Feb. 24, 1953 D. C. HUBBARD ET AL 2,629,794

FUSED DROP-OUT CUTOUT

Original Filed July 26, 1948 2 SHEETS--SHEET 1

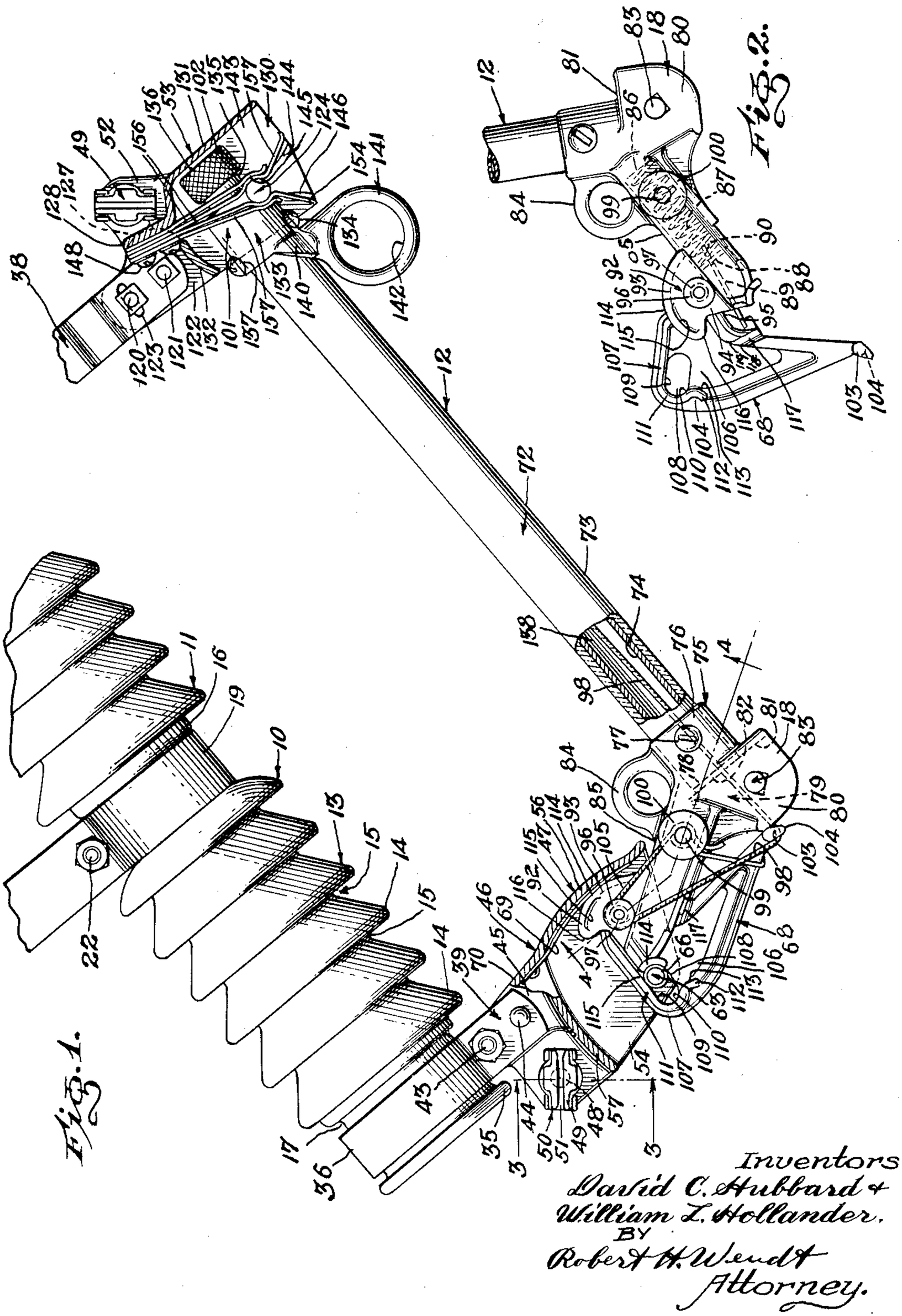

Fig. 1.

Fig. 2.

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Fig. 3.

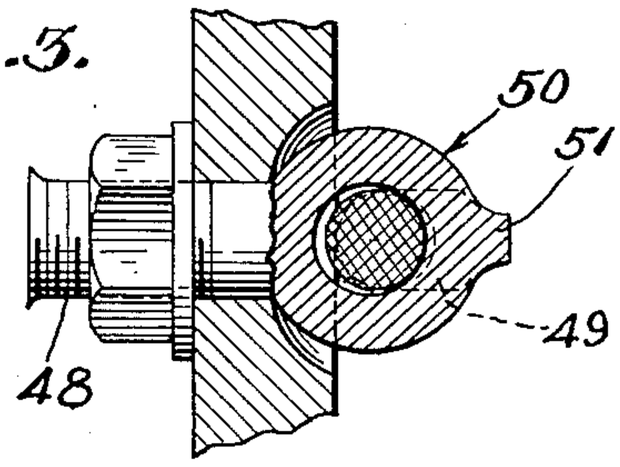
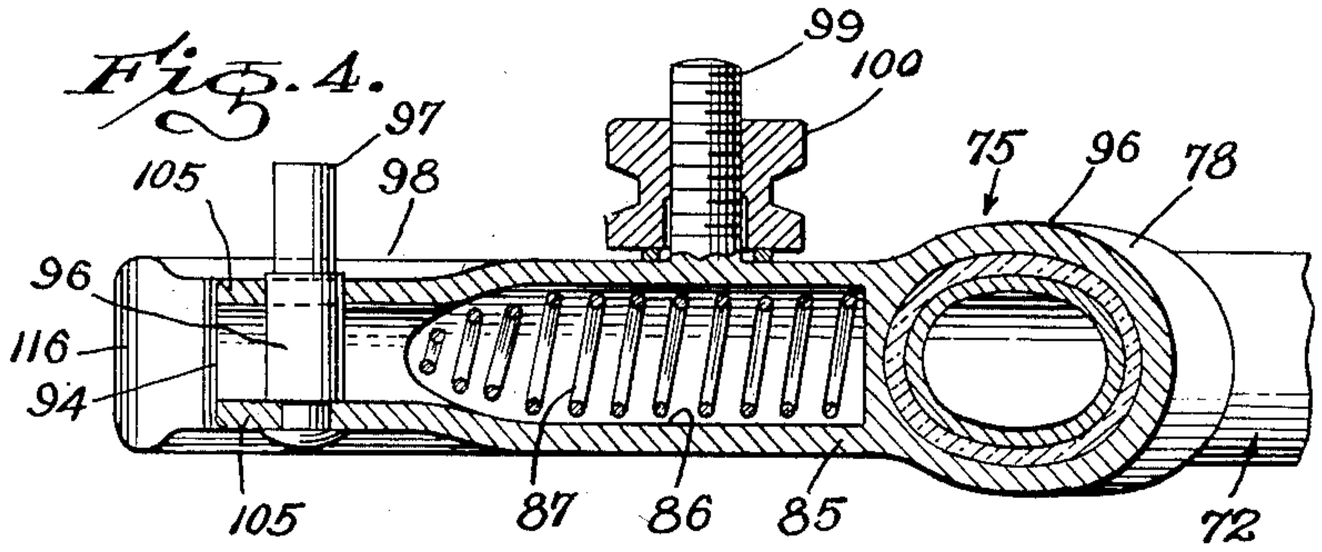


Fig. 4.



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2,629,794

FUSED DROP-OUT CUTOUT

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Original application July 26, 1948, Serial No. 40,756, now Patent No. 2,537,348, dated January 9, 1951. Divided and this application December 29, 1950, Serial No. 203,380

12 Claims. (Cl. 200—114)

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The present invention relates to fused drop-out cut-outs, and is particularly concerned with automatic fuse devices of the type adapted to be used upon transmission lines for interrupting the flow of current when the current exceeds a predetermined amount, the interruption being accompanied by the melting of the fuse and the expulsion of the parts of the fuse, accompanied by the automatic mechanical opening of the circuits, after the circuit is broken, to assure the permanent breaking of the circuit until it is manually closed, and to give an indication of the condition of the circuit.

The present application is a division of our prior application, Ser. No. 40,756, filed July 26, 1948, for fused drop-out cut-outs, Patent No. 2,537,348, granted January 9, 1951.

One of the objects of the invention is the provision of an improved drop-out type fuse cut-out adapted to utilize the standard universal fuse links and provided with a fuse tube, which is closed at the top and open at the bottom, and so constructed that the lower contact of the fuse tube is ejected from the bottom contact of the circuit, so that the fuse tube will hang with its opening downward before and after operation, thus protecting the fiber liner of the fuse tube from all adverse weather conditions.

Another object of the invention is the provision of an improved fuse drop-out cut-out in which the actual parting of the lower contacts upon rupture of the fuse link is delayed until after the arc has been extinguished inside the fuse tube.

Another object is the provision of an improved device of the class described in which the ejector arm travels over a predetermined arc before unlatching the lower contact, so that the actual mechanical opening of the circuit will be delayed until the arc has been definitely extinguished within the fuse tube.

Another object is the provision of an improved device of the class described in which there is a wiping contact between the contacts on the fuse tube and those on the support so that the contacts may be kept in good condition and so that the wiping contact at the lower contact of the fuse tube may be used during the unlatching of the fuse tube to assist in delaying the mechanical opening of the circuit until the arc has been extinguished within the tube.

A further object of the invention is the provision of an improved drop-out fuse construction in which the jet action from the opening at the lower end of the fuse tube reacts with the upper trunnion to produce a torque that tends to swing the lower end of the fuse tube inward toward its contact to hold the lower contact in engaged position during the blast of the arc so as to delay the mechanical opening until the arc has been extinguished.

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Another object of the invention is the provision of an improved construction for devices of the class described in the form of the resilient spring supported contacts, and the provision of stops which protect the springs during jet action to prevent the straining of the springs and to cause the forces to react in such manner that the top trunnion of the fuse tube is also held in closed position during the violent jet action from the lower end of the fuse tube.

Another object of the invention is the provision of an improved ejector construction adapted to pull the fuse link from the fuse quickly at all times, even though the rupturing currents are too light to generate sufficient gases within the fiber tube to eject the link rapidly, thus assuring the extinguishment of the arc in a minimum time.

Another object of the invention is the provision of an improved fuse tube drop-out cut-out, the parts of which are protected from the weather at all times, and which is also adapted to be operated in a conventional way as a disconnect by permitting the manual disengagement of the upper contacts by merely pulling outward on this end of the tube, leaving the tube supported by its lower contacts, and indicating that it has been manually operated as a disconnect.

Another object of the invention is the provision of an improved fuse construction which is adapted to be re-fused and operated in accordance with conventional procedure so that the operators will already be familiar with the mode of handling the device.

Another object of the invention is the provision of an improved fuse drop-out cut-out which is "trip-free," even during the manual closing of the circuit, so that when the fuse tube unit is being connected with its contacts, the operator cannot force the closing of the circuit during the existence of an overload; but while the operator is swinging the upper contact into closed position and holding it, the device may nevertheless open at the bottom contact automatically, if a short circuit exists at that time.

Another object of the invention is the provision of an improved fuse tube unit which is provided with means for guiding and diverting the molten elements and the major force of the blast which takes place on fusing, away from the operator, so as to provide limited but effective pro-

tection for the operator, and particularly for his face.

Another object is the provision of an improved device of the class described having a mechanism that is unaffected by accumulations of ice, and which is adequately protected from such accumulations as may occur.

Another object of the invention is the provision of a device of the class described which gives a visual indication in the open position whether the device has been operated automatically, indicating the existence of a fault, or whether the device has been opened manually, indicating the purposeful de-energizing of the circuit for repairs or other reasons.

Another object is the provision of an improved contact structure which is self-aligning with relation to the trunnions on the fuse tube unit, and the provision of stops and buffers to arrest the reaction that is due to the jet action, and to prevent overstressing the contact springs.

Another object is the provision of an improved fuse tube unit and support therefore which is so constructed that the forcible closing of the contacts, by slamming the fuse tube into position, tends to force the ejector arm against the bottom of the fuse tube, rather than to cause the arm to place additional tension on the fuse link element, thus eliminating the shocks that are imparted to the fragile fuse link in the devices of the prior art.

Another object of the invention is the provision of an improved ejector mechanism for the fuse leader, in which the cable is so arranged that it does not slide over the end of the ejector lever as the lever moves, thus reducing or substantially eliminating the friction which would be caused by such a sliding action, and which would resist the ejector lever operation.

Another object is thep rovision of improved contact arrangements by means of which the contact fixtures on the fuse tube unit are resiliently urged into engagement with the fixed contact arms, and by means of which the contacts are self-aligning with respect to the trunnions on the fuse tube unit, and by means of which the longitudinal pressure on the fuse tube, which sometimes causes bending, after a long period of time, is substantially eliminated.

Other objects and advantages will be apparent from the following description and the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the two sheets of drawings accompanying this specification,

Fig. 1 is a fragmentary side elevational view in partial section, showing a fused drop-out cut-out embodying the invention;

Fig. 2 is a fragmentary side elevational view, howing the position of the parts of the lower end of the fuse tube unit after the fuse has blown;

Fig. 3 is a fragmentary sectional view on the plane of the line 3—3 of Fig. 1, showing the electrical connector by means of which the lower contact arm is connected to a wire cable or other conductor; and

Fig. 4 is a fragmentary sectional view, taken on the plane of the line 4—4 of Fig. 2, looking in the direction of the arrows.

Referring to Fig. 1, 10 indicates in its entirety the fuse drop-out cut-out assembly, which preferably includes a supporting structure 11 and fuse tube unit 12 carried thereby. The supporting structure 11 may be embodied in the single insulator type shown in Fig. 1, or it may be carried by two insulators in the manner shown in the prior application of David C. Hubbard, Ser. No. 11,076, filed February 26, 1948, Fuse Drop-Out Cut-Outs, now U. S. Patent No. 2,584,586 granted February 5, 1952.

The single insulator type of Fig. 1 has a porcelain insulator 13, which is formed with a multiplicity of peripherally extending skirts 14 separated by grooves 15; and the insulator preferably has a reduced cylindrical portion 16 adjacent at its middle, and additional reduced cylindrical portions 17 at each end. The middle cylindrical portion 16 of the insulator is surrounded by a metal band 19, the ends of which are provided with two laterally projecting attaching flanges, having a screw bolt 22 passing through them and clamping them together.

The clamping band 19 is a part of the structure used for supporting insulator 13 from a cross arm or other support substantially as disclosed in our prior application of the same title, filed March 8, 1948, Ser. No. 13,704, now U. S. Patent No. 2,581,954 granted January 8, 1952.

Thus the insulator 13 is adapted to be supported from a horizontal cross arm in a tilted position so that the fuse tube unit 12 will extend diagonally upward and away from the cross arm in such manner that whenever the fuse tube unit hangs only from the upper contact arms it hangs in a vertical position by gravity. By reason of this position of the insulator and fuse tube unit the fuse tube unit is so supported that it may pivot upon either the upper trunnions or the lower trunnions by gravity to a position which it will retain by gravity.

The reduced cylindrical portions 17 at each end of the insulator 13 are bordered by one of the insulator skirts on one side and a radially projecting rib 35 on the other side, forming a groove for receiving the clamping bands 36, which carry the upper and lower contact supporting arms 38, 39, substantially as described in our said U. S. Patent No. 2,581,954.

The contact supporting arms consist of a pair of laterally extending flanges or straps extending from the clamping bands 36 and adapted to be secured to contact fittings by being provided with aligned bores for the screw bolts 43, 44 below and 120, 121 above.

The lower contact fitting 46 comprises an elongated conductive metal casting provided with a flat attaching flange 45, which may be received between the flanges of the arm 39 on hand 36 and secured by screw bolts 43, 44. Lower contact fixture 46 has a hood or partial housing 47 for supporting the lower contact trunnions 63 and for enclosing the ejector and contact mechanism, and for protecting the lower mechanism from rain, snow, and other adverse weather conditions.

The lower fixture 46 may consist of a cast metal member provided with a relatively flat attaching flange 45 and with an aperture 48 for passing a connector bolt 49, which is apertured below its elongated head 50 for receiving a conductor that is clamped in a groove 51 by a nut on the shank of the bolt which pulls the head against the conductor.

A similar connector 49 is carried by an upwardly projecting flange 52 carried by the upper contact fixture 53. The hood 47 has parallel side walls 54, a curved top wall 56, and a flat rear wall 57 (Fig. 1), leaving the bottom open between the side walls 54, when the fixture is installed properly, as in Fig. 1.

The side walls 54 of the hood 47 are provided

with the laterally inwardly projecting integral cylindrical trunnions 63, which project inwardly from the side walls in alignment with each other and toward each other, but terminate short of each other to permit the ejector lever of the tube unit 12 to move between these trunnions 63.

The inner ends 66 of the trunnions 63 are spaced from each other sufficiently to pass the relatively flat flange and reinforcing portions of the ejector arm 68, which is pivotally mounted on the tube unit 12.

The hood 47 supports a leaf spring 69, which extends along the inside of its top wall 56, and which is initially spaced from the top wall, being tensioned when bent upward, as shown in Fig. 1. This leaf spring 69 passes through an aperture in the rear wall 57, and is secured to a horizontal flange 70 by means of a rivet 71. Spring 69 urges the contact portions of the fuse tube unit 12 resiliently against the trunnions 63.

The fuse tube unit 12 comprises an insulating tube 72, preferably having an outer portion 73, which is adapted to resist exposure to weather, and an inner portion 74, which is adapted to resist burning by the heat generated in the melting of the fuse, these two portions being integrally cemented together to form a single tube.

At its lower end the fuse tube 72 supports the contact fixture 75, which has an upwardly open tubular member 76 for receiving the lower end of the fuse tube. The fuse tube is fixedly secured in the ferrule 76 of the lower fixture 75 by a pair of screw bolts 77 threaded into bores in the ferrule and penetrating only partly into the thick tube 73 so that the inner ends of the bolts 77 are covered by the inner tube 74.

The fuse tube terminates at 78, inside the blast chute 79, and is open at its lower end, where it is constantly protected from the weather by hanging downward, either in the position of Fig. 1 or, after blowing of the fuse, in the vertical position of Fig. 2. The lower fixture 75 supports the integral blast chute 79, which has a pair of parallel side walls 80, a top wall 81 flush with the end 78 of the tube, and a diagonally extending rear wall 82, which extends over toward the center of the tube 72, and is adapted to deflect the gases downwardly and toward the right, away from the face of the operator.

The side walls 80 of the blast chute 79 each support an outwardly projecting cylindrical stud 83, which is adapted to provide the pivotal support and point of attachment of a fuse leader guard adapted to receive and hold the cable of the fuse when the fuse is blown. The fuse leader guard forms no part of the present invention and may be substantially as shown in the prior application of David C. Hubbard, Ser. No. 792,804, filed December 19, 1947, now U. S. Patent No. 2,461,898 granted February 15, 1949.

The lower fixture 75 is formed with an integral ring 84 located on its upper side, in Fig. 1, for reception of the laterally projecting operating pin of a disconnect stick, upon which the fuse unit 12 is hung when it is to be installed. Lower fixture 75 also has an integral substantially cylindrical body portion 85 below the ring 84 and provided with a cylindrical bore 86 for receiving an ejector spring 87.

The ejector spring comprises a helical coil spring reacting at its right end on the end of the bore 86 and engaging at its left end the washer 88 of an ejector strut 89. Ejector strut comprises a stiff strip of sheet metal, having a reduced end 90, which passes through an aperture

in the insulating washer 88, and having at its other end 91 a V-groove or fork for engaging on both sides of the ejector lever 68 at its right edge. Thus the ejector spring 87 urges the ejector lever 68 toward the left in Fig. 1 by means of the strut 89.

The upper wall of the cylindrical formation 85 is extended toward the left to form a part of a roof 92, which curves upwardly under the top wall 56 of the hood to make sure that the hood overlaps and drains on the lower fixture 75 at a point where the water will not run into the mechanism.

Referring to Fig. 2, the laterally projecting portion 93 of the lower fixture 75 is provided with a rectangular slot 94 open toward the left, and adapted to receive the pivot flange 95 of the ejector lever 68, which is pivoted on the rivet 96. The rivet 96, which forms the pivot for the ejector lever, also has a laterally projecting cylindrical portion 97 (Fig. 4), about which the cable leader 98 may be wrapped when the fuse is installed in the fuse unit 12.

Lower contact fixture 75 also has a laterally projecting cylindrical threaded stud 99 provided with a knurled thumb nut 100, which is adapted to clamp the end of the fuse leader 98 after it has been passed about the threaded stud 99.

The present fuse units 12 are adapted to receive standard fuses, each of which has a circular button at the top adapted to be clamped against an end surface on the upper fixture 101 by means of the internally threaded cap 102. The fusible portion of the fuse is located in the upper end of the tube 72, and is connected to the stranded copper wire leader cable wire 98, which extends downwardly out of the lower end of the tube 72 and out of the blast chute 79.

Fuse leader 98 passes around the end 103 of the ejector lever 68, and is located in a groove 104 in the bottom or end of ejector lever 68. From the groove 104 the leader 98 passes about the stud 93; and its end is passed about the stud 99 and clamped by the thumb nut 100. When the fuse leader is so installed, the ejector lever 68 is tensioned; that is, it is moved from the position of Fig. 2 to that of Fig. 1, compressing the spring 87 and causing the fuse ejector lever 68 to place a tension on the fuse leader 98.

The ejector lever 68 is pivoted in the slot 94 between the parallel portions 105 of the lower fixture 75; and ejector lever 68 has a relatively flat body flange 106, which is relatively thin, but which is reinforced by a thicker border flange 107.

The oval aperture 108 (Fig. 2) in the ejector lever flange 106 is merely for convenience in machining adjacent surfaces, comprising the flat inner surface 109 and the cylindrical end surface 110 on a pair of laterally projecting guide flanges 111. These guide flanges, which are on both sides of the ejector lever 68, also have downwardly extending lips 112, with a diagonally extending face 113 for guiding the trunnions 63 into proper position. The lateral thickness of the reinforcing border flange 107 is such that it passes between the ends 66, 67 of the trunnions which are carried by the hood 47.

The laterally projecting body 93 of the lower fixture 75 has each of its side webs 105 provided with the laterally projecting curved contact members 114. These arcuate contact members have lower partially cylindrical surfaces 115 for engaging the trunnions 63, against which they are urged by the spring 69, which bears on the

top of the lateral extension 93 at the flange 92 (Fig. 1).

The side webs 105 of the lower contact fixture 75 are extended toward the left, in Fig. 1, to form the curved camming surfaces 116, which engage the spring 69 in the installation of the fuse tube unit 12 and urge the fixed contacts 114 into proper engaging position with the trunnions 63.

The ejector lever 68 is also preferably provided with a pair of laterally projecting hammer flanges 117, which are beveled at 118 on the lower left corner to provide a sharp edge at 119. The sharp edge 119 is so located that it is adapted to penetrate between each trunnion 63 and each fixed contact 114. Thus the ejector lever has a sharp hammer flange, which is forced between the fixed and movable contacts to separate them when the fuse is blown and withdrawn by the ejector lever.

Referring to the upper contact supporting arm 38, it is supported on the insulator 13 in substantially the same way as described with respect to the contact band 36 at the bottom. The two flanges of the arm 38 have apertures for the screw bolts 120, 121, which also pass through an attaching flange 122 on the upper contact arm fixture 53 to secure this fixture to the upper arm 38.

The fixture 53 pivots on the bolt 121 by reason of the clearance provided by an enlarged aperture 123 in attaching flange 122 surrounding the bolt 120. This pivotal movement provides a predetermined amount of adjustment of the jaws of the upper fixture 53 to accord variations in length of the fuse tube unit 12 and still bring the upper trunnions 124 into good contact engagement with the upper fixed contacts.

The screw bolts 120, 121 are provided with spring lock washers, thereby taking up any rattling and preventing the contact fixture 53 from pivoting too loosely.

The upper contact fixture 53 may comprise a cast metal member; and it is preferably formed with a housing having a pair of parallel side walls 130 integrally joined to a curved top wall 131 and a depending back wall 132, forming a hood which is open at the bottom for receiving the upper end of the fuse tube unit 12 and for protecting the contacts and upper mechanism from snow, rain, and other weather conditions.

The upper contact fixture, on the fuse tube unit 12, has a cylindrical body 133, with a cylindrical bore for receiving the fuse tube 72, which is again secured in place by a plurality of screw bolts arranged like the screw bolts 77 of the lower fixture. The cylindrical body 133 has a reduced cylindrical extension 135, which is threaded externally to receive the internal threads of the cap 102, which is closed at its upper end 136.

There is a bore 137 extending through the fixture 101 and registering with the bore 138 in fuse tube 72 for receiving the fuse and its leader. At the upper right corner of the cylindrical portion 133 (Fig. 1) the cylindrical body 133 is provided with a pair of laterally projecting cylindrical trunnions 124; and these trunnions 124 form the upper contacts carried by fuse tube unit 12.

At its lower end the cylindrical body 133 of the upper contact fixture 101 has a partially cylindrical extension 140, which carries a laterally projecting operating ring 141. This ring has an aperture 142 like the ring 84, of sufficient size to pass the head on the laterally projecting pin of a disconnect stick by means of which the fuse tube unit 12 may be manipulated.

Ring 141 is used for operating the unit as a disconnect by merely pulling out and disconnecting the upper contact, while the unit 12 pivots on the lower trunnions. Ring 141 is also used in the installation of the fuse tube unit to swing the unit upward from a position where the tube unit 12 depends from the lower trunnions 63 to the position of Fig. 1.

The parallel side walls 130 of the upper contact fixture are spaced sufficiently to receive the trunnions 124, which extend laterally from one side wall 101 to the other side wall 101. Above the trunnions 124 the side walls 101 may again have inner walls 143, which are spaced sufficiently to pass the cap 102, but which terminate in lower shoulders 144 located above the trunnions 124. In other words, the side walls of fixture 53 are offset at 143.

The lateral shoulders 144 are formed with upwardly curved shoulders 145, above the trunnion 124 in Fig. 1, for reinforcing the spring contacts carried by the upper fixture 53 and preventing their being strained too far. Trunnion-engaging shoulders 144 curve upwardly and toward the right in Fig. 1, forming the upper wall of a tapering opening to guide the trunnions 124 into position to engage the upper contact springs.

At the lower part of the side walls 130 there is a similar downwardly and outwardly flaring surface 146 for engaging the bottoms of the trunnions 124 and aiding and guiding them into engagement with the contact fingers.

The upper contact fixture 53 has an aperture 127 in its rear wall 132 and an attaching flange 128 extending rearwardly and upwardly. A plurality of leaf springs 156, 157 below, and 156, 157 above, are secured to the attaching flange 128 by screw bolts 148 passing through the springs and threaded into the flange 128.

The two innermost contact springs 156 have straight portions extending forwardly and terminate in partially cylindrical trunnion-engaging portions engaging the trunnion 124. Thereafter these contact springs 156 flare outwardly like the surfaces 144, 146, to aid in guiding the trunnions between the springs.

The two outermost leaf springs 157 have straight portions extending outwardly toward the trunnions and partially cylindrical portions at the trunnions engaging the outside of the springs 156, for reinforcing the springs 156 and improving their tension. All four springs are initially tensioned toward each other so that they tend to close and present a smaller opening, which is spread when the trunnions 124 enter the flaring spring 156.

The trunnions 124 are retained in the partially cylindrical latching formations of the leaf springs 156, into which they can be pushed by means of a disconnect stick, or from which they can be pulled with the same tool.

Operation

The mode of manipulation and mode of operation of the mechanism is as follows: A fuse with its leader 98, arranged as shown in Fig. 1, is first placed in the fuse tube unit 12; then ejector lever 68 being pressed up against the end of the baffle wall 82 tensions the spring, the leader passing through the groove 104 around the pin 97, and being secured by means of thumb nut 100.

A predetermined tension is thus placed upon

the fuse leader 98, tending to withdraw this leader from the tube 72 as soon as the fuse melts. The explosive tendency of the melting fuse, supplemented by the leader ejector 68, tends to break the circuit as quickly as possible and to extinguish the arc inside the tube 72.

The fuse tube unit 12 having been re-fused, it is then hung upon a disconnect stick by means of the ring 84 in a position depending from the ring 84; and then the fuse tube unit may be lifted by means of the stick until the lip 112 passes over the trunnions 63, as shown in Fig. 3; and the unit is hung on the trunnions 63 by means of the cylindrical portions 110 of the laterally projecting flanges 111.

It should be understood that the trunnions 63 project laterally from each parallel side wall 54, 55, but terminate with a space between their ends, into which the ejector lever can be inserted. The laterally projecting flanges 111 on the ejector lever project far enough to extend over the inwardly projecting trunnions carried by the side walls 55 so that the ejector lever serves at this time as a support with which to hang the fuse tube unit 12 on the lower trunnions in its inverted position.

The operator then removes his disconnect stick from the ring 84 and places it in the ring 141, which is now lowermost. The operator then uses the disconnect stick to pivot the fuse tube unit 12 counterclockwise from the depending position described, upward on the trunnions 63 to the posiiton of Fig. 1.

As the fuse tube unit 12 passes from its upside down depending position to the position of Fig. 1, the laterally projecting flanges 111 engage the trunnions 63 by means of their flat surfaces 109. As the fuse tube unit moves upward counterclockwise gravity causes the fuse tube unit 12 to slide toward the left, in Fig. 1, on trunnions 63, engaging surface 109, because the surface 109 slopes downward toward the left. This brings the trunnions 63 into engagement with contacts 114.

As the upper contact fixture 101 approaches the contacts 156, 157 it is guided between the contacts by having its trunnions 124 guided by the flaring surfaces 144, 146 until the trunnions are forced between the contact springs 156. During this action the upper contact fixture 53 may pivot on its bolt 121 under the friction imposed by a spring lock washer on this bolt, the movement being permitted at the bolt 120 by the elongated slot 123. Thus the effective distance between the upper and lower contact arms is automatically adjusted to the length of the fuse tube unit; and variations in length of this unit will not affect its proper operation.

The curved contacts 114 engaging the trunnions 63 at the bottom have enough curvature and extend peripherally sufficient to overhang the back or left side of the trunnions 63 slightly. Thus the lower end of the fuse tube unit 12 is retained on trunnions 63, carried by hood 46. The upper end is retained by contact springs 156 engaging trunnions 124 on fuse tube unit 12. The fuse tube unit is now installed, ready to protect the circuit.

Operation as a disconnect

To operate the cut-out as a disconnect, a disconnect stick may have its end hooked in the ring 141. If the operator then pulls on the stick, the trunnions 124 will cam the contact springs 156 apart to release the trunnions 124. When

the upper end of the fuse tube unit 12 is pulled in a clockwise direction, the unit will rotate on the lower trunnions 63 and may be swung in a clockwise direction until it depends from the trunnions 63 in the same position as it assumes when the fuse tube unit is first being installed.

When the fuse tube unit hangs from its lower contacts, this indicates the purposeful disconnection by the operator as a disconnect, as distinguished from the blowing of the fuse.

The operation of the cut-out on overload is as follows: Assuming that the fuse tube unit is in the position of Fig. 1, when an overload occurs, the fusible portion of the fuse 98 is melted by the electric current and ruptured, producing an explosive amount of gas, which passes out of the lower end of the lower fixture 75, expelling the cable leader 98, which is also pulled out by the fuse ejector arm 68.

The fuse ejector arm is urged in a clockwise direction by the compression spring 87 acting on the strut 89, which has a forked end engaging the ejector lever 68, pulling out the fuse leader 98.

As the ejector lever 68 rotates upon its pivot 96, hammer flange 117 has its sharp end moved toward the trunnions 62, 63 until this sharp end engages between the trunnions in the fixed contact 114 on each side of the lower fixture 75.

This tends to raise the contacts 114; and the entire fuse tube unit is raised sufficiently for the overhang of the contacts 114 to clear the trunnions 62, 63; and simultaneously the contacts 114 are urged outwardly toward the right, away from the trunnions 62, 63.

This releases the lower end of the fuse tube unit 12 from the contact supporting arm 46; and the fuse tube unit 12 swings toward the right at its lower end in a counterclockwise position from the position of Fig. 1 to a position which corresponds to that of Fig. 2.

When the fuse tube unit is in this position, it is an indication that the circuit has not been opened by using the device as a disconnect; but it has been opened by the blowing of a fuse.

It will thus be observed that we have invented a fused drop-out-cut-out, in which the jet action of the expelled gases will tend to push the fuse tube unit into engagement with its upper and its lower contacts, retarding any tendencies of the device to open too quickly. The device will not open until the power arcs are extinguished because it is only after the arc is extinguished that the jet action ceases from pressing the fuse tube unit backwardly into engagement with its contacts.

The present assembly has the contacts so arranged that they are self-aligning to compensate for discrepancies in the length of the fuse tube units or in the spacing between the contact supporting arms, which are due to the variations in manufacture. The advantages of our improved device may be summarized as follows:

1. It is adapted to use standard universal fuse links of any manufacturer and to be handled according to conventional practise.

2. The lower contact of the fuse tube is ejected from the bottom contact arm upon rupture of the fuse link so that the fuse tube will hang with its opening extending downward after operation, thus protecting the interior of the fuse tube from all adverse weather conditions.

3. The construction of the mechanism is such that the mechanical opening of the lower contacts is delayed until the arc has been definitely extinguished.

4. The jet action from the lower end of the tube tends to keep the upper end of the fuse tube in its proper position and to hold the lower end in position until after the blast, thus delaying mechanical opening until the arc has been extinguished.

5. The resilient spring contacts with their wide flaring ends are adapted to register with the trunnions of the fuse tube units, even though the dimensions may vary due to manufacturing tolerances and the contacts may give sufficiently to become self-aligning as they engage the trunnions.

6. Any undue strain on the spring contacts is prevented by the provision of stop surfaces which take the thrust that is caused by jet action during rupture of a fuse.

7. The present fuse unit may be operated as a disconnect switch; but when so operated, its automatic mechanism is still "trip-free" so that a fault on the line will open the lower contacts, even while the operator is closing and holding the upper contacts.

8. The device gives a visual indication at all times whether it is actively in the circuit or whether the circuit has been broken purposefully at the top or automatically by rupture of a fuse at the bottom.

While we have illustrated a preferred embodiment of our invention, many modifications may be made without departing from the spirit of the invention, and we do not wish to be limited to the precise details of construction set forth, but desire to avail ourselves of all changes within the scope of the appended claims.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent of the United States, is:

1. In a fuse tube unit, the combination of an insulating tube with a contact fixture, said contact fixture having a laterally projecting arm provided with a pair of flanges, a fuse throw-out lever pivotally mounted between said flanges, said flanges being provided at their lower ends with a pair of partial bearing formations to be supported on trunnions, and a hammer formation having a pointed end and located on each side of said throw-out lever for engaging below the partial bearings to lift the fuse unit off said trunnions when the throw-out lever rotates.

2. In a fuse tube unit, the combination of an insulating tube with a contact fixture, said contact fixture having a laterally projecting arm provided with a pair of flanges, a fuse throw-out lever pivotally mounted between said flanges, said flanges being provided at their lower ends with a pair of partial bearing formations to be supported on trunnions, and a hammer formation having a pointed end and located on each side of said throw-out lever for engaging below the partial bearings to lift the fuse unit off said trunnions when the throw-out lever rotates, said laterally projecting arm being provided with an enlargement located axially with respect to the point of the axis of pivot, for supporting the fuse leader, and with clamping means engageable with said fuse leader.

3. In a lower contact structure for fuse tube units, the combination of an insulating support with a laterally projecting contact arm carried thereby and having a downwardly and forwardly open hood, a fuse tube unit having a laterally projecting arm to be received in said hood, and a fuse ejector lever having a camming extension engaging the top of said hood to counteract the jet propulsion effect which is encountered when the fuse tube unit is blown and the gas escapes from the lower end thereof so that the ejector arm cannot open the circuit at said contact arm until the circuit is actually broken in the fuse tube unit.

4. In a lower contact structure for fuse tube units, the combination of an insulating support with a laterally projecting contact arm carried thereby and having a downwardly and forwardly open hood, a fuse tube unit having a laterally projecting arm to be received in said hood, and a fuse ejector lever having a camming extension engaging the top of said hood to counteract the jet propulsion effect which is encountered when the fuse tube unit is blown and the gas escapes from the lower end thereof so that the ejector arm cannot open the circuit at said contact arm until the circuit is actually broken in the fuse tube unit, said laterally projecting arm of said fuse tube unit carrying a pair of partially cylindrical bearing flanges, and said fuse ejector lever carrying an anvil formation for engaging below said bearing formations and lifting the fuse tube unit off its trunnions when a fuse is broken.

5. In a lower contact structure for a fuse tube unit, the combination of metal fixture having a through bore for receiving the open end of a fuse tube, said through bore terminating in a downwardly and forwardly open blast chute, said fixture having a laterally projecting arm provided with a cylindrical bore, a compression spring in said bore, a pair of parallel flanges carried by said arm and a fuse ejector lever pivotally mounted on said flanges.

6. In a lower contact structure for a fuse tube unit, the combination of a metal fixture having a through bore for receiving the open end of a fuse tube, said through bore terminating in a downwardly and forwardly open blast chute, said fixture having a laterally projecting arm provided with a cylindrical bore, a compression spring in said bore, a pair of parallel flanges carried by said arm and a fuse ejector lever pivotally mounted on said flanges, and a pair of partial bearing formations carried by said arm, one on each side of said ejector lever for resting on a trunnion to be carried by a support.

7. In a lower contact structure for a fuse tube unit, the combination of a metal fixture having a through bore for receiving the open end of a fuse tube, said through bore terminating in a downwardly and forwardly open blast chute, said fixture having a laterally projecting arm provided with a cylindrical bore, a compression spring in said bore, a pair of parallel flanges carried by said arm and a fuse ejector lever pivotally mounted on said flanges, and a pair of partial bearing formations carried by said arm, one on each side of said ejector lever for resting on a trunnion to be carried by a support, the ejector lever being provided with a pair of knife edge anvil members, one on each side of said ejector lever and located at such a radius with respect to the axis of rotation that the knife edge anvil passes immediately under said bearing formations when the ejector lever is rotated to lift the bearing formations off their supporting trunnions.

8. In a lower contact structure for a fuse tube unit, the combination of a metal fixture having a through bore for receiving the open end of a fuse tube, said through bore terminating in a downwardly and forwardly open blast chute, said fixture having a laterally projecting arm pro-

vided with a cylindrical bore, a compression spring in said bore, a pair of parallel flanges carried by said arm and a fuse ejector lever pivotally mounted on said flanges, said ejector lever being provided with a groove at its end for passing a fuse tube leader and with an enlargement substantially at the axis of rotation about which the fuse tube leader is to be bent so that the fuse tube leader does not slide on said enlargement as the ejector lever rotates.

9. In a lower contact structure for a fuse tube unit, the combination of a metal fixture having a through bore for receiving the open end of a fuse tube, said through bore terminating in a downwardly and forwardly open blast chute, said fixture having a laterally projecting arm provided with a cylindrical bore, a compression spring in said bore, a pair of parallel flanges carried by said arm and a fuse ejector lever pivotally mounted on said flanges, said ejector lever being provided with a groove at its end for passing a fuse tube leader and with an enlargement substantially at the axis of rotation about which the fuse tube leader is to be bent so that the fuse tube leader does not slide on said enlargement as the ejector lever rotates, and said fixture being provided with a threaded clamping member for clamping the end of the fuse tube leader.

10. A fuse tube unit comprising an elongated insulating tube provided with a metal contact fixture at each of its ends, the contact fixture at the upper end comprising a metal member having a bore for receiving said tube, and a removable cap for clamping one end of a fuse assembly, said latter fixture being provided with a pair of integral cylindrical trunnions aligned with each other and projecting laterally from each side of said latter fixture, and a lower contact fixture comprising a metal member having a bore for said tube, said tube being open at its lower end, said lower contact fixture having a laterally projecting arm provided with a bore and with a pair of bearing flanges, a throw-out lever pivotally mounted between said bearing flanges, and resilient means in said bore for urging said throw out lever in such a direction as to draw a fuse out of said tube.

11. A fuse tube unit comprising an elongated insulating tube provided with a metal contact fixture at each of its ends, the contact fixture at the upper end comprising a metal member having a bore for receiving said tube, and a removable cap for clamping one end of a fuse assembly, said latter fixture being provided with a pair of integral cylindrical trunnions aligned with each other and projecting laterally from each side of said latter fixture, and a lower contact fixture comprising a metal member having a bore for said tube, said tube being open at its lower end, said lower contact fixture having a laterally projecting arm provided with a bore and with a pair of bearing flanges, a throw-out lever pivotally mounted between said bearing flanges, and resilient means in said bore for urging said throw-out lever in such a direction as to draw a fuse out of said tube, said laterally projecting arm being provided on each side with a pair of partially cylindrical bearing members, which face downwardly for engagement with trunnion members carried by another member for supporting the fuse tube unit.

12. A fuse tube unit comprising an elongated insulating tube provided with a metal contact fixture at each of its ends, the contact fixture at the upper end comprising a metal member having a bore for receiving said tube, and a removable cap for clamping one end of a fuse assembly, said latter fixture being provided with a pair of integral cylindrical trunnions aligned with each other and projecting laterally from each side of said latter fixture, and a lower contact fixture comprising a metal member having a bore for said tube, said tube being open at its lower end, said lower contact fixture having a laterally projecting arm provided with a bore and with a pair of bearing flanges, a throw-out lever pivotally mounted between said bearing flanges, and resilient means in said bore for urging said throw-out lever in such a direction as to draw a fuse out of said tube, said laterally projecting arm being provided on each side with a pair of partially cylindrical bearing members, which face downwardly for engagement with trunnion members carried by another member for supporting the fuse tube unit, said throw-out lever being provided with a rearwardly pointed anvil on each side for engaging below said partially cylindrical bearings to lift the fuse tube unit off said latter member when the said throw-out lever withdraws a fuse.

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