lever 86 is no longer maintained in the position shown in Fig. 1, so that the contact lever may pivot with supporting link 72 about its pivot pin 68 an amount sufficient to clear locking lug 118, and thereafter contact lever 86 will move relative to supporting link 72 about its pivot 96 therewith, because of the frictional engagement of its contact portion 92 with contact assembly 20. This relative movement of contact lever 86 and supporting lever 72 continues, of course, until the parts reach the position shown in Fig. 2 of the drawings, when the momentum of the door and fuse assembly and parts moving therewith cause disengagement of the contact lever 86 from contact assembly 20. At the position of the parts shown in Fig. 2, contact assembly 20 no longer exerts any force on contact lever 86, so that there is no frictional resistance to continued movement of the fuse and door.

It will be noted that when the fuse and door have moved to an open position with respect to casing 2 and with respect to the circuit between contact assemblies 18 and 20, the door and fuse assembly will assume a depending position as shown in Fig. 4 of the drawings. In this position, an aperture 120 in the connecting portion 90 of contact lever 86 is exposed, and this aperture has a rounded lower portion, as viewed in Fig. 4, and a narrowed upper portion 122 to present a substantially pear-shaped opening for the reception of a hook stick operating member or the like, which may be inserted in opening 120 to lift the door and fuse assembly upwardly and outwardly to remove notches 78 in the supporting link from pivot pins 82 and detach the door and fuse assembly from the casing without the necessity of manually grasping any of the parts. The particular shape of aperture 120 in contact lever 86 is of advantage in that it permits the insertion of the enlarged end of a hook stick so that when the door and fuse assemblies are lifted upwardly, the enlarged end of the hook stick cannot be withdrawn from the upper narrow portion 122 of the aperture.

To replace the blown fuse link, the door and fuse assembly are preferably removed from casing 2 in the manner outlined above, and the remaining portions of the blown fuse link may be removed by removing terminal cap 56, whereupon a new fuse link may be inserted in the fuse tube without removing the tube from the door, and fastened in place by terminal cap 56 and nut 104, after which the fuse and door may be again assembled with the casing by lifting it by means of a hook stick inserted in aperture 120

in contact lever 86, to cause slots 78 in the supporting link to telescope over pivot pins 82, whereupon by insertion of a hook stick in aperture 44 in projection 42 on the outer side of door 38, the door and fuse assembly may be pivotally moved in a clockwise direction about the pivot pins 82 into closed position with respect to casing 2, and with respect to the circuit connected to contact assemblies 18 and 20. In the attachment and detachment of the fuse and door assembly with respect to casing 2, the locking of supporting link 72 and contact lever 86 to the door 38 by virtue of the inter-engagement of locking projection 114 and locking lug 118 is of particular value in that it prevents undue stress being placed on the fuse link by such attaching or detaching operations and provides a rigid structure by which the assembly may be handled.

In the embodiment of the invention shown in Fig. 3 of the drawings, it will be noted that relative movement of supporting link 72 and the fuse tube and door is prevented by a relatively rigid strap member 126 secured in position between the fuse tube and door in a manner like rod-like pintle supporting member 66, in that strap 126 has an intermediate curved portion seated in a slot 124 provided at the inner surface of door panel 40 intermediate flanges 62 for receiving this portion of strap 126 between the door panel and fuse tube 52. The outer ends of strap 126 are bent inwardly towards each other to overlie a downwardly projecting extension 128 on connecting portion 76 of supporting link 72, to positively secure the link with respect to the door and fuse tube. The projection 128 of the supporting link is provided with an outwardly curved central portion 130 extending through connecting portion 76 as shown in Fig. 6 of the drawings, to enable the link to lie close to fuse tube 52.

The strap 126 for fixedly connecting supporting link 72 to the fuse tube and door assembly may be readily applied to a fuse constructed in accordance with this invention merely by removing the fuse tube 52 from the apertures of supporting projections 48 and 60 on the door, inserting strap 126 in slot 124, and then replacing the fuse tube. In the operation of this embodiment of the invention, when the fuse blows, the bias exerted by contact assemblies 18 and 20 will obviously be inoperative to cause any movement of supporting link 72, and consequently, the fuse tube and door will remain latched in the position shown in Fig. 1 and will not drop out of the circuit.

By the particular method of assembly of the lower contact and supporting means for the fuse tube and door assembly to these parts, it is also possible to readily assemble in the same manner a means, such as strap 126, for converting the drop-out fuse structure shown in Figs. 1, 2 and 4 through 8 of the drawings, to a non-dropout form of fuse cutout in the manner shown in Fig. 3.

From the foregoing, it is believed to be readily apparent that the fuse cutout structure herein disclosed is especially adapted to provide for the fuse and door assembly to drop out of the circuit when the fuse blows, and that this drop-out action is provided by a novel lower fuse terminal and support assembly under the bias exerted by line contacts. Furthermore, the drop-out action of the fuse of this invention acts to pull out the lower fuse link terminal and isolate the fuse and door assembly from both line contacts so that the assembly will be entirely electrically isolated. There has also been herein disclosed relatively simple and novel means for assembling a fuse and cutout housing door in a manner such that the parts are maintained in assembly merely by threading the fuse tube through a pair of supporting apertures, thereby enabling assembly or disassembly of the parts without the use of any tools whatsoever and in an extremely easy and efficient manner. Furthermore, there has also been disclosed in connection with this invention a means for positively preventing the assertion of undue tension on a fuse link in securing the terminals thereof to the fuse holder terminals with which it is assembled. The latter feature is especially important in fuses of the dropout type because the means exerting a biasing action on the fuse to cause it to drop out of the circuit when the fuse blows is usually opposed by the fuse link itself, thereby placing a certain amount of tension on the fuse link, so that any additional tension placed thereon in assembling it in a fuse holder may readily cause impairment of the link so that it will not operate properly.

Having described preferred embodiments of the invention in accordance with the patent statutes, it is desired that the invention be interpreted as broadly as possible, and that it be not limited to the particular embodiments disclosed inasmuch as it will be obvious, particularly to persons skilled in the art, that many modifications and changes may be made in these particular embodiments without departing from the broad spirit and scope of the invention. Accordingly, it is desired that the invention be interpreted as broadly as possible and that it be limited only by what is expressly set forth in the following claims and by the prior art.

I claim as my invention:

1. In a fuse, spaced line contacts, a fuse holder, a fuse link in said holder, a support, means mounting said holder on said support for movement into and out of engagement with at least one of said contacts, latch means for maintaining said holder in closed circuit position with respect to said contacts, said mounting means including a supporting link pivoted to said holder and to said support, means secured to said fuse link and engageable with said supporting link and a part movable with said holder for locking said supporting link against movement with respect to said holder, whereby to release said supporting link for movement relative to said holder and permit movement of said holder out of engagement with said latch means and with at least said one contact when said fuse link blows.

2. In a fuse, spaced line contacts, a fuse holder, a fuse link in said holder, a support, means mounting said holder on said support for movement into and out of engagement with at least one of said contacts, latch means for maintaining said holder in closed circuit position with respect to said contacts, said mounting means including a supporting link pivoted on said holder and on said support, pivoted latch means secured to said fuse link for locking said supporting link against movement with respect to said holder, whereby to release said supporting link for movement relative to said holder and permit movement of said holder out of engagement with said latch means and with at least said one contact when said fuse link blows.

3. In a fuse, vertically spaced line contacts, a fuse tube having a terminal adjacent the upper end thereof, a fuse link in said tube having one

end thereof connected to said terminal, a combined tube terminal and supporting assembly for the lower end of said tube adapted to support said tube for movement of the terminals thereof into and out of engagement with said contacts, latch means for maintaining said tube terminals in engagement with said contacts, said assembly including a pivoted supporting link for the lower end of said tube, and a terminal pivoted on said supporting link, the other end of said fuse link being directly connected to said pivoted terminal for maintaining said pivoted terminal in a position to engage one of said contacts and to maintain said supporting link in a predetermined supporting position relative to said tube, whereby to release said supporting link for movement relative to said tube when said fuse blows to release said tube from said latch means and permit movement of the tube and terminals out of engagement with said contacts.

4. In a fuse, vertically spaced resilient line contacts, a fuse tube having a terminal adjacent the upper end thereof, a fuse link in said tube having one end thereof connected to said terminal, a combined tube terminal and supporting assembly for the lower end of said tube adapted to support said tube for movement of the terminals thereof into and out of engagement with said contacts, latch means for maintaining said tube terminals in engagement with said contacts, said assembly including a pivoted supporting link for the lower end of said tube, a terminal pivoted on said supporting link, the other end of said fuse link being directly connected to said pivoted terminal for maintaining said pivoted terminal in a position to engage one of said contacts and to maintain said supporting link in a predetermined supporting position relative to said tube, said tube and supporting link constituting a toggle maintained by said fuse link adjacent its dead-center position, both of said tube terminals adapted to slidably engage lower surfaces of said contacts at least when moved into engagement to obtain pressure wiping contact and to exert a force substantially longitudinally of said tube in a direction to break said toggle, whereby to release said supporting link for movement relative to said tube when said fuse blows to release said tube from said latch means and permit movement of the tube and terminals out of engagement with said contacts.

5. In a fuse, a line contact, a fuse tube assembly, means supporting said tube assembly for movement toward and away from said contact including a link pivotally connected to a supporting base and said assembly at spaced points, terminal means pivotally mounted on said link, a fuse link mounted in said tube and directly engaging said terminal means to normally maintain said terminal means and link in a predetermined position relative to said assembly so that said terminal means is adapted to engage said contact, and latch means engageable with said assembly to maintain said terminal means and contact in engagement, whereby when said fuse blows said link is released for movement relative to said tube to disengage said latch means and move said terminal means out of engagement with said contact.

6. In a fuse, a resilient line contact, a fuse tube assembly, means supporting said tube assembly for movement toward and away from said contact including a link pivotally connected to a supporting base and said assembly at spaced points, terminal means pivotally mounted on said link, a fuse link mounted in said tube and directly engaging said terminal means to normally maintain said terminal means and link in a predetermined position relative to said assembly so that said terminal means is adapted to engage and stress said contact, and latch means engageable with said assembly to maintain said terminal means and contact in engagement, whereby when said fuse blows said link is released for movement relative to said tube to disengage said latch means while said terminal means and contact remain in engagement, and to thereafter move said terminal means away from said contact.

7. In a fuse, a resilient line contact, a fuse tube assembly, means supporting said tube for movement toward and away from said contact including a link pivotally connected to a supporting base and said assembly at spaced points, terminal means pivotally mounted on said link, a fuse link mounted in said tube and directly engaging said terminal means to normally maintain said terminal means and link in a predetermined position relative to said assembly so that said terminal means is adapted to engage and stress said contact, and latch means engageable with said assembly to maintain said terminal means and contact in engagement, whereby when said fuse blows said link is released for movement relative to said tube to disengage said latch means while said terminal means and contact remain in engagement, and to thereafter move said terminal means away from said contact, and said terminal means pivot being spaced from said spaced points so that said stressed contact is effective to cause said movements when said fuse blows.

8. In a fuse, a resilient contact, a fuse tube assembly, means supporting said tube for movement toward and away from said contact including a link pivotally connected to a supporting base and said assembly at spaced points, terminal means pivotally mounted on said link, a fuse link mounted in said tube and directly engaging said terminal means to normally maintain said terminal means and link in a predetermined position relative to said assembly so that said terminal means is adapted to engage and stress said contact, means on said assembly engageable by a portion of said terminal means for positively preventing movement of said link and terminal means when in said predetermined position, and latch means engageable with said assembly to maintain said terminal means and contact in engagement, whereby when said fuse blows said assembly, terminal means and link are freed for relative movement to disengage said assembly from said latch means.

9. In a fuse, spaced line contacts, a fuse holder, a fuse link in said holder, means mounting said holder for movement into and out of engagement with at least one of said contacts, latch means for maintaining said holder in closed circuit position with respect to said contacts, said mounting means including a pivoted supporting linkage, means under the control of said fuse link for locking said supporting linkage against movement with respect to said holder, whereby to release said supporting linkage for movement relative to said holder and permit movement of said holder out of engagement with said latch means and with at least said one contact when said fuse links blow, and said linkage including an apertured part positioned to be exposed upon

movement of said holder out of engagement for the reception of a hook stick or the like.

10. In a fuse, spaced line contacts, a fuse holder, a fuse link in said holder, means mounting said holder for movement into and out of engagement with at least one of said contacts, latch means for maintaining said holder in closed circuit position with respect to said contacts, said mounting means including a pivoted supporting link, pivoted latch means under the control of said fuse link for locking said supporting link against movement with respect to said holder, whereby to release said supporting link for movement out of engagement with said latch means and with at least said one contact when said fuse link blows, said pivoted latch means including an apertured part for the reception of a hook stick or the like.

11. In a fuse, a resilient line contact, a fuse tube assembly, means supporting said tube for movement toward and away from said contact including a link pivotally connected to a supporting base and said assembly at spaced points, terminal means pivotally mounted on said link, a fuse link mounted in said tube and directly engaging said terminal means to normally maintain said terminal means and supporting link in a predetermined position relative to said assembly so that said terminal means is adapted to engage and stress said contact, latch means engageable with said assembly to maintain said terminal means and contact in engagement, whereby when said fuse blows said link is released for movement relative to said tube to disengage said latch means while said terminal means and contact remain in engagement, and to thereafter move said terminal means away from said contact, and means limiting relative movement of said assembly, supporting link and terminal means to an amount sufficient to release said assembly from said latch means, whereby after such relative movement said assembly and terminal means are adapted to move pivotally with said supporting link away from said contact.

12. In an enclosed fuse cutout construction, a housing having spaced contacts therein, a door and fuse assembly for said housing, cooperating pivot means in said housing and on said assembly for mounting said assembly for movement to and from a position in which said door closes said housing and said fuse is in bridging relation with said contacts, said pivot means constructed to be freely separable only in an open position of said assembly, means on the outer side of said door providing an aperture for the reception of a hook stick or the like, the portion of said cooperating pivot means on said assembly mounted on a lever pivoted with said assembly, terminal means pivotally mounted on said lever for engaging one of said contacts, and said terminal means located at the inner side of said door and apertured for the reception of a hook stick or the like to remove said assembly from said housing in an open position thereof.

13. In an enclosed fuse cutout construction, a housing having spaced contacts therein, a door and fuse assembly for said housing, cooperating pivot means in said housing and on said assembly for mounting said assembly for movement to and from a position in which said door closes said housing and said fuse is in bridging relation with said contacts, said pivot means constructed to be freely separable only in an open position of said assembly, means on the outer side of said door providing an aperture for the reception of a hook stick or the like, and means forming a part of said assembly at the inner side of said door provided with an aperture also for the reception of a hook stick or the like to facilitate detachment of said assembly from said housing in an open position thereof.

14. In a fuse, vertically spaced line contacts, a fuse tube having a terminal adjacent the upper end thereof, a fuse link in said tube having one end thereof connected to said terminal, a combined tube terminal and supporting assembly for the lower end of said tube adapted to support said tube for movement of the terminals thereof into and out of engagement with said contacts, latch means for maintaining said tube terminals in engagement with said contacts, the other end of said fuse link connected to said terminal assembly, said assembly including a pivoted supporting link for said tube, and means preventing relative movement of said link when said fuse blows to maintain said tube terminals latched in engagement with said contacts.

15. In a door and fuse assembly for an enclosed fuse cutout, a housing door member having spaced laterally extending apertured supporting portions for receiving a fuse tube member, supporting means for said assembly having a part extending between said door and tube members, said part seated in a groove in at least one of said members, said part retained in said groove by the other of said members, and said supporting means being otherwise unsecured to said members whereby said supporting means is freely removable upon removal of said fuse tube member from said door member.

16. In a door and fuse assembly for an enclosed fuse cutout, a housing door member, a fuse tube member, means detachably securing said members together, supporting means for said assembly having a part extending between said door and tube members, said part seated in a groove in at least one of said members, said part retained in said groove by the other of said members, and said supporting means being otherwise unsecured to said members whereby said supporting means is freely removable upon removal of said fuse tube member from said door member.

17. In a door and fuse assembly for an enclosed fuse cutout, a housing door member, a fuse tube member, means detachably securing said members together, supporting means for said assembly having a part extending between said door and tube members, said part seated in a groove in at least one of said members, said part and groove being configurated so as to prevent relative endwise movement thereof, said part retained in said groove by the other of said members, and said supporting means being otherwise unsecured to said members whereby said supporting means is freely removable upon removal of said fuse tube member from said door member.

18. In an enclosed fuse cutout door and fuse assembly, a housing door member, a fuse tube member, means detachably securing said members together, terminal means for said assembly secured thereto by a part extending between said door and tube members, said part seated in a groove in at least one of said members, said part retained in said groove by the other of said members, and said supporting means being otherwise unsecured to said members whereby said supporting means is freely removable upon removal of said fuse tube member from said door member.

19. In an enclosed fuse cutout door and fuse assembly, a housing door member, a fuse tube member, means detachably securing said members together, supporting means for said assembly secured thereto by a part extending between said door and tube members and seated in a groove in at least one of said members, said part and supporting means pivotally associated, and means having a portion adapted to be positioned between said members and seated in a groove in one of said members for engaging said supporting means to prevent pivotal movement therof.

20. In a fuse, vertically spaced resilient line contacts, a fuse tube having a terminal adjacent the upper end thereof, a fuse link in said tube having one end thereof connected to said terminal, a combined tube terminal and supporting assembly for the lower end of said tube adapted to support said tube for movement of the terminals thereof into and out of engagement with said contacts, latch means for maintaining said tube terminals in engagement with said contacts, said assembly including a pivoted supporting link for the lower end of said tube, and a terminal pivoted on said supporting link, the other end of said fuse link being directly connected to said pivoted terminal for maintaining said pivoted terminal in a position to engage one of said contacts and to maintain said supporting link in a predetermined supporting position relative to said tube, said tube and supporting link constituting a toggle maintained by said fuse link adjacent its dead-center position, both of said tube terminals adapted to slidably engage lower surfaces of said contacts at least when moved into engagement to obtain pressure wiping contact and to exert a force substantially longitudinally of said tube, and in a direction to break said toggle, whereby to release said supporting link for movement relative to said tube when said fuse blows to release said tube from said latch means and permit movement of the tube and terminals out of engagement with said contacts and said pivoted terminal adapted to stress its respective contact when moved into engagement therewith an amount such that said contact for said pivoted terminal is effective upon blowing of the fuse, to exert force on said terminal in a direction to cause movement of said tube away from said contacts even after disengagement of said tube and latch means.

21. In a dropout fuse, spaced resilient line contacts, a fuse tube having a terminal, supporting linkage for said tube including a pivoted supporting lever, a terminal lever pivoted on said supporting lever, a fuse link connecting said terminal and terminal lever for maintaining said levers in one position wherein said terminal and terminal lever are engaged with said contacts, respectively, and wherein said levers form with said fuse tube toggle means adjacent dead-center position, with the force exerted by said resilient contacts acting in a direction to break said toggle means and cause movement of said fuse terminals away from said contacts.

22. In a fuse, spaced line contacts, a fuse holder, a fuse link in said holder, means mounting said holder for movement into and out of engagement with at last one of said contacts, latch means for maintaining said holder in closed circuit position with respect to said contacts said mounting means including a main pivoted supporting link and an auxiliary link pivoted on said main link, and said auxiliary link directly connected to said fuse link, whereby to release said linkage for relative movement and permit movement of said holder out of engagement with said latch means and with at least said one contact when said fuse link blows.

23. In a dropout fuse, spaced resilient line contacts, a supporting lever, a pair of members each having a terminal portion, each of said members pivoted on said lever at spaced points for movement relative to said lever and relative to each other and adapted to engage and bias said contacts in a manner such that each of said contacts exerts a force on its respective terminal in a direction to cause movement of said lever in one direction to move said terminals out of engagement with said contacts, and means including fusible means connecting said terminals to normally prevent movement of said lever in said one direction.

24. In a fuse, a contact, a fuse tube assembly, means supporting said tube for movement toward and away from said contact including a link pivotally connected to a supporting base and said assembly at spaced points, terminal means pivotally mounted on said link, a fuse link mounted in said tube and directly engaging said terminal means to normally maintain said terminal means and link in a predetermined position relative to said assembly so that said terminal means is adapted to engage said contact, means on said assembly engageable by a portion of said terminal means for positively preventing movement of said link and terminal means when in said predetermined position, and latch means engageable with said assembly to maintain said terminal means and contact in engagement, whereby when said fuse blows said assembly, terminal means and link are freed for relative movement to disengage said assembly from said latch means.

25. In a fuse, spaced line contacts, a fuse holder, a fuse link in said holder, means mounting said holder for movement into and out of engagement with at least one of said contacts, latch means for maintaining said holder in closed circuit position with respect to said contacts, said mounting means including a supporting link pivoted on said holder and on a support, cooperating latch means on said link and a part fixed with respect to said holder, one part of said latch means being movably mounted and secured to said fuse link for locking said supporting link against movement with respect to said holder, whereby to release said supporting link for movement relative to said holder and permit movement of said holder out of engagement with said latch means and with at least said one contact when said fuse link blows.

26. In a fuse, spaced line contacts, a fuse holder, a fuse link in said holder, means mounting said holder for movement into and out of engagement with at least one of said contacts, latch means for maintaining said holder in closed circuit position with respect to said contacts, said mounting means including a pivoted supporting linkage, means under the control of said fuse link for maintaining said supporting linkage against movement with respect to said holder, whereby to release said supporting linkage for movement relative to said holder and permit movement of said holder out of engagement with said latch means and with at least

said one contact when said fuse links blow, and said linkage including an apertured part positioned to be exposed upon said movement of said holder out of engagement for the reception of a hook stick or the like.

27. In an enclosed fuse cutout construction, a housing having spaced contacts therein, a door and fuse assembly for said housing, cooperating pivot means in said housing and on said assembly for mounting said assembly for movement to and from a position in which said door closes said housing and said fuse is in bridging relation with said contacts, said pivot means constructed to be freely separable only in an open position of said assembly, and means mounted on said door at the inner side thereof provided with an aperture for the reception of a hook stick or the like to facilitate detachment of said assembly from said housing in an open position thereof with said aperture located in a plane substantially parallel to the plane of said door.

28. In an enclosed fuse cutout door and fuse assembly, a housing door member, a fuse tube member, means detachably securing said members together, supporting means for said assembly including a supporting link pivoted on said assembly, means connecting said link and assembly for preventing relative movement thereof, said connecting means maintained in operative position by a part thereof extending between said members with said part maintained in a groove formed in one of said members by the other of said members.

29. In a drop-out fuse, spaced resilient line contacts, a fuse tube having a terminal, supporting linkage for said tube including a pivoted supporting link, a terminal lever pivoted on said link, a fuse link connecting said terminal and terminal lever for maintaining said linkage in one position wherein said terminal and terminal lever are engaged with said contacts, respectively, and wherein said link and fuse tube form toggle means positioned adjacent dead-center at said one position of said linkage, and the force exerted by said resilient contacts acting in a direction to break said toggle means and cause movement of said fuse terminals away from said contacts.

30. In a drop-out fuse, spaced resilient line contacts, a pivoted supporting lever, separate members each having a terminal, said members pivoted on said lever at spaced pivot points and adapted to engage and bias said contacts in a manner such that each of said contacts exerts a force on its respective terminal in a direction to cause movement of said lever in one direction to move said terminals out of engagement with said contacts, and means including fusible means connecting said terminals to normally prevent movement of said lever in said one direction.

31. In a dropout fuse, spaced resilient line contacts, a fuse tube having a terminal, supporting means for said tube including a supporting lever pivoted to said tube and to a support, a terminal lever pivoted on said supporting lever, a fuse link connecting said terminal and terminal lever for maintaining said levers in one position wherein said terminal and terminal lever are engaged with said contacts, respectively, said supporting lever and tube forming toggle means between said support and one line contact, said two levers forming toggle means between said support and the other of said contacts, said fuse link normally maintaining both of said toggle means adjacent dead-center position, with the force exerted by said resilient contacts acting in a direction to break said toggle means and cause movement of said fuse terminals away from said contacts.

32. In a fuse, a resilient line contact, a fuse tube assembly, means supporting said tube assembly for movement toward and away from said contact including a link pivotally connected to a supporting base and said assembly at spaced points, terminal means mounted on said link for limited pivotal movement relative to said link, a fuse link mounted in said tube and directly engaging said terminal means to normally maintain said terminal means and link in a predetermined position relative to said assembly so that said terminal means is adapted to engage and stress said contact, and latch means engageable with said assembly to maintain said terminal means and contact in engagement, whereby when said fuse blows said link is released for movement relative to said tube to disengage said latch means while said terminal means and contact remain in engagement by virtue of relative movement of said terminal means and link, and at the end of said relative movement said terminal means is moved away from said contact.

33. In a fuse, spaced line contacts, a fuse holder, a fuse link in said holder, means mounting said holder for movement into and out of engagement with at least one of said contacts, latch means for maintaining said holder in closed circuit position with respect to said contacts, said mounting means including a pivoted supporting linkage, means under the control of said fuse link for locking said supporting linkage against movement with respect to said holder, whereby to release said supporting linkage for movement relative to said holder and permit movement of said holder out of engagement with said latch means and with at least said one contact when said fuse links blow.

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