

Nov. 9, 1943.

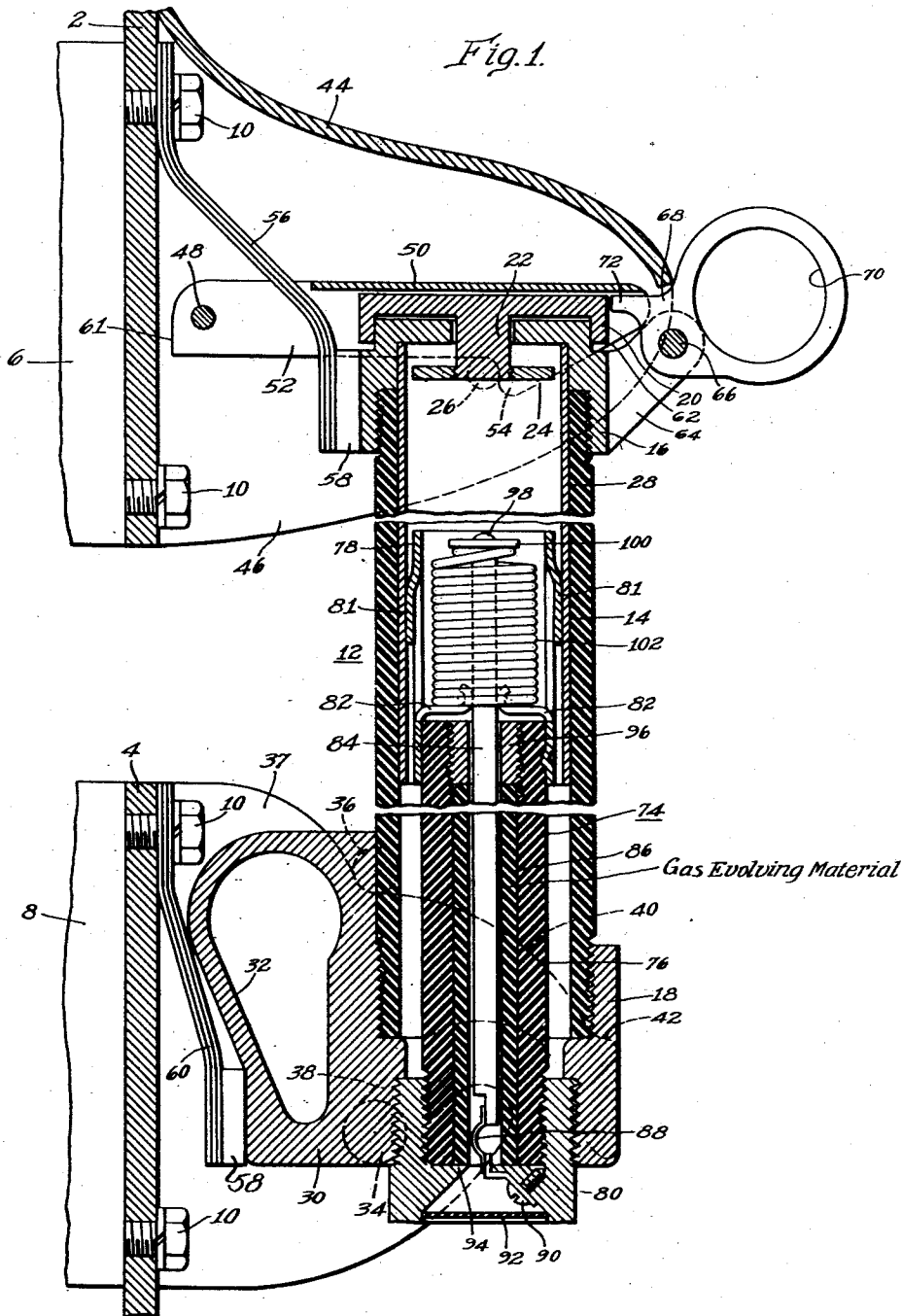
H. H. FAHNOE

2,333,774

CIRCUIT INTERRUPTER

Filed Sept. 26, 1941

4 Sheets-Sheet 1



WITNESSES:

W. J. Weller.
G. T. Stratton

INVENTOR

Harold H. Fahnoe.

BY

Ralph H. Swingle
ATTORNEY

Nov. 9, 1943.

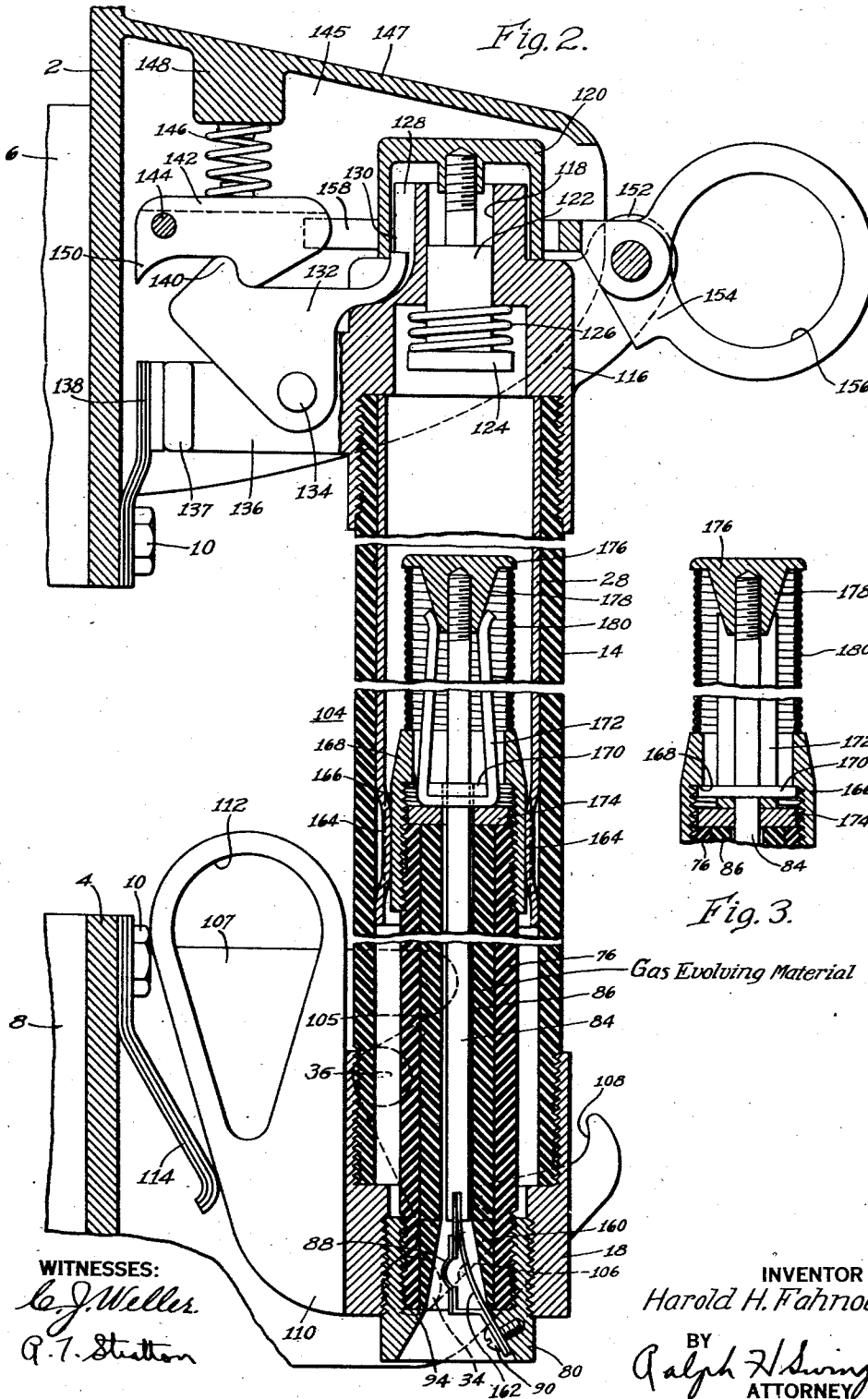
H. H. FAHNOE

2,333,774

CIRCUIT INTERRUPTER

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4 Sheets-Sheet 2



WITNESSES:
C. J. Weller
R. T. Stutton

INVENTOR
Harold H. Fahnoe.
BY
Ralph H. Swingle
ATTORNEY

Nov. 9, 1943.

H. H. FAHNOE

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CIRCUIT INTERRUPTER

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4 Sheets-Sheet 3

Fig. 4.

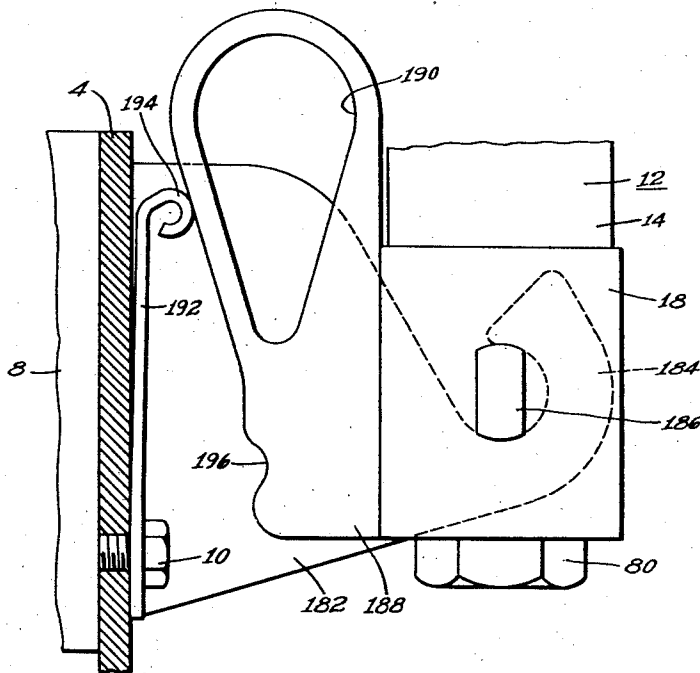
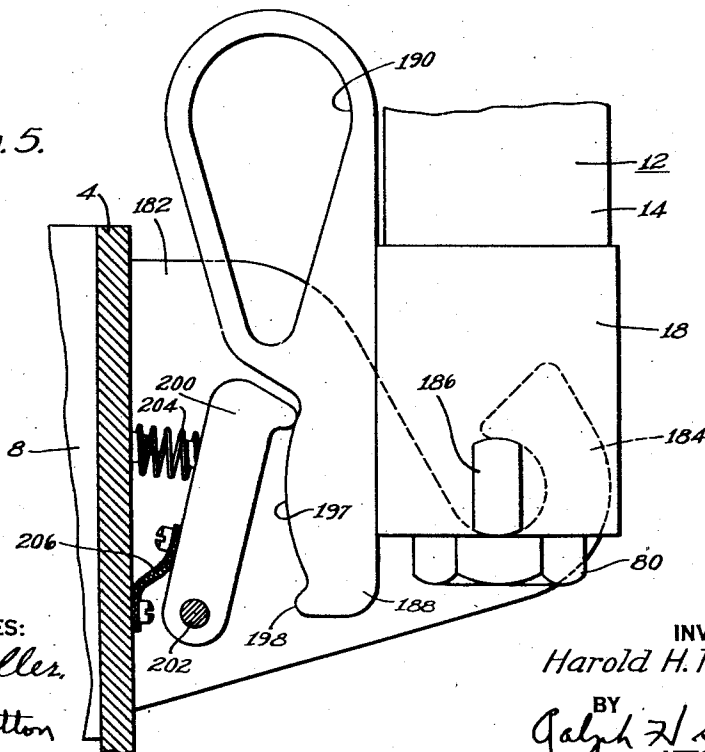


Fig. 5.



WITNESSES:

W. J. Weller
Q. T. Stratton

INVENTOR

Harold H. Fahnoe.

BY
Ralph W. Swingle
ATTORNEY

Nov. 9, 1943.

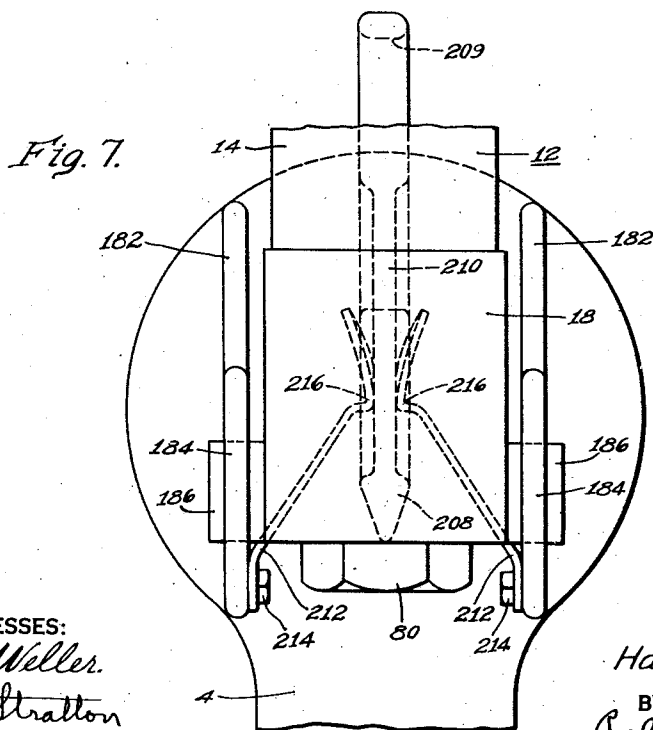
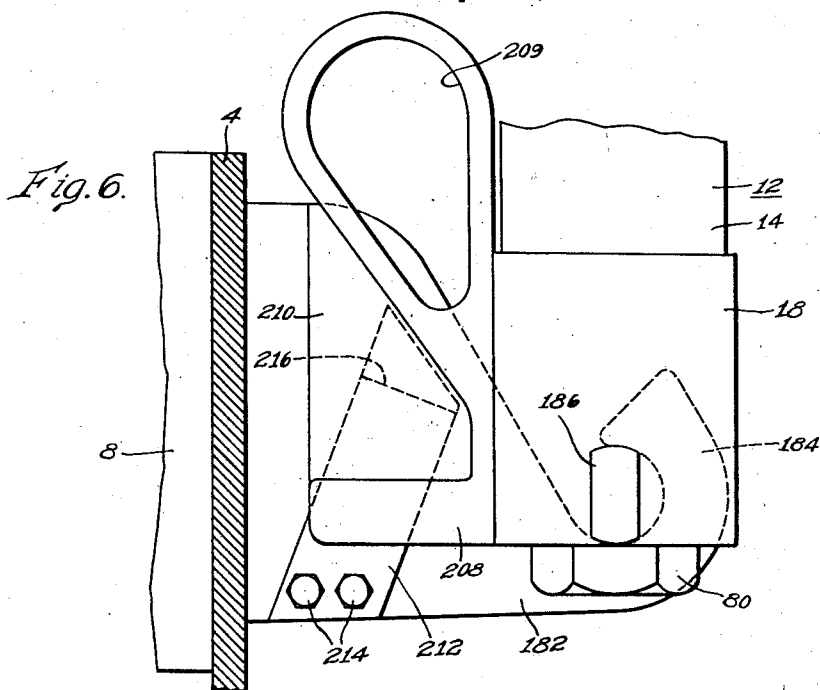
H. H. FAHNOE

2,333,774

CIRCUIT INTERRUPTER

Filed Sept. 26, 1941

4 Sheets-Sheet 4



WITNESSES:

G. J. Meller.
G. F. Stratton

INVENTOR

Harold H. Fahnoe.

BY

Ralph F. Swingle
ATTORNEY

UNITED STATES PATENT OFFICE

2,333,774

CIRCUIT INTERRUPTER

Harold H. Fahnoe, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application September 26, 1941, Serial No. 412,374

46 Claims. (Cl. 200—114)

This invention relates, generally, to electric circuit interrupters and, more specifically, to high voltage fuses.

This invention is primarily concerned with high voltage fuses of the type wherein a refill unit having fusible means, arc extinguishing means, and terminal separating means is associated with a fuse holder so as to be cooperable with releasable supporting means for the holder in a manner to release the holder and permit it to drop out of the circuit in response to blowing of the fuse.

One object of this invention is to provide a novel type of dropout fuse holder and mounting therefor, wherein a removable fuse refill unit associated with the holder is adapted to release the holder from its mounting so it will drop out of the circuit following a circuit interrupting operation.

Another object of this invention is to provide a relatively simple and inexpensive refill unit for a fuse of the type described.

Another object of this invention is to provide a novel cooperative relationship of a fuse holder of the type described and a refill unit therefor.

Another object of this invention is to provide for cooperation with a fuse of the type described, novel supporting means for releasably maintaining the fuse in engagement with line terminals and for biasing said fuse away from at least one of the terminals in response to blowing of the fuse.

Another object of this invention is to provide novel latch means for releasably maintaining a fuse in engagement with line terminals.

Another object of this invention is to provide in a fuse mounted for movement into and out of engagement with at least one line terminal, novel means for controlling such movement.

Another object of this invention is to provide in a dropout fuse, novel manually releasable means for stopping the dropout movement of the fuse at a predetermined disconnected position.

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

Figure 1 is a longitudinal sectional view of a fuse constructed in accordance with one embodiment of this invention with certain parts thereof broken away;

Fig. 2 is a view similar to Fig. 1 but illustrating a modified form of fuse;

Fig. 3 is a partial sectional view of the upper

end of the fuse refill unit shown in Fig. 2, taken substantially at right angles to Fig. 2;

Fig. 4 is a sectional view illustrating a still further modified form of hinge mounting for a fuse, with certain of the parts shown in elevation;

Fig. 5 is a view like Fig. 4 but illustrating another modified form of hinge mounting;

Fig. 6 is a view like Figs. 4 and 5 showing still another modified type of hinge mounting; and

Fig. 7 is a front view of the structure shown in Fig. 6.

Referring to the drawings, there is illustrated in Fig. 1 a high voltage dropout fuse adapted to be supported on spaced supports 6 and 8, which may be of insulating material or may be insulator caps. Terminal straps 2 and 4 are supported on the insulating supports 6 and 8, respectively, for example, as by bolts 10 or the like. The fuse 12 is preferably constructed with an insulating fuse tube 14, which may be of any desired insulating material, such, for example, as fiber or a synthetic resin, and an upper terminal cap 16 is threadedly engaged with the upper end of the tube 14, and the lower end of the tube has threaded thereon a terminal ferrule 18. The upper terminal cap 16 has a reduced outer end for receiving a latch releasing cap 20, and this cap has a stem 22 adapted to project through a central opening in terminal cap 16, as shown in Fig. 1, and the inner end of the stem has threaded thereon a disk-like head 24 to limit outward movement of cap 20. Cap 20 by this arrangement has limited longitudinal sliding movement with respect to fuse tube 14. Terminal cap 16 is provided at opposite sides thereof with outwardly extending latch lugs 26 (only one of which is shown) for a purpose to be hereinafter described. A tubular conducting sleeve 28 is positioned within fuse tube 14 and of a size to closely fit against the inner walls of the tube, and is preferably secured at its upper end to terminal cap 16 in any desired manner, such, for example, as soldering, welding, or the like. Conductor sleeve 28 may be of any good conducting material, such, for example, as copper or the like.

Terminal ferrule 18 at the lower end of fuse tube 14 is provided with a lateral terminal extension 30 having a pear-shaped aperture 32 therein forming a hook eye, for the reception of a hook stick or other operating member. Terminal ferrule 18 is also provided at opposite sides thereof with laterally extending trunnions 34 adjacent the lower end thereof for pivotally supporting fuse 12, and with laterally extending stop pins 36. Fuse 12 is adapted to be mounted at its lower end

between spaced supporting jaws 37 which may be either fixed to or integral with terminal strap 4, and the lower side of each of jaws 37 adjacent the outer end thereof is provided with a curved slot 38, for receiving trunnions 34 on ferrule 18. The upper surfaces of supporting jaws 37 adjacent the outer end of the jaws are provided with curved guide surfaces 40 for cooperation with stop pins 36, and this surface terminates at its outer end in an abutment 42 for the purpose of limiting pivotal movement of fuse 12 in a clockwise direction about trunnions 34 by engagement therewith of stop pins 36.

A sleet hood 44 is provided rigid with terminal strap 2, and may either be secured thereto or formed integral therewith as shown in Fig. 1, and this hood includes spaced side walls 46 between which the upper end of the fuse is adapted to be positioned in the normal closed circuit condition of the fuse. A latch lever 50 is pivotally supported adjacent the inner end thereof, as by the pin 48 extending between sides 46 of the sleet hood, and this latch is of substantially inverted U-shape in section, with the sides thereof provided with downwardly extending projections 54 behind which latch lugs 26 are adapted to be located to prevent rotation of the fuse in a clockwise direction, as shown in Fig. 1. The latch 50 also maintains the fuse in a position wherein terminal cap 16, and extension 30 of ferrule 18 are maintained in engagement with contacts 58 on the outer ends of laminated resilient contact strips 56 and 60, which are preferably secured to terminal straps 2 and 4 by one of the bolts 10. It will be noted that the inner ends 61 of the sides of the U-shaped latch 50 are adapted to engage terminal strap 2 to limit rotation of the latch in a clockwise direction about its pivot 48, and that the outer edges of the sides of the latch are inclined as at 62, to form cam surfaces engageable by latch lugs 26 when the fuse is moved from an open circuit position counterclockwise to the position shown in Fig. 1, so that the latch will be automatically cammed upwardly by engagement of the lugs with inclined edges 62 to permit latching of the fuse in the position shown in Fig. 1. To facilitate manual release of the latch, a manually operable latch release lever 68 is pivotally supported from terminal cap 16 by spaced bracket arms 64 integral therewith and supporting a pivot pin 66 for lever 68. The outer end of the latch release lever is provided with a large aperture 70 for the reception of a hook stick operating member or the like, and the inner end of this lever is provided with an operating extension 72 which normally is adapted to be positioned beneath latch 50, as shown in Fig. 1 of the drawings.

In the fuse construction thus far described, it will be obvious that the fuse may be manually moved from the closed circuit position shown in Fig. 1 by inserting a tool in hook eye 70 of latch release lever 68, and exerting a downward and outward pull to rotate this lever in a clockwise direction about its pivot 66 to cause the operating projection 72 to raise latch 50 an amount sufficient so that projection 54 clears latch lugs 26, whereupon the entire fuse will move in a clockwise direction about trunnions 34. This clockwise movement of the fuse will continue until stop lugs 36 engage abutments 42 on supporting jaws 37. If it is desired to move fuse 12 further in a clockwise direction, or to remove the fuse entirely from supporting jaws 37, it will be necessary to exert a force on hook eye 70 in a direction longitudinally

outwardly of fuse 12 to cause stop lugs 36 to be lifted above abutment 42 with trunnions 34 moving along the inner end of curved slot 38 in the supporting jaws. As soon as stop lugs 36 clear abutment 42, clockwise movement of fuse 12 about trunnion 34 may be continued until the fuse is in a depending position with respect to the supporting jaws. With the fuse in such a depending position, it may be readily entirely removed from the supporting jaws by merely inserting a hook stick or other operating member in hook eye 32, and lifting the same upwardly and outwardly to bring trunnions 34 up and around the curve of slot 38. Hook eye 32 is preferably of the specific form shown so that when the fuse is lifted from supporting jaws 37, the hook stick or other operating member will wedge into the narrow portion of the hook eye, and thus preclude accidental dislodgement of the fuse from the hook stick. The fuse may be replaced in supporting brackets 37 by reversing the procedure outlined above, that is, lifting the fuse by hook eye 32 to bring trunnions 34 up and into slot 38, whereupon hook eye 70 may be utilized to rotate the fuse about trunnions 34 in a counterclockwise direction to the closed circuit position shown in Fig. 1. As the fuse approaches its closed circuit position shown in Fig. 1, terminal extension 30 and ferrule 16 will engage contacts 58, respectively, prior to attaining the position shown in Fig. 1, so that when the fuse is latched closed, these contact springs will be under predetermined stresses tending to move the fuse in a clockwise direction to drop out of the circuit.

The fuse holder described above is adapted to cooperate with a novel type of fuse refill unit 74. This refill unit comprises a unitary construction including insulating refill tube 76, preferably of fiber or the like, and having at the upper end thereof a tubular terminal 78 secured to insulating tube 76 in any desired manner, such, for example, as by prick-punching. A terminal ferrule 80 is threadedly mounted on the lower end of refill tube 76, and is externally threaded for cooperation with the internally threaded bore in terminal ferrule 18. Tubular terminal 78 is provided with outwardly struck contact finger portions 81 for engagement with the lower end of conducting sleeve 28 mounted in the fuse holder, and inwardly bent, cutout contact fingers 82 are adapted to engage a fuse terminal rod 84. Terminal rod 84 extends through the bore of tube 76, and this bore is preferably lined with material 86 capable of evolving an arc extinguishing gas when in proximity to an electric arc, such, for example, as boric acid, synthetic resin, or the like. The lower end of terminal rod 84 is connected to terminal ferrule 80 of the refill unit by a fusible connection 88, secured to the ferrule, for example, as by a screw 90. Refill terminal ferrule 80 has the outer end thereof preferably closed by a weather-proof closure 92 which, however, is frangible or displaceable in response to pressures developed in the fuse upon a circuit interrupting operation to permit the products of interruption to be expelled through ferrule 80. Thus, disk 92 may be secured in position by friction or by a cement, which will enable displacement thereof upon blowing of the fuse. Terminal ferrule 80 is provided with an inwardly projecting flange 94 at the lower end of refill tube 76 for preventing outward movement of the tube lining 86, and movement of this lining out of the tube in the opposite direction is prevented by an annular plug 96 threadedly engaged in

the other end of refill tube 76. Terminal rod 84 is provided with a head 86 at the upper end thereof for supporting a washer 100, and a coil compression spring 102 is normally maintained in compression between washer 100 and contact fingers 82.

The electric circuit through the fuse shown in Fig. 1 may now be traced from upper terminal strap 2 through contact strip 56, terminal extension 58, conducting tube 28, contact fingers 81, terminal sleeve 78, contact fingers 82, terminal rod 84, through fusible connection 88 to refill terminal ferrule 80, terminal ferrule 18, extension 30, contact strip 60, and lower terminal strap 4.

When the current passing through the circuit containing this fuse exceeds a value predetermined by the rating of fusible connection 88, this connection will be fused, thereby releasing terminal rod 84 so that spring 102 is free to move the same upwardly into engagement with head 24 on latch operating cap 20, and move this cap and, consequently, latch 50 upwardly to release latch projections 26, and permit contact springs 56 and 60 to initiate clockwise movement of the fuse about trunnion 34. This movement of the fuse obviously will continue under the force of gravity at least until stop pins 36 engage abutments 42 on the supporting jaws 37. After the fuse has blown and dropped out of the circuit to this position, it may be entirely manually removed from supporting jaws 37 in the manner described above, and refilled merely by unscrewing the refill unit from ferrule 18 by manipulation of terminal ferrule 80. This permits removal of the entire refill unit including spring 102, terminal rod 84, and the means of connecting the upper end of the refill to the upper terminal 16 of the fuse holder. A new refill unit may be then very easily substituted for the used one by merely inserting the same into the fuse holder through the opening in ferrule 18 and screwing the ferrule 80 up tightly to form a good electrical connection between ferrules 18 and 80. This mere act of inserting the ferrule and turning it up tight in the fuse holder also establishes the connection between contact fingers 81 with the upper fuse holder terminal 16 through conducting sleeve 28. This construction obviously eliminates the use of a flexible shunt between moving contact rod 84 and the upper terminal of the fuse holder which has been used in prior art constructions, and also eliminates the necessity for removing and reestablishing the connections of such a shunt when removing and inserting a refill unit in the fuse holder. It will also further be noted that because of the particular construction of the fuse shown in Fig. 1 wherein terminal rod 84 is utilized to release latch 50, and the terminal rod is normally maintained at a position spaced from the latch release cap 20, that the latch will not be released upon blowing of the fuse until a predetermined time thereafter, that is, the time required to move terminal rod 84 from the position shown in Fig. 1 into engagement with head 24 of latch release cap 20, and this is also the same time required to draw out the arc formed upon fusion of fusible connection 88 past gas evolving material 86, so that exposure of the arc to the full arc extinguish capabilities of the fuse, that is, to full attenuation thereof, and exposure to gas evolving material 86 is accomplished before the latch holding the fuse and circuit is released, to thereby insure that the circuit will have been interrupted within the fuse

before disengagement of the fuse terminal from any line contact.

In Fig. 2 there is shown a dropout fuse construction similar in many respects to that shown in Fig. 1, and, accordingly, like reference numerals will be used to designate like parts. The fuse 104 shown in Fig. 2 is adapted to be pivotally supported between spaced supporting jaws 107 having generally outwardly and upwardly opening substantially rectangular slots 105 therein, with an angularly extending notch portion 106 at the inner lower corner of each slot 105 for receiving the trunnions 34 on the lower terminal ferrule 18. The lower side of each slot 105 at the outer end thereof, is provided with a stop projection 108, for engagement with stop lugs 36 on terminal ferrule 18 for a purpose to be described. Ferrule 18 is provided in this instance with a terminal extension 110 extending rearwardly, and this extension also has a substantially pear-shaped hook eye 112 for the reception of a hook stick or other operating member. A laminated contact strip 114 is bolted to terminal strip 4 and is adapted to engage terminal extension 110 on ferrule 18 when the fuse is in the closed circuit position.

An upper terminal cap 116 is threadedly mounted on the upper end of fuse tube 14, and has the outer end thereof reduced and elongated, and provided with a bore 118 therethrough. A latch retaining cap 120 is adapted to be seated over the reduced extension of terminal cap 116, and is provided with a stem 122 secured centrally thereof and extended through bore 118. The inner end of stem 122 is provided with an enlarged head 124 to limit outward movement of cap 120 with respect to the fuse tube, and to form a seat for a light coil compression spring 126 seated between head 124 and the inner surface of terminal cap 116. A longitudinally extending slot 128 is formed at one outer side of terminal cap 116 for receiving the end 130 of a toggle latch lever 132. This lever is pivotally mounted on a pivot pin 134 mounted between spaced bracket arms 136 integral with terminal cap 116 and connected at their outer ends by a terminal strap 137 adapted to engage a laminated contact 138 secured to terminal strap 2, for example, as by bolt 10. The other end of the lever 132 is provided with a latching projection 140 for cooperation with another toggle latch lever 142, pivotally mounted on a pivot pin 144 extending between sides 145 of the sleet hood 147. Lever 142 is biased in a clockwise direction about its pivot 144 by a coil compression spring 146 engaging between the lever and an integral abutment 148 on sleet hood 147. An integral projection 150 is provided at the pivoted end of lever 142 for engagement with terminal strap 2 to limit clockwise movement of the lever under the influence of biasing spring 146. It is apparent that engagement of cap 120 with the end 130 of lever 132 prevents counterclockwise movement of this lever under the influence of the downward force exerted thereon by spring 146 acting through lever 142, so that in the position shown in Fig. 2, the fuse 104 is latched in the closed circuit position. A manually operable latch releasing lever 154 is pivotally supported between a pair of spaced bracket arms 152 integral with terminal cap 116, and the lever is provided at one end with an enlarged annular portion forming a hook eye 156, and at the other end the lever is forked to receive cap 120 and to extend beneath toggle latch lever

142, as shown in Fig. 2. Lever 142 is preferably of inverted U-shape in form, so that the forked ends 158 of lever 154 may be received between the sides of lever 142 beneath the bight portion thereof.

To manually move the fuse 104 to open circuit position from its closed circuit position shown in Fig. 2, a hook stick or other operating member may be inserted in hook eye 156 and pulled downwardly and outwardly to rotate lever 154 in a clockwise direction, and thereby raise latch lever 142 against the bias of spring 146 to clear projection 140 on toggle latch lever 132, whereupon the entire fuse may be moved in a clockwise direction about trunnions 34 until stop lugs 36 engage stop projections 108 formed on supporting jaws 107. The fuse may then be further moved in this direction by exerting a longitudinal force outwardly on hook eye 156 so that stop lugs 36 clear projections 108 with trunnions 34 moving along the angularly extending notch 106 in the supporting jaws. When the fuse is in a depending position with respect to supporting jaws 107, it may be removed therefrom by inserting a hook stick in hook eye 112 and raising it in a manner to guide trunnions 34 out of notch 106 and slot 105 in a manner similar to that previously described in connection with the embodiment of this invention shown in Fig. 1. After renewing the fuse, it may be reinserted in the circuit by following the above steps in a reverse manner, that is, by lifting the fuse by hook eye 112 to bring trunnions 34 into notch 106, then rotating the fuse by hook eye 156 until the inclined outer ends of latch levers 132 and 142 engage, causing counterclockwise movement of lever 142 against the bias of spring 146 until projection 140 on lever 132 is cleared, whereupon the fuse will again be latched in its closed circuit position shown in Fig. 2. As in the embodiment shown in Fig. 1, contact strips 114 and 138 are preferably in a stressed condition in the closed circuit position of the fuse, so that they may exert a force tending to move the fuse out of the circuit.

The refill unit shown in connection with the fuse of Fig. 2 is in many respects similar to that shown in Fig. 1, and includes a lower refill terminal ferrule 80 having therein between shoulder 94 and gas evolving material 86, an annular throat forming member 160 having an outwardly tapered passage therethrough. This throat member 160 is preferably of a material having a greater mechanical strength than such gas evolving material as boric acid, and is preferably also of a gas evolving material, such, for example, as fiber or the like. The lower end of refill terminal rod 84 is connected to refill terminal ferrule 80 by a strain member 162 paralleling fusible connection 88 to relieve the strain from the fusible connection. In this embodiment of this invention, conducting sleeve 28 at the upper end of fuse tube 14 is provided with inwardly struck contact portions 164 for engagement with the upper refill terminal ferrule 166. Terminal ferrule 166 is provided with an outer reduced bore to form a shoulder 168 for receiving a retaining strip 170 which acts to clamp the bight portion of a substantially U-shaped contact 172 between strip 170 and retaining washer 174. The upper end of refill terminal rod 84 is provided with a relatively massive enlarged contact head 176, having a tapered shank 178 adapted to engage between the outer ends of the legs of U-shaped contact 172. A coil

compression spring 180 reacts between contact head 176 and refill terminal ferrule 166 to bias the terminal rod upwardly as viewed in Fig. 2.

In the operation of this embodiment of the fuse, upon the passage of excessive currents through the circuit, fusible connection 88 will melt, thus transferring the current to strain member 162, preferably of a high resistance material so that this will be substantially instantaneously destroyed, to release spring 180 and permit the spring to move refill terminal rod 84 upwardly, and draw the arc up through the bore in gas evolving material 86. As soon as contact head 176 on the terminal rod separates from U-shaped contact 172, current will be carried from refill terminal ferrule 166 to the contact rod by spring 180. However, since this is for but a very short time, the spring will not be damaged. Upon upward movement, contact head 176, after drawing out the arc so that it will be extinguished, will engage head 124 of stem 122 on cap 120 and cause this to move upwardly while compressing the relatively light spring 126, until the flange of cap 120 moves above end 130 of toggle latch lever 132 to thereby permit counterclockwise rotation of this lever about its pivot 134. Inasmuch as spring 146 acting through lever 142 tends to rotate lever 132 in a counterclockwise direction, and furthermore since the force exerted by this spring will tend to cause movement of pivot 134 of the lever to the right, as shown in Fig. 2, it is obvious that spring 146 will not only cause rotation of levers 132 and 142 out of engagement with each other, but will also tend to move fuse 104 outwardly or in a clockwise direction about trunnions 34, with this latter action being aided by the stress stored in resilient contact strips 114 and 138. This dropout action will also be aided by the force of gravity, and the fuse will continue to move outwardly until stop lugs 36 engage stop projections 108 on the supporting jaws. Thereafter the fuse may be removed from the supporting jaws by the use of a hook stick, as previously described, and the refill may be removed merely by unscrewing refill terminal ferrule 80 from holder ferrule 18, and a new refill introduced merely by inserting the same through ferrule 18 and screwing it up tightly. This simple operation not only replaces the fusible portion of this novel fuse, but also replaces all the operating parts as well as acting to form their connections to the fuse holder terminals, so that this replacement may be made very quickly, and the fuse reinserted in service in a very short time. It will be noted that in this embodiment of the invention, the mass of refill terminal rod 84 is substantially increased by the use of contact head 176, to thereby increase the kinetic energy of the rod assembly when moved by spring 180 and render is capable of exerting a greater force on cap 120 to insure positive movement of the cap to release latch lever 132. It will further be noted that levers 132 and 142 form in effect, a toggle latch which is biased by spring 146 exerting a force substantially at the knee of the toggle, to not only break the toggle, but also to exert an outward force on the fuse to cause it to drop out of the circuit.

In Fig. 4 there is shown a slightly modified form of lower contact and hinge support for a fuse which may be of the type shown in Figs. 1 or 2. In this modified form of supporting means, the fuse is adapted to be supported between spaced supporting jaws 182 having outer hooked

ends 184 for receiving generally flattened trunnions 186 located substantially centrally on lower fuse terminal ferrule 18. It will be noted that the opening leading to the bight portion of the hook formed by ends 184 of the supporting jaws, is large enough to pass trunnions 186 when their smallest dimension is presented, but is not large enough to permit removal of the trunnions from the hook portions at any other angular position relative thereto. Accordingly, it will be observed that it will be impossible to remove fuse 12 from supporting jaws 182 unless the fuse is rotated in a clockwise direction substantially 135° from the position shown in Fig. 4 to present the smallest dimension of the trunnions to the opening of the hooked portions. Ferrule 18 in this embodiment of the invention is provided with a rearward terminal extension 188 having at its upper end a pear-shaped hook eye opening 190, one side of which is adapted to be engaged by the outer curved end 194 of a leaf contact spring 192 secured to terminal strap 4, for example, as by bolt 10. The lower portion of terminal extension 188 is provided with an indentation 196 positioned so that the curved end 194 of contact strip 192 will enter indentation 196 upon predetermined movement of fuse 12 in a clockwise direction about trunnions 186. This position may be, for example, about 45° from the normal closed circuit position. The fuse may obviously be manually released from the closed circuit position and moved to the 45° position in which the curved end 194 engages indentation 196, and left in this position to clearly indicate that the fuse is in a disconnected position. Obviously the fuse may be manually moved past this position by stressing leaf spring 192 an amount sufficient to clear the bottom edge of indentation 196, whereupon the fuse may be moved to a depending position and entirely removed from the support jaws, if desired. Similarly when the fuse drops out of the circuit automatically in response to fusion of the fusible connection thereof, it will not have sufficient momentum at least by the time it has reached the position in which curved end 194 of contact 192 enters indentation 196 on the fuse terminal to stress the contact strip sufficiently to move past this position, so that upon automatic dropout operation, the fuse will be stopped in its dropout movement at a position in advance of the extreme limit of such movement. It will be observed that in this particular hinge mounting the means for securing a good electrical connection between the line terminal and lower fuse terminal, also operates to provide an intermediate stop for the fuse in its movement out of the circuit.

The hinge mounting shown in Fig 5 is of the same general type as that shown in Fig. 4. However, in this specific mounting the terminal projection 188 is provided with a circular surface 197 having its center at trunnions 186. This arcuate surface 197 terminates in a stop projection 198, and a pivoted contact lever 200 is adapted to cooperate with surface 197 to provide good electrical contact between terminal strap 4 and fuse ferrule 18, and with projection 198 to limit dropout movement of the fuse. Contact lever 200 is biased in a clockwise direction about its pivot 202 by a coil compression spring 204, and is electrically connected to terminal strap 4, preferably by a flexible shunt 206.

The operation of the mounting shown in Fig. 5 is substantially identical with that previously described in connection with Fig. 4 and, there-

fore, will not be given again in detail. A somewhat better electrical connection may be obtained with the structure shown in Fig. 5 because the spring is not required to carry any current. Otherwise, this construction is operative to automatically stop dropout movement of the fuse upon automatic dropout operation thereof, and is manually movable beyond such a stopped position to permit the fuse to be removed from the supporting jaws.

In Figs. 6 and 7 there is illustrated a still further modified form of hinge contact and supporting structure wherein the lower fuse terminal 18 is provided at one side with an outwardly extending rib 208 and a substantially pear-shaped rib structure forming a hook eye 209 of the same form spaced from rib 208, with a web 210 connecting the two ribs. Supporting jaws 182 are each provided with a contact spring 212, the lower end of which is secured to its respective jaw, as by bolts 214, and the upper ends of contacts 212 being provided with inwardly bent portions 216 adapted to engage web 210 in the closed circuit position of the fuse.

When the fuse moves in a clockwise direction about trunnions 186 to open circuit position, the action is unimpeded until inwardly bent portions 216 of the contact springs 212 engage rib 208. When the movement to open circuit position is initiated automatically by blowing of the fuse, the fuse will be stopped upon engagement of the contact springs with rib 208. The fuse may be manually moved past such a stopped position as in the embodiments of the invention described in Figs. 4 and 5 by exerting a force sufficient to cause rib 208 to cam contact straps 212 outwardly and permit the rib to pass thereby.

From the foregoing it will be obvious that there is disclosed herein novel forms of high voltage fuses including novel latch means together with means for releasing such latch means in response to blowing of the fuse, as well as novel refill means for such fuses especially adapted for fuses of the dropout type. The specific refills disclosed are exceptionally simple and susceptible of quick replacement, while being efficient in construction; and there is further disclosed novel pivot supporting means and contact constructions for the hinge end of a fuse of the type which is pivoted at one end and latched in engagement with line terminals at its other end.

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

I claim as my invention:

1. In a high voltage fuse, a tubular fuse holder having an open end and terminals adjacent opposite ends thereof, line contacts adapted to engage said terminals, respectively, means for movably supporting said holder adjacent said open end so that said holder is movable to engage and disengage at least one of said terminals and contacts, latch means adjacent the other end of said holder to releasably maintain said terminals and contacts in engagement including

a member slidably mounted on said holder at said other end thereof and adapted to be moved to release said latch means, a refill unit insertable through the open end of said holder, said unit including tubular means of insulating material having contact means at opposite ends thereof, said tubular means being of less length than said holder so that one end thereof may be secured to the holder adjacent the open end of the holder with the adjacent terminal and contact means in engagement, and the other end of said unit will be spaced from the other end of said holder, conducting means secured to the terminal adjacent said other end of said holder and extending into said holder to a point where it is adapted to be engaged by the inner contact means of said unit, fusible means in said unit connected between the contact means thereof, and said unit also including means biased to move into engagement with said slidable member and normally restrained by said fusible means but operable upon fusion thereof to actuate said slidable member so that said holder is released for movement to disengage at least said one terminal and contact.

2. In a high voltage fuse, a tubular fuse holder having an open end and terminals adjacent opposite ends thereof, line contacts adapted to engage said terminals, respectively, means for movably supporting said holder adjacent said open end so that said holder is movable to engage and disengage at least one of said terminals and contacts, movable latch means adjacent the other end of said holder to releasably maintain said terminals and contacts in engagement, a refill unit insertable through the open end of said holder, said unit including tubular means of insulating material having contact means at opposite ends thereof, said tubular means being of less length than said holder so that one end thereof may be secured to the holder adjacent the open end of the holder with the adjacent terminal and contact means in engagement, and the other end of said unit will be spaced from the other end of said holder, conducting means secured to the terminal adjacent said other end of said holder and extending into said holder to a point where it is adapted to be engaged by the inner contact means of said unit, fusible means in said unit connected between the contact means thereof, and said unit also including means biased to engage said latch means and normally restrained by said fusible means but operable upon fusion thereof to actuate said latch means so that said holder is movable to disengage at least said one terminal and contact.

3. In a high voltage fuse, a tubular fuse holder having terminals adjacent opposite ends thereof, line contacts adapted to engage said terminals, respectively, means for movably supporting one end of said holder so that said holder is movable to engage and disengage at least one of said terminals and contacts, movable latch means adjacent the other end of said holder to releasably maintain said terminals and contacts in engagement, conducting means secured to the terminal adjacent said other end of said holder and extending into said holder, fusible means connected between said terminal adjacent said one end of said holder and to a biased terminal means, said terminal means having a connection with the inner end of said conducting means which is adapted to be separated upon fusing of said fusible means and consequent movement of said terminal means outwardly relative to said holder, for releasing said latch means and per-

mitting said holder to move to disengage at least said one terminal and contact.

4. In a high voltage fuse, a tubular fuse holder having terminals adjacent opposite ends thereof, line contacts adapted to engage said terminals, respectively, means for movably supporting one end of said holder so that said holder is movable to engage and disengage at least one of said terminals and contacts, movable latch means adjacent the other end of said holder to releasably maintain said terminals and contacts in engagement, conducting means secured to the terminal adjacent said other end of said holder and extending into said holder, fusible means connected between said terminal adjacent said one end of said holder and to a biased terminal means, said terminal means being spaced a substantial distance from the other end of said holder and said latch means, and having a connection with the inner end of said conducting means which is adapted to be separated upon fusing of said fusible means and consequent movement of said terminal means outwardly relative to said holder, for releasing said latch means and permitting said holder to move to disengage at least said one terminal and contact a predetermined time after fusion of said fusible means.

5. In a high voltage fuse, a tubular fuse holder having terminals adjacent opposite ends thereof, line contacts adapted to engage said terminals, respectively, means for movably supporting one end of said holder so that said holder is movable to engage and disengage at least one of said terminals and contacts, movable latch means adapted to engage said holder adjacent the other end thereof to releasably maintain said terminals and contacts in engagement, said latch means comprising a movable latch of substantially inverted U-form so as to receive the other end of said holder in latching position, conducting means including a fusible portion connecting said holder terminals, resiliently biased means normally maintained at a position spaced from said latch by said fusible portion and operative upon fusion of said fusible portion to draw out the arc formed and release said latch a predetermined time thereafter.

6. In a high voltage fuse, a tubular fuse holder having terminals adjacent opposite ends thereof, line contacts adapted to engage said terminals, respectively, means for movably supporting one end of said holder so that said holder is movable to engage and disengage at least one of said terminals and contacts, movable latch means adapted to engage said holder adjacent the other end thereof to releasably maintain said terminals and contacts in engagement, said latch means comprising a movable latch of substantially inverted U-form so as to receive the other end of said holder in latching position, with the sides of said latch positioned at opposite sides of said holder, cooperating releasably engageable means on the sides of said latch and said opposite sides of said holder, respectively, conducting means including a fusible portion connecting said holder terminals, resiliently biased means normally maintained at a position spaced from said latch by said fusible portion and operative upon fusion of said fusible portion to draw out the arc formed and release said latch a predetermined time thereafter.

7. In a high voltage fuse, a tubular fuse holder having terminals adjacent opposite ends thereof, line contacts adapted to engage said terminals, respectively, means for movably supporting one

end of said holder so that said holder is movable to engage and disengage at least one of said terminals and contacts, movable latch means adjacent the other end thereof to releasably maintain said terminals and contacts in engagement, said latch means including cooperating releasably engageable latch levers on said holder and on a relatively fixed support, respectively, movable holding means on said holder for normally maintaining the one latch lever on said holder against movement, the other of said latch levers biased for movement in a direction to engage said one lever, conducting means including a fusible portion connecting said holder terminals, resiliently biased means normally maintained at a position spaced from said latch means by said fusible portion and operative upon fusion of said fusible portion to draw out the arc formed and engage and release said holding means to permit said one lever to move out of engagement with said other lever and release said holder.

8. In a high voltage fuse, a tubular fuse holder having terminals adjacent opposite ends thereof, line contacts adapted to engage said terminals, respectively, means for movably supporting one end of said holder so that said holder is movable to engage and disengage at least one of said terminals and contacts, movable latch means adjacent the other end thereof to releasably maintain said terminals and contacts in engagement, said latch means including cooperating releasably engageable latch levers on said holder and on a relatively fixed support, respectively, movable holding means on said holder for normally maintaining the one latch lever on said holder against movement, the other of said latch levers biased for movement in a direction to engage said one lever, conducting means including a fusible portion connecting said holder terminals, resiliently biased means normally maintained at a position spaced from said latch means by said fusible portion and operative upon fusion of said fusible portion to draw out arc formed and engage and release said holding means to permit said one lever to move out of engagement with said other lever and release said holder, and manually operable means on said holder for moving said other latch lever out of engagement with said one lever.

9. In a high voltage fuse, a tubular fuse holder having terminals adjacent opposite ends thereof, line contacts adapted to engage said terminals, respectively, means for movably supporting one end of said holder so that said holder is movable to engage and disengage at least one of said terminals and contacts, movable latch means adjacent the other end thereof to releasably maintain said terminals and contacts in engagement, said latch means including resiliently biased toggle means adapted to have spaced supporting points on said holder and a relatively fixed support, respectively, holding means normally preventing collapse of said toggle means, conducting means including a fusible portion connecting said holder terminals, resiliently biased means normally maintained at a position spaced from said latch means by said fusible portion and operative upon fusion of said fusible portion to draw out the arc formed and release said holding means to permit collapse of said toggle means and release of said fuse holder.

10. In a high voltage drop-out fuse, a tubular fuse holder of insulating material, terminals on said holder adjacent opposite ends thereof, respectively, conducting means including a fusible

portion interiorly of said holder for electrically connecting said terminals, latch releasing means movably mounted for limited movement on said holder, resilient means reacting between said holder and a relatively infusible terminal of said fusible portion for drawing out the arc formed upon fusion of said fusible portion, said resilient means positioned on the opposite side of said infusible terminal from said latch releasing means, and said latch releasing means having a part normally spaced from but positioned in the path of movement of a part moved by said resilient means upon an arc drawing operation thereof, there being an open space between said parts, whereby said latch releasing means is actuated by impact a predetermined time after fusion of said fusible means.

11. In a high voltage drop-out fuse, a tubular fuse holder of insulating material, terminals on said holder adjacent opposite ends thereof, respectively, conducting means including a fusible portion interiorly of said holder for electrically connecting said terminals, latch releasing means movably mounted on said holder, resilient means biasing said latch releasing means to an inactive position, second resilient means reacting between said holder and a relatively infusible terminal of said fusible portion for drawing out the arc formed upon fusion of said fusible portion, and said latch releasing means having a part normally spaced from but positioned in the path of movement of a part moved by said second resilient means upon an arc drawing operation thereof, whereby said latch releasing means is actuated by impact a predetermined time after fusion of said fusible means.

12. In a high voltage fuse, a tubular fuse holder of insulating material, terminals on said holder adjacent opposite ends thereof, respectively, conducting means extending from the terminal adjacent one end of said holder along the inner wall of said holder to a point spaced from the ends of said holder, a refill unit for said holder including tubular means of insulating material having terminals secured thereon adjacent opposite ends thereof and of a size to be inserted into said holder through the other end thereof, means responsive to a rotative movement of said unit for releasably securing said unit in operative position with the outer terminal thereof electrically associated with the adjacent holder terminal and with the inner terminal thereof in engagement with an inner portion of said conducting means, and means in said refill tubular means including a fusible portion connecting said refill terminals.

13. In a high voltage fuse, a tubular fuse holder of insulating material, terminals on said holder adjacent opposite ends thereof, respectively, conducting means extending from the terminal adjacent one end of said holder along the inner wall of said holder to a point spaced from the ends of said holder, a refill unit for said holder including tubular means of insulating material having terminals secured adjacent thereon opposite ends thereof and of a size to be inserted into said holder through the other end thereof, means releasably securing said unit in operative position with the outer terminal thereof electrically associated with the adjacent holder terminal and with the inner terminal thereon in proximity with an inner portion of said conducting means, said inner terminal having resilient contact fingers adapted to engage the inner portion of said conducting means when said unit is in its opera-

tive position, and means in said refill tubular means including a fusible portion connecting said refill terminals.

14. In a high voltage fuse, a tubular fuse holder of insulating material, terminals on said holder adjacent opposite ends thereof, respectively, tubular conducting means extending from the terminal adjacent one end of said holder along the inner wall of said holder to a point spaced from the ends of said holder, a refill unit for said holder including tubular means of insulating material having fixed terminals adjacent opposite ends thereof and of a size to be inserted into said holder through the other end thereof, means releasably securing said unit in operative position with the outer terminal thereof electrically associated with the adjacent holder terminal and with the inner terminal thereof in engagement with an inner portion of said conducting means, means in said refill tubular means including a fusible portion connecting said refill terminals and said refill unit further including resilient means adapted to expand into said tubular conducting means upon fusion of said fusible portion to extend the arc.

15. In a high voltage fuse, a tubular fuse holder of insulating material, terminals on said holder adjacent opposite ends thereof, respectively, conducting means extending from the terminal adjacent one end of said holder along the inner wall of said holder to a point spaced from the ends of said holder, a refill unit for said holder including tubular means of insulating material having terminals adjacent opposite ends thereof and of a size to be inserted into said holder through the other end thereof, means releasably securing said unit in operative position with the outer terminal thereof electrically associated with the adjacent holder terminal and with the inner terminal thereof in engagement with an inner portion of said conducting means, means in said refill tubular means including a fusible portion connected between the outer refill terminal and a relatively infusible movable terminal, resilient means biasing said relatively infusible terminal towards said one end of said holder to tension said fusible portion, and relatively movable contact portions on said relatively infusible terminal and inner refill terminal, respectively, for normally completing the electric circuit through the holder.

16. In a high voltage fuse, a tubular fuse holder of insulating material, terminals on said holder adjacent opposite ends thereof, respectively, conducting means extending from the terminal adjacent one end of said holder along the inner wall of said holder to a point spaced from the ends of said holder, a refill unit for said holder including tubular means of insulating material having terminals adjacent opposite ends thereof and of a size to be inserted into said holder through the other end thereof, means releasably securing said unit in operative position with the outer terminal thereof electrically associated with the adjacent holder terminal and with the inner terminal thereof in engagement with an inner portion of said conducting means, means in said refill tubular means including a fusible portion connected between the outer refill terminal and a relatively infusible movable terminal, resilient means reacting between said refill unit and said relatively infusible terminal for biasing said relatively infusible terminal towards said one end of said holder to tension said fusible portion, and relatively movable contact portions on said rela-

tively infusible terminal and inner refill terminal, respectively, for normally completing the electric circuit through the holder.

17. In a high voltage drop-out fuse, a tubular fuse holder of insulating material, terminals on said holder adjacent opposite ends thereof, respectively, conducting means extending from the terminal adjacent one end of said holder along the inner wall of said holder to a point spaced from the ends of said holder, a refill unit for said holder including tubular means of insulating material having terminals adjacent opposite ends thereof and of a size to be inserted into said holder through the other end thereof, means releasably securing said unit in operative position with the outer terminal thereof electrically associated with the adjacent holder terminal and with the inner terminal thereof in engagement with an inner portion of said conducting means, means in said refill tubular means including a fusible portion connected between the outer refill terminal and a relatively infusible movable terminal, resilient means biasing said relatively infusible terminal towards said one end of said holder to tension said fusible portion, relatively movable contact portions on said relatively infusible terminal and inner refill terminal, respectively, for normally completing the electric circuit through the holder, and latch release means movably mounted at said one end of said holder and having a part normally spaced from said relatively infusible terminal but in the path of movement thereof so as to be actuated thereby a predetermined time after fusion of said fusible portion.

18. In a high voltage fuse, a tubular fuse holder of insulating material, terminals on said holder adjacent opposite ends thereof, respectively, conducting means extending from the terminal adjacent one end of said holder along the inner wall of said holder to a point spaced from the ends of said holder, a refill unit for said holder including tubular means of insulating material having terminals adjacent opposite ends thereof and of a size to be inserted into said holder through the other end thereof, means releasably securing said unit in operative position with the outer terminal thereof electrically associated with the adjacent holder terminal and with the inner terminal thereof in engagement with an inner portion of said conducting means, means in said refill tubular means including a fusible portion connected between the outer refill terminal and a relatively infusible movable terminal, resilient means biasing said relatively infusible terminal towards said one end of said holder to tension said fusible portion, and separable contact portions on said relatively infusible terminal and inner refill terminal, respectively, for normally completing the electric circuit through the holder.

19. In a high voltage fuse, a tubular fuse holder of insulating material, terminals on said holder adjacent opposite ends thereof, respectively, conducting means extending from the terminal adjacent one end of said holder along the inner wall of said holder to a point spaced from the ends of said holder, a refill unit for said holder including tubular means of insulating material having terminals adjacent opposite ends thereof and of a size to be inserted into said holder through the other end thereof, said other end of said holder being interiorly threaded to receive an exteriorly threaded portion on the outer end of said unit for releasably securing said unit in operative position with the outer terminal thereof elec-

trically associated with the adjacent holder terminal and with the inner terminal thereof in engagement with an inner portion of said conducting means, and means in said refill tubular means including a fusible portion connecting said refill terminals.

20. In a high voltage fuse, a tubular fuse holder of insulating material having an open end, terminals on said holder adjacent opposite ends thereof, respectively, with the terminal at said open end constituting a ferrule for the holder, conducting means extending from the terminal adjacent the other end of said holder along the inner wall of said holder to a point spaced from the ends of said holder, a refill unit for said holder including tubular means of insulating material having terminals adjacent opposite ends thereof and of a size to be inserted into said holder through the open end thereof, said terminal ferrule being internally threaded to receive an externally threaded portion of the outer terminal of said unit for releasably securing said unit in operative position with the outer terminal thereof electrically associated with the adjacent holder terminal and with the inner terminal thereof in engagement with an inner portion of said conducting means, and means in said refill tubular means including a fusible portion connecting said refill terminals.

21. In a high voltage fuse, a tubular fuse holder of insulating material, terminals on said holder adjacent opposite ends thereof, respectively, conducting means extending from the terminal adjacent one end of said holder along the inner wall of said holder to a point spaced from the ends of said holder, fusible means in said holder connected between the other terminal and a relatively movable infusible terminal, resilient means biasing said relatively infusible terminal towards said one end of said holder to tension said fusible portion, relatively separable contact portions on said relatively infusible terminal and the inner portion of said conducting means, respectively, for normally completing the electric circuit through the holder, and said contact portions and resilient means constituting the sole electrical connections between said relatively infusible terminal and said one terminal.

22. A fuse refill unit including a tubular refill holder of insulating material, terminals adjacent opposite ends of said holder, fusible means in said holder and connected between one of said terminals and a movably mounted, relatively infusible terminal rod, and a cooperating contact portion on the other of said terminals for slidably engaging said rod at all positions thereof, and said rod normally maintained in a predetermined position by said fusible means.

23. A fuse refill unit including a tubular refill holder of insulating material, terminals adjacent opposite ends of said holder, fusible means in said holder and connected between one of said terminals and a movably mounted relatively infusible terminal, cooperating contact portions on the other of said terminals and said relatively infusible terminal, respectively, normally maintained in predetermined fixed contacting relation by said fusible means, and resilient means engaging said holder and said relatively infusible terminal to draw out the arc formed upon fusion of said fusible means.

24. A fuse refill unit including a tubular refill holder of insulating material, terminals adjacent opposite ends of said holder, fusible means in said holder and connected between one of said termi-

nals and a movably mounted relatively infusible terminal, cooperating separable contact portions on the other of said terminals and said relatively infusible terminal, respectively, normally maintained in engagement by said fusible means, one of said contact portions being resilient and adapted to bias said infusible terminal in a direction to cause separation of said separable contact portions.

25. A fuse refill unit including a tubular refill holder of insulating material, terminals adjacent opposite ends of said holder, fusible means in said holder and connected between one of said terminals and a movably mounted relatively infusible terminal, a separable electric connection between the other of said terminals and said relatively infusible terminal normally maintained against separation by said fusible means, resilient means for separating said connection upon fusion of said fusible means, and said separable connection and resilient means constituting the sole electrical conducting paths between said other holder terminal and said infusible terminal.

26. A fuse refill unit including a tubular refill holder of insulating material, terminals adjacent opposite ends of said holder, fusible means in said holder and connected between one of said terminals and a movably mounted relatively infusible terminal, cooperating contact portions on the other of said terminals and said relatively infusible terminal, respectively, normally maintained in predetermined fixed relation by said fusible means, and resilient means reacting between the contact portions on said holder and said relatively infusible terminal to draw out the arc formed upon fusion of said fusible means, and to normally urge said contact portions into pressure engagement.

27. In a high voltage fuse, a tubular fuse holder having an open end and terminals adjacent opposite ends thereof, line contacts adapted to engage said terminals, respectively, means for movably supporting said holder adjacent said open end so that said holder is movable to engage and disengage at least one of said terminals and contacts, movable latch means adjacent the other end of said holder to releasably maintain said terminals and contacts in engagement, a refill unit insertable through the open end of said holder, said unit including tubular means of insulating material having contact means at opposite ends thereof, said tubular means being of less length than said holder so that one end thereof may be secured to the holder adjacent the open end of the holder with the adjacent terminal and contact means in engagement, and the other end of said unit will be spaced from the other end of said holder, conducting means secured to the terminal adjacent said other end of said holder and extending into said holder to a point where it is adapted to be engaged by the inner contact means of said unit, fusible means in said unit connected between the terminal means thereof, said unit also including means biased to engage said latch means normally restrained by said fusible means but operable upon fusion thereof to actuate said latch means so that said holder is movable to disengage at least said one terminal and contact, and manually releasable latch means limiting disengaging movement of said holder to a position short of the limit of its movement.

28. In a drop-out fuse, a fuse holder pivotally mounted at one end thereof for movement of a terminal at the other end thereof into and out of engagement with a line contact, latch means

for maintaining said terminal and contact in engagement, fusible means in said holder, means responsive to fusion of said fusible means for releasing said latch means, said holder being biased for movement of said terminal away from said contact to drop-out of the circuit, and manually releasable latch means for automatically limiting such drop-out movement to a position short of the limit of such movement.

29. In a drop-out fuse, a fuse holder pivotally mounted at one end thereof for movement of a terminal at the other end thereof into and out of engagement with a line contact, latch means for maintaining said terminal and contact in engagement, fusible means in said holder, means responsive to fusion of said fusible means for releasing said latch means, said holder being biased for movement of said terminal away from said contact to drop-out of the circuit, a relatively fixed support for the pivoted mounting of said holder, and cooperating means on said support and holder including resilient means on one and a projection on the other positioned to be engaged by said resilient means only after predetermined drop-out movement of said holder, for automatically limiting such drop-out movement to a position short of the limit of such movement, and said holder being manually movable a further amount in the same direction by applying a force to the holder sufficient to flex said resilient means past said projection.

30. In a drop-out fuse, a fuse holder pivotally mounted at one end thereof for movement of a terminal at the other end thereof into and out of engagement with a line contact, latch means for maintaining said terminal and contact in engagement, fusible means in said holder, means responsive to fusion of said fusible means for releasing said latch means, said holder being biased for movement of said terminal away from said contact to drop-out of the circuit, a terminal member adjacent said one end of said holder, a line contact member having means supporting the pivotal mounting of said holder, cooperating means on said members including resilient means on one member normally engaging the other member, and a projection on said other member spaced from the point of normal engagement of said resilient means so as to be engaged by said resilient means only after predetermined drop-out movement of said holder for automatically limiting such drop-out movement to a position short of the limit of such movement, and said holder being manually movable a further amount in the same direction by applying a force to the holder sufficient to flex said resilient means past said projection.

31. A fuse refill unit including a tubular refill holder of insulating material, terminals adjacent opposite ends of said holder, fusible means in said holder and connected between one of said terminals and a movably mounted relatively infusible terminal, a separable electric connection between the other of said terminals and said relatively infusible terminal normally maintained against separation by said fusible means, and resilient means engaging said holder and said relatively infusible terminal to draw out the arc formed upon fusion of said fusible means.

32. In a high voltage fuse, a tubular fuse holder of insulating material, terminals on said holder adjacent opposite ends thereof, respectively, conducting means extending from the terminal adjacent one end of said holder along the inner wall of said holder to a point spaced from the ends

of said holder, a refill unit for said holder including tubular means of insulating material having fixed terminals adjacent opposite ends thereof and of a size to be inserted into said holder through the other end thereof, means releasably securing said unit in operative position with the outer terminal thereof electrically associated with the adjacent holder terminal and with the inner terminal thereof adjacent the inner end of said conducting means, resilient contact means on said inner terminal for frictionally engaging said conducting means, and means in said refill tubular means including a fusible portion connecting said refill terminals.

33. In a high voltage drop-out fuse, a tubular fuse holder of insulating material, terminals on said holder adjacent opposite ends thereof, respectively, conducting means including a fusible portion interiorly of said holder for electrically connecting said terminals, latch releasing means movably mounted on said holder, resilient means reacting between an intermediate portion of said holder spaced from said latch releasing means and a relatively infusible terminal of said fusible portion for drawing out the arc formed upon fusion of said fusible portion, and said latch releasing means having a part normally spaced from but positioned in the path of movement of a part moved by said resilient means upon an arc drawing operation thereof, whereby said latch releasing means is actuated by impact a predetermined time after fusion of said fusible means.

34. In a high voltage drop-out fuse, a tubular fuse holder of insulating material, terminals on said holder adjacent opposite ends thereof, respectively, conducting means including a fusible portion interiorly of said holder for electrically connecting said terminals, latch releasing means movably mounted on said holder, a coil compression spring reacting between a portion of said holder spaced from said latch releasing means and a relatively infusible terminal of said fusible portion for drawing out the arc formed upon fusion of said fusible portion, and said latch releasing means having a part normally spaced from but positioned in the path of movement of a part moved by said resilient means upon an arc drawing operation thereof, there being an open space between said parts, whereby said latch releasing means is actuated by impact a predetermined time after fusion of said fusible means.

35. In a high voltage fuse, a tubular fuse holder having terminals adjacent opposite ends thereof, line contacts adapted to engage said terminals, respectively, means for movably supporting one end of said holder so that said holder is movable to engage and disengage at least one of said terminals and contacts, movable latch means adjacent the other end thereof to releasably maintain said terminals and contacts in engagement, said latch means including a latch lever biased into engagement with a cooperating latch part on said holder in a manner such as to exert a force component in a direction to cause said holder to move away from said line contacts, holding means for preventing movement of said holder under the influence of said force component, conducting means including a fusible portion connecting said holder terminals, resiliently biased means normally maintained at a position spaced from said latch means by said fusible portion and operative upon fusion of said fusible portion to draw out the arc formed and engage and release said holding means to permit said force com-

ponent to move said holder toward an open circuit position.

36. In a high voltage fuse, a tubular fuse holder having terminals adjacent opposite ends thereof, line contacts adapted to engage said terminals, respectively, means for movably supporting one end of said holder so that said holder is movable to engage and disengage at least one of said terminals and contacts, movable latch means adjacent the other end thereof to releasably maintain said terminals and contacts in engagement, said latch means including cooperating releasably engageable latch levers on said holder and on a relatively fixed support, respectively, movable holding means on said holder for normally maintaining the latch lever on said holder against movement, said other latch lever biased for movement in a direction to engage said one lever at a point spaced from the pivot of said one lever, conducting means including a fusible portion connecting said holder terminals, resiliently biased means normally maintained at a position spaced from said latch means by said fusible portion and operative upon fusion of said fusible portion to draw out the arc formed and engage and release said holding means to permit said one lever to move out of engagement with said other lever and release said holder, and manually operable means on said holder for moving said latch lever on said fixed support out of engagement with the other of said latch levers.

37. In a high voltage fuse, a tubular fuse holder having terminals adjacent opposite ends thereof, line contacts adapted to engage said terminals, respectively, means for movably supporting one end of said holder so that said holder is movable to engage and disengage at least one of said terminals and contacts, movable latch means adjacent the other end thereof to releasably maintain said terminals and contacts in engagement, said latch means including a latch lever biased into engagement with a cooperating latch part on said holder in a manner such as to exert a force component in a direction to cause said holder to move away from said line contacts, holding means for preventing movement of said holder under the influence of said force component, conducting means including a fusible portion connecting said holder terminals, and means responsive to fusion of said fusible portion for releasing said holding means.

38. In a high voltage fuse, a tubular fuse holder having terminals adjacent opposite ends thereof, line contacts adapted to engage said terminals, respectively, means for movably supporting one end of said holder so that said holder is movable to engage and disengage at least one of said terminals and contacts, movable latch means adjacent the other end thereof to releasably maintain said terminals and contacts in engagement, said latch means including resiliently biased toggle means adapted to have spaced supporting points on said holder and a relatively fixed support, respectively, holding means normally preventing collapse of said toggle means, conducting means including a fusible portion connecting said holder terminals, and means responsive to fusion of said fusible portion for releasing said holding means.

39. In a drop-out fuse, spaced line contacts, a fuse holder having terminals adjacent opposite ends thereof, said holder pivotally mounted at one end thereof adjacent one line contact for movement of at least the opposite end thereof

toward and away from the other line contact, latch means for maintaining said holder in a position where both terminals are in engagement with said line contacts, respectively, said one contact resiliently urged into engagement with the adjacent terminal, fusible means in said holder, means responsive to fusion of said fusible means for releasing said latch means to permit said holder to drop-out of the circuit, and means on said holder engageable by said resiliently urged contact for automatically limiting such drop-out movement to a position short of the limit of such movement.

40. In a drop-out fuse, spaced line contacts, a fuse holder having terminals adjacent opposite ends thereof, said holder pivotally mounted at one end thereof adjacent one line contact for movement of at least the opposite end thereof toward and away from the other line contact, latch means for maintaining said holder in a position where both terminals are in engagement with said line contacts, respectively, said one contact resiliently urged into engagement with the adjacent terminal, fusible means in said holder, means responsive to fusion of said fusible means for releasing said latch means to permit said holder to drop-out of the circuit, and means on said adjacent terminal engageable by said resiliently urged contact for automatically limiting such drop-out movement to a position short of the limit of such movement.

41. In a fuse, a fuse holder pivotally mounted at one end thereof for movement of a terminal at the other end into and out of engagement with a line contact, means for moving said holder, and manually releasable latch means for automatically limiting movement of said holder to an open circuit position to a position short of its full open position.

42. In a fuse, a fuse holder pivotally mounted at one end thereof for movement of a terminal at the other end into and out of engagement with a line contact, means for moving said holder, a relatively fixed support for the pivoted mounting of said holder, and cooperating means on said support and holder including resilient means on one and a projection on the other positioned to be engaged by said resilient means only after predetermined opening movement of said holder, for automatically limiting such opening movement to a position short of the limit of such movement, and said holder being manually movable a further amount in the same direction by applying a force to the holder sufficient to flex said resilient means past said projection.

43. In a high voltage fuse, a tubular fuse holder having terminals adjacent opposite ends thereof, line contacts adapted to engage said terminals, respectively, means for movably supporting one end of said holder so that said holder is movable to engage and disengage at least one of said terminals and contacts, movable latch means adjacent the other end of said holder to releasably maintain said terminals and contacts in engagement, conducting means secured to the terminal adjacent said other end of said holder and extending into said holder, fusible means connected between said terminal adjacent said one end of said holder and to a terminal means, spring means biasing said terminal means toward said latch means, said terminal means having a connection with the inner end of said conducting means which is adapted to be separated upon fusing of said fusible means and consequent movement of said terminal means outwardly rel-

ative to said holder, for releasing said latch means and permitting said holder to move to disengage at least said one terminal and contact, and said spring means arranged electrically in shunt relation with said separable connection to carry all of the current during arcing.

44. In a high voltage fuse, a tubular fuse holder of insulating material, terminals on said holder adjacent opposite ends thereof, respectively, conducting means extending from the terminal adjacent one end of said holder along the inner wall of said holder to a point spaced from the ends of said holder, fusible means in said holder connected between the other terminal and a relatively movable infusible terminal, resilient means biasing said relatively infusible terminal towards said one end of said holder to tension said fusible portion, separable contacts on said relatively infusible terminal and the inner portion of said conducting means, respectively, for normally completing the electric circuit through the holder, and said contact portions and resilient means constituting the sole connections between said relatively infusible terminal and said one terminal.

45. In a fuse, a fuse holder pivotally mounted at one end thereof for movement of a terminal at the other end thereof into and out of engagement with a line contact, fusible means in said

holder, a terminal member adjacent said one end of said holder, a line contact member having means supporting the pivotal mounting of said holder, cooperating means on said members including resilient means on one member normally engaging the other member, and a projection on said other member spaced from the point of normal engagement of said resilient means so as to be engaged by said resilient means only after predetermined movement of said holder away from said line contact, and said holder being manually movable a further amount in the same direction by applying a force to the holder sufficient to flex said resilient means past said projection.

46. In a fuse, a fuse holder pivotally mounted at one end thereof for movement of a terminal at the other end thereof into and out of engagement with a line contact, fusible means in said holder, resilient detent means adjacent the pivotal mounting of said holder adapted to hold said holder at an open circuit position wherein said terminal is spaced from said contact, and said holder being manually movable a further amount in a direction away from said contact by applying a force sufficient to overcome the holding power of said detent means.

HAROLD H. FAHNOE.