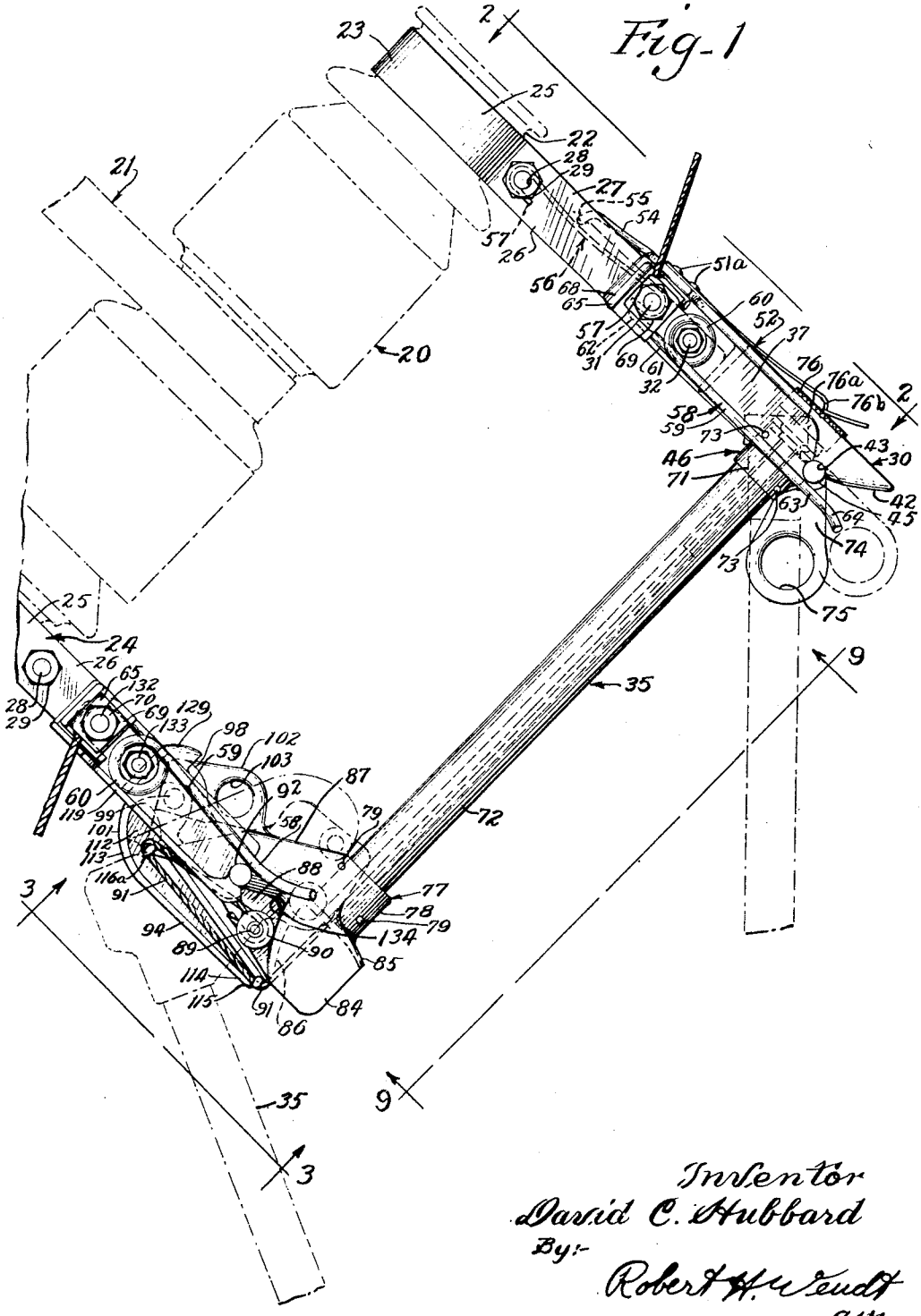
April 3, 1951 D. C. HUBBARD 2,547,160

FUSED DROPOUT CUTOUT

Filed May 6, 1949 4 Sheets-Sheet 1

Fig. 1



Inventor
David C. Hubbard
By:-
Robert H. Freudt
Atty.

April 3, 1951 D. C. HUBBARD 2,547,160

FUSED DROPOUT CUTOUT

Filed May 6, 1949 4 Sheets-Sheet 2

Fig-2

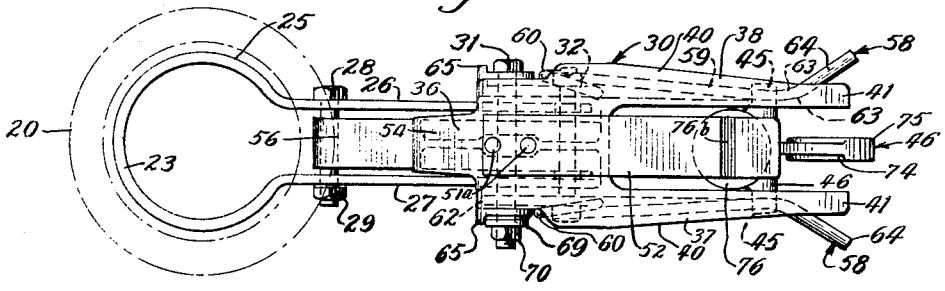


Fig-3

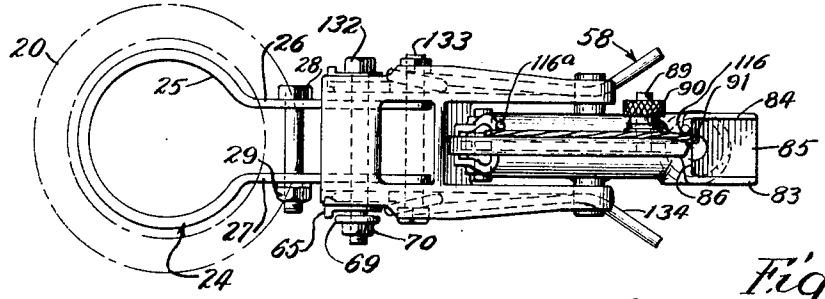


Fig-6

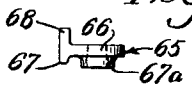
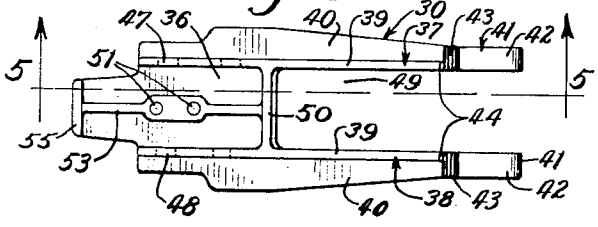


Fig-4



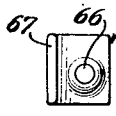


Fig-7

Fig-5

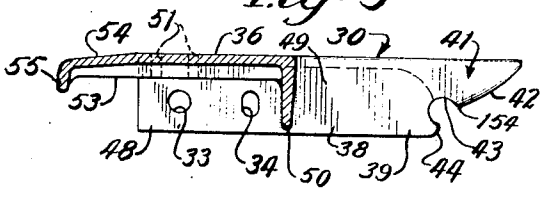
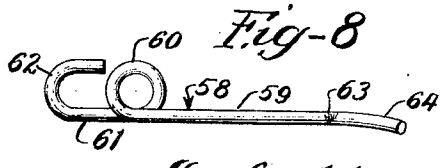


Fig-8



Inventor
David C. Hubbard
By:-
Robert H. Teuelt
Atty.

April 3, 1951 D. C. HUBBARD 2,547,160

FUSED DROPOUT CUTOUT

Filed May 6, 1949 4 Sheets-Sheet 3

Fig-9

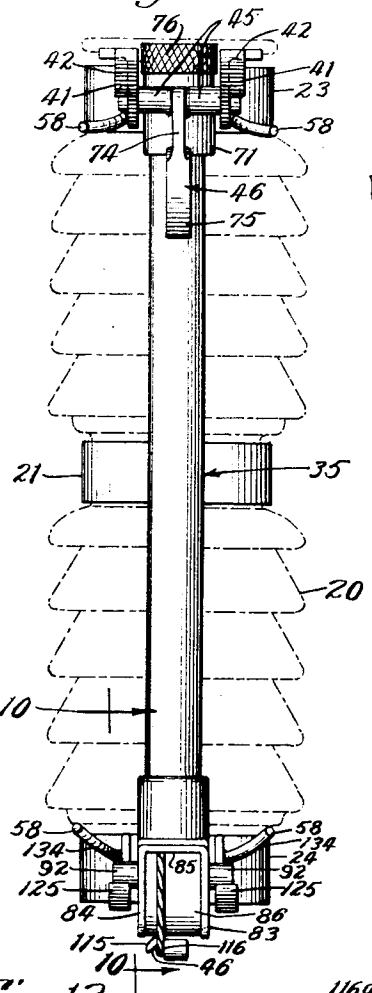


Fig-10

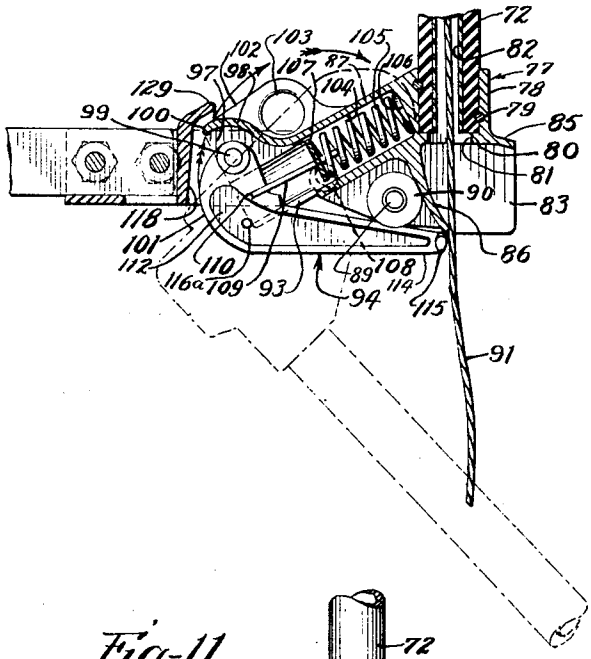


Fig-11

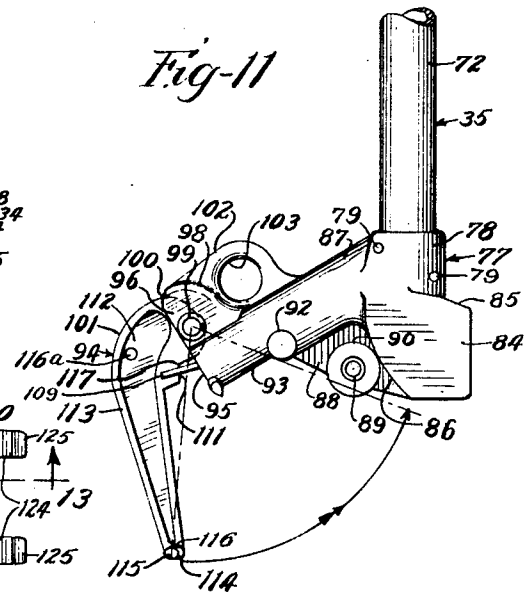


Fig-12

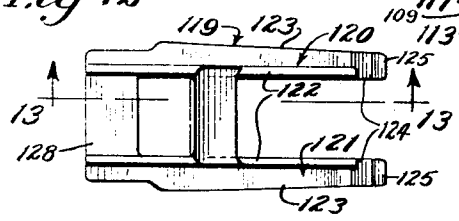
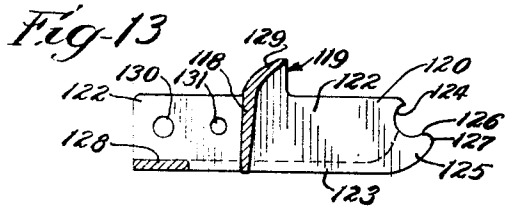


Fig-13



Inventor
David C. Hubbard
By: Robert H. Wendt
Atty.

April 3, 1951 D. C. HUBBARD 2,547,160

FUSED DROPOUT CUTOUT

Filed May 6, 1949 4 Sheets-Sheet 4

Fig-14

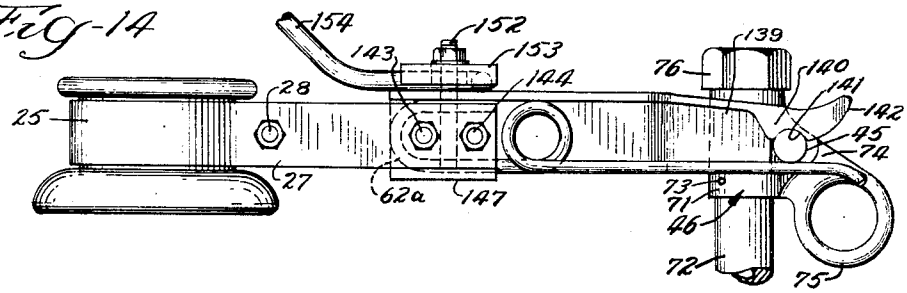


Fig-15

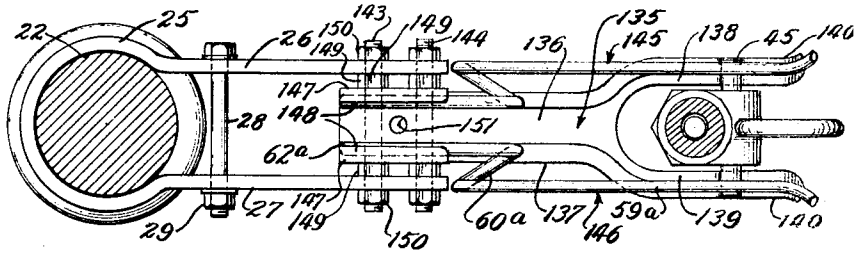
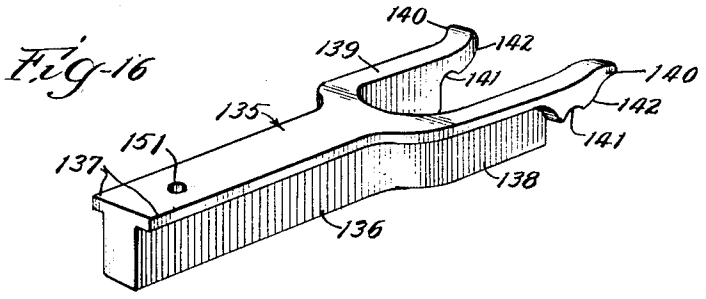


Fig-16



Inventor
David C. Hubbard
By:-
Robert H. Freudt
Atty.

Patented Apr. 3, 1951

2,547,160

UNITED STATES PATENT OFFICE

2,547,160

FUSED DROPOUT CUTOUT

David C. Hubbard, Centralia, Mo., assignor to A. B. Chance Company, Centralia, Mo., a corporation of Missouri

Application May 6, 1949, Serial No. 91,777

19 Claims. (Cl. 200—114)

1

The present invention relates to fused drop-out cut-outs, and is particularly concerned with the provision of an improved cut-out having the following advantages.

1. The cut-out is adapted to use standard universal fuse links of any manufacture, according to conventional practice.

2. The cut-out is so constructed that it is pivoted at the upper end of the fuse unit, and the lower fuse tube contact is ejected from the bottom contact arm upon rupture of the fuse link so that the fuse tube will hang with its opening downward after operation, thus protecting the interior of the fuse tube from all adverse weather conditions.

3. The actual physical parting of the lower contacts due to fuse link rupture, is delayed until after the arc has been extinguished within the fuse tube, thus preventing the arcing between the contacts.

4. The delaying of the actual parting of the lower contacts is accomplished by the following features:

(*a*) Requiring the ejector arm to travel eighty to ninety degrees before unlatching the lower contact.

(*b*) Providing a limited wiping contact after unlatching to delay the travel of the lower fuse tube contact out of engagement.

(*c*) Using the jet action from the opening at the lower end of the fuse tube to react with the top trunnion to produce a torque that tends to hold the lower end of the fuse tube in engagement with its contact during the blast and therefore during the arcing period.

5. The cut-out is provided with an ejector arm which pulls the fuse link from the fuse tube, even though rupturing currents are too light to generate sufficient gases within the fiber tube to eject the link rapidly, thus providing a quick circuit break on light currents.

6. The present cut-out may be used as a disconnect because it is also pivoted at the lower contacts, and the upper contacts may be pulled apart while it pivots on its lower contacts to a downwardly hanging position, indicating it has been manually disengaged.

7. Re-fusing and manipulating the fuse tube unit is accomplished according to conventional practice in re-fusing similar types of cut-outs, since the fuse tube hangs from a disconnect stick and is first connected to the lower contact and then pivoted upward to engage the top contact.

8. The present cut-out is "trip free" because after it has been re-fused and has its lower contacts connected, the lower end of the fuse unit is ready to be ejected if the fault still exists when the upper end is swung up into engagement with the top contact arm.

2

9. The fuse tube unit has a blast chute which offers a limited but effective protection to the operator in the event a short circuit still exists, as the blast chute directs the molten elements and force of the blast away from the face of the operator.

10. The mechanisms of the cut-out are so constructed that they are unaffected by ice accumulations, or are adequately protected from such accumulations as may occur.

11. Visual inspection of the cut-out device in open position indicates whether the device was operated automatically, indicating the existence of a fault, when the lower contacts are separated; and it indicates whether the device was opened manually, indicating the purposeful de-energization of the circuit for repairs or other reasons, when the upper contacts have been separated, these two operations involving the opposite ends of the fuse unit.

12. The cut-out has firm stops for arresting skyrocketing, which may be due to the jet action from the open end of the tube, so that the contact springs will not be overstressed.

13. Three points of contact are assured at the top and at the bottom support, regardless of the casting alignment, thus assuring good electrical contact with two wire springs, and at least one side of the casting.

14. The cut-out is provided with a biasing spring which provides contact pressure in addition to the clip pressure, and also serves as a buffer to absorb a portion of the shock resulting from jet action on heavy short circuits.

15. Wiping contact on all the springs and trunnions keeps them in clean condition; and all closing stresses on fragile fuse elements have been eliminated, since no external force of any kind is applied to the ejector arm during the placing of the fuse tube unit.

16. The blast chute tends to divert the high blasts of ionized gas which might otherwise mushroom back toward the lower contact support, where they might otherwise establish an arc across the supporting insulator.

Other objects and advantages of the invention 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 drawings, of which there are four sheets,

Fig. 1 is a side elevational view of a fused drop-out cut-out embodying my invention;

Fig. 2 is a top plan view, taken on the plane of the line 2—2 of Fig. 1, looking in the direction of the arrows;

Fig. 3 is a bottom plan view, taken on the plane of the line 3—3 of Fig. 1, looking in the direction of the arrows;

Fig. 4 is a bottom plan view of the contact housing;

Fig. 5 is a side elevational view of the contact housing, taken on the plane of the line 5—5 of Fig. 4, looking in the direction of the arrows;

Fig. 6 is a side elevational view of the spring retaining washer;

Fig. 7 is a plan view of said washer;

Fig. 8 is a side elevational view of one of the contact springs;

Fig. 9 is a front elevational view of the fuse tube unit, taken on the plane of the line 9—9 of Fig. 1, looking in the direction of the arrows;

Fig. 10 is a fragmentary sectional view, taken on the plane of the line 10—10 of Fig. 9, looking in the direction of the arrows;

Fig. 11 is a fragmentary elevational view of the fuse tube unit, showing the position of its ejector arm after the fuse has been ruptured and ejected;

Fig. 12 is a top plan view of the lower contact bracket;

Fig. 13 is a sectional view of said bracket, taken on the plane of the line 13—13 of Fig. 12, looking in the direction of the arrows;

Fig. 14 is a fragmentary side elevational view of a modification;

Fig. 15 is a fragmentary bottom plan view of said modification;

Fig. 16 is a view in perspective of the contact housing of this modification.

Referring to Figs. 1 to 3, 20 indicates an insulator, which is mounted by means of a bracket 21 upon a cross arm or other support at an angle, as shown. The present devices may be mounted upon a single insulator or upon a pair of insulators, the latter type of mounting being shown in my prior application on fused drop-out cut-outs, Ser. No. 11,076, filed February 26, 1948.

In the embodiment selected to illustrate the invention, a single insulator 20 is used; and it is provided with end portions 22 of reduced diameter for receiving a clamping metal band 23 at the top of the insulator and another clamping band 24 at the bottom.

The clamping bands 23 and 24 are each provided with the partially cylindrical portion 25, which extends about the reduced cylindrical part 22 of the insulator and carries a pair of attaching flanges 26, 27. These attaching flanges are clamped together close to the insulator by a through bolt 28, which passes through apertures in the attaching flanges 26, 27 and is provided with a nut 29 for drawing the clamping band tightly about the insulator.

The attaching flanges 26, 27 extend parallel to each other toward the right in Fig. 2, where they are secured to the contact housing 30 by a pair of screw bolts 31, 32 passing through registering apertures in the attaching flanges 26, 27 and in the contact housing (Fig. 5), as indicated at 33, 34.

The aperture 34 in the contact housing is preferably oval, being elongated in a direction transverse to the major axis of the housing 30 so that the contact housing may pivot on the bolt 31, due to the clearance provided around the bolt 32 by the oval opening 34.

This permits automatic adjustment of the upper contact to compensate for differences in length of the fuse tube units 35 (Fig. 1), which may be caused by ordinary methods of manufacture.

The contact housing 30 may consist of a metal casting having a substantially flat upper body 36 and a pair of forwardly extending parallel legs 37, 38. The legs 37, 38 are preferably angular in cross section, having a vertical flange 39 and an upper horizontal flange 40 in each case.

The upper horizontal flange 40 merges into a deeper and thicker end portion 41, which has a diagonally extending camming surface 42 leading to a partially cylindrical transverse groove 43. The groove 43 is bordered on its lower side (Fig. 5) with a longitudinally projecting lug 44.

The grooves 43 are of suitable size to provide a recess for receiving the cylindrical trunnions 45 carried by the upper contact fitting 46 of the fuse tube unit 35 (Fig. 1).

The camming surface 42 engages the top and advancing side of the trunnion 45 so that the contact housing 30 may pivot upward on bolt 31 to permit the trunnion to enter the groove 43, due to the camming action of the trunnion 45 on the surface 42.

The horizontal flanges 40 of the contact housing 30 merge into the upper flat body 36, which also has a pair of depending vertical flanges 47, 48; and the space 49 between the legs 37, 38 is bounded at its base by a depending flange 50. The upper flat body 36 has a pair of axially located apertures 51 for attachment of a spring 52, further to be described, and shown in Fig. 1. These are formed in a depending enlargement of a depending reinforcing rib 53. The flat body 36 extends backwardly beyond the ribs 47, 48, having a tail portion 54 with a depending spring engaging end 55, that is, transverse to the tail portion 54.

The spring engaging end 55 engages a spring 56, preferably a leaf spring, which is carried by bolts 28 and 31, as shown in Fig. 1. The leaf spring 56 has an initial tension in an upward direction to urge the contact housing 30 in a clockwise direction about the bolt 31.

The spring 56 has a U-shaped end portion 57 at each end, for extending about the bolts 28 and 31, and by means of which it is retained on the bolts.

The contact housing 30 also carries a pair of contact springs 58, shown in Fig. 8, constructed of resilient wire. The springs 58 have a straight portion 59, which terminates in a single spiral loop 60 for receiving the screw bolt 32. The spring continues with a short straight portion 61 and a U-shaped end portion 62, which is of sufficient size and in proper location to extend about the bolt 31.

At its forward end the straight portions 59 have an easy curvature at 63 and have diagonally outwardly extending portions 64. The straight portion 59 extends diagonally inward from its point of attachment to the bolt 32, which passes through the loop 60; and the straight portion 59 is located immediately below the groove 43 in each case, being substantially parallel to the thickened portion 41 at that point.

The outwardly flaring diagonal portions 64 serve to engage and guide the upper contact fitting 46 of the fuse tube unit 35 into a position be-

tween the legs 37, 38 of the contact housing 30 and between two of the springs 58. The same bolts 31 and 32 which secure the contact housing to the attaching flanges 26, 27, clamp the springs 58 against the side of the contact housing at the flanges 47, 48.

Springs 58 also have an initial tension, tending to close toward the grooves 43 of the contact housing so that the springs 58 must be spread away from the grooved portions 43, to permit the trunnions 45 to enter the grooves 43.

The bolt 31 preferably supports a special washer plate 65 (Figs. 6, Fig. 7), which comprises a rectangular metal member having a through bore 66 for the bolt and having a tubular lug 67a for receiving the hook formation 62 of the spring 58.

In addition to the tubular formation, this plate supports a rib 67 on the same side as the tubular formation for engaging outside of the hook 62 of the spring; and it preferably has a connector flange 68 on the opposite side of the plate for use in securing a conductor, such as a tap wire.

The conductor goes in between the washer 69 and the plate 65, and is secured by the nut 70, thus providing an electrical connection to the upper contact arm, contact housing 30, and to the springs 58. The headed end of the bolt 31 preferably supports a similar washer plate 65; and both the springs and the contact housing are in good electrical conducting relation to the tap wire.

The fuse tube unit 35 is provided at its upper end with a contact fixture 46, comprising a tubular body 71 for receiving the insulating tube 72, which may be secured in place by a plurality of transverse riveted pins 73, preferably so located that they are received in grooves in the side of the insulating tube 72, while passing completely through the tubular member 71.

The tubular member 71 has a laterally extending flange 74, which is provided with a ring 75 for engagement with a clamp stick or with the laterally projecting lug on the end of a disconnect stick. The hole in the ring 75 is large enough to pass the head on the lug of the disconnect stick.

The contact fixture 46 is provided at its right side in Fig. 2 with a pair of cylindrical trunnions 45, these trunnions forming an integral part of the tubular member 71 and flange 74, and projecting oppositely and axially with respect to each other. The contact fixture 46 is so constructed that the screw cap 76, which may be threaded into the tubular member 71, secures the button that is usually carried by the upper end of the fuse cable.

The top of the cap 76 is flat, thus providing an outer corner 76a, Fig. 1, which engages a complementary latching shoulder 76b on spring 52. Spring 52 is a leaf spring having one end secured to the contact housing at holes 51 by rivets 51a, and it extends above the groove between the legs 37, 38 and is tensioned downward against the end of the fuse unit 35.

When the fuse unit swings from the full line position of Fig. 1 to the dotted line position, spring 52 latches the fuse unit in the dotted line position, preventing it from swinging in the wind.

At its lower end the fuse tube unit carries a lower contact fixture 77, comprising a cast metal body formed with a tubular portion 78 having a bore for receiving the insulating tube 72, which is open at its lower end. The tube is again secured in place by a plurality of pins or rivets 79. Below the insulating tube 72 the contact fixture 77 is formed with a partition wall 80 (Fig. 10), against which the end of the tube abuts. This wall has a through bore 81 as large or larger than the bore 82 in the insulating tube. Below the partition wall 80 the fixture 77 is formed with a blast chute. This blast chute includes flat side walls 83, 84, a top wall 85, and a rear wall 86.

The top wall 85 may extend outwardly and slightly downwardly. The side walls 83, 84 may be flat and parallel, both extending downwardly. The rear wall 86 preferably curves toward the right, and terminates with its lower edge approximately at the axis of the tube 72 so that the cable may clear the rear wall 86, while still being located in the axis of the tube 72.

The blast chute, comprising the walls 83–86, directs the explosive discharge, which comes out of the lower end of the fuse tube, away from the face of the operator, who is usually toward the left, in Fig. 10, with respect to this blast chute.

The lower contact fixture 77 has an integral tubular spring housing 87, which extends diagonally downward, toward the left, in Fig. 11. This is joined to the rear wall 81 of the blast chute by a reinforcing flange 88, which may carry a threaded lug 89 and a nut 90 for clamping the end of the fuse cable 91 (Fig. 10).

The tubular spring housing 87 supports a pair of integral laterally projecting trunnions 92, which are cylindrical and located on the same axis on the opposite sides of the fixture 77. The trunnions are located laterally with respect to the tube 72; and thus, when the jet action of the escaping gases from the bottom of the tube 72 reacts upon the fuse tube unit, the trunnions 92 are urged upward, which is resisted by suitable stops, further to be described; and the top end of the fuse tube unit is urged in a counterclockwise direction, to maintain its engagement with the upper contact housing 30 and contact springs 58.

The tubular spring housing 87 is provided with a lower slot 93 to the left of the trunnions 92 for permitting a wider range of movement of the ejector lever 94. At its upper side the spring housing 87 is again slotted adjacent its left end 95 and provided with a pair of upwardly extending flat walls 96, 97 joined by a curved yoke 98.

These integral parts of the lower fixture 77 are for the purpose of pivotally supporting the ejector lever 94, which is pivoted upon a through pin or rivet 99 passing through the flanges 96, 97.

The extreme end of the yoke 98 at the point 100 serves as a stop for engaging the curved end portion 101 of the ejector lever, limiting its clockwise rotation. The yoke 98, which joins the pivot flanges 96, 97, is also integrally joined to a reinforcing flange 102, extending over toward and joining with the spring housing 87.

This reinforcing flange has a relatively large through bore 103, forming another lifting ring for engagement with a clamp stick or disconnect stick.

The spring housing 87 has a cylindrical bore 104 for receiving the helical compression spring 105. This spring is seated at its right end against the base 106 of the bore 104. At its other end it bears against a washer 107, which has a slot or aperture 108 for receiving the end of a strut 109.

The strut 109 has a smaller portion to go in the aperture 108 and a shoulder resting against the washer 107, by which it is permitted a limited amount of pivotal movement. At its other end, 110, it has a longitudinal slot separating two legs; and the slot receives the flanged portion 111 (Fig. 11) of the ejector lever.

The spring has an initial compression so that it constantly urges the ejector lever 94 toward the position of Fig. 11. The ejector lever 94 may comprise a cast metal member of generally triangular shape provided with a central flat web 112 surrounded by a border flange 113, which projects from both sides of the web 112.

The ejector lever 94 is generally triangular, tapering toward its free end 114, where it is provided with a laterally projecting hook 115, having a groove 116 on its lower side for receiving the leader cable 91. The leader cable 91, which depends from the fuse in the tube 72, goes out the lower end of the tube and blast chute, passes over the end of the ejector lever 94 in the groove 116 of hook 115. From groove 116, the cable passes about a pin 116a located as close as possible to the pivot of the ejector lever, and is then wrapped around the threaded member 89 and clamped by the nut 90 with the ejector lever in the position of Fig. 10, where it is compressing the spring and located at its uppermost position.

The upper end of the ejector lever has a curved surface 101 of gradually increasing curvature, this curved end extending about the aperture for the pivot pin 99, and terminating at 117, adjacent the flat portion 111 that is engaged by the spring strut 109.

The ejector lever 94 is thus always ready to pull the cable out of the tube when the tube has been re-fused, as shown in Fig. 1. Even when the fault is caused by a relatively low current, which melts the fuse slowly and does not provide sufficient blast to eject the cable, the cable ejector lever will pull the cable out quickly, breaking the circuit inside the tube 72, before the circuit is broken mechanically by the lower contact fixture outside of the tube.

The curved surface 101 of the ejector lever also serves as a camming surface for engaging the back wall 118 of the lower contact housing 119 to cam the fuse tube unit away from the lower contact housing 119, as will be further described.

Referring now to Figs. 12 and 13, these are views of the top and of a section of the lower contact housing 119. This lower contact housing may consist of a metal casting, which has a pair of legs 120, 121, each of which has a thin vertical flange 122 and a laterally projecting horizontal reinforcing flange 123.

These flanges extend from end to end of the lower contact housing 119, except that the vertical flange 122 terminates at the forward trunnion groove 124. This trunnion groove is substantially half cylindrical and also extends into a thickened portion 125 of the horizontal flange 123 so that the groove 124 will extend under the trunnion and toward the left of the trunnion in Fig. 13.

When the contact housing 119 is disposed at an angle, as shown in Fig. 1, the corner 126 of the trunnion groove or bearing 124 extends upwardly into the path of the trunnion as the trunnion goes into or out of the groove 124. In other words, the angular installation of the fused cutout places the contact housing 119 in such position that the corner 126 forms only a slight obstruction to the movement of the lower trunnions 92.

The groove 124 forms a bearing for the trunnion 92 on its lower side and back side of the trunnion 92; and the corner 126 provides a latching shoulder to hold the trunnion in place; but the trunnion can be cammed over the latching shoulder 126, if force is exerted, to push the fuse tube unit toward the right, away from the contact housing 119.

The extreme right end 127 of the contact housing 119 is preferably rounded to act in the manner of a cam, to urge the trunnion 92 upward when it is struck by the trunnion 92.

The two legs 120 and 121 of the contact housing 119 are joined by the back wall or partition 118, previously mentioned, and by a bottom yoke 128. The partition or back wall 118 extends upward and curves toward the right at 129. It is thus located to be engaged by the curved camming surface 101 on the ejector lever 94, while the upper curved part 129 overhangs the yoke 98.

The part 129 serves as a stop, preventing the lower contact fixture from moving upward when the jet action occurs out of the lower end of the tube 72. This stop prevents the jet action from overstressing the contact springs.

The vertical flanges 122 are provided with a pair of apertures 130, 131 for receiving the screw bolts 132, 133 (Fig. 3), which are provided with similar washer plates 65, washers 69, and nuts 70. Thus the bolt 132 may pass through the attaching flanges 26, 27 of the lower clamping band 24 and through the contact housing 30; and may also serve as a connector to secure a tap wire or other lead by means of which electrical current is conducted to or from the cutout.

These bolts also support the lower contact springs 58, which are identical in shape to those previously described; but are inverted in position. Thus the contact springs 58 of the bottom contact housing 30 have the loop 60 turned downwardly, the straight portion 59 running along the upper part of the contact housing on either side of the vertical flanges 122.

The contact springs are again given initial tension toward the trunnion 92 and toward the groove 124 so that they tend to close the groove; and the contact spring is cammed upwardly by the trunnion 92, which engages the upwardly curving end portion 134.

Besides curving upwardly, the contact springs spread laterally at the portion 134, providing a wider opening, into which the lower contact fixture is to be inserted, the spreading portion 134 guiding the lower contact fixture into position. During this movement the tubular spring housing 87 passes between the legs 120, 121.

Referring to Figs. 14 and 15, these show modifications of the upper contact housing and connector. In this case the upper contact housing 135 has a substantially T-shaped shank 136, the main body of which is rectangular in cross section and provided at its top with laterally projecting reinforcing ribs 137.

The body 136 supports a pair of legs 138, 139, also T-shaped in cross section; but the top flange becomes thicker at the end portion 140, where it has the downwardly open trunnion groove 141. To the right of this trunnion groove there is a curved camming portion 142, to be engaged by the trunnion so that the trunnion will be cammed downward until it rides over into the groove 141.

The clamping band 25 in this case has its attaching flanges 26, 27 at a greater spread; but they are again secured by a through bolt 28 and have apertures for passing the two securing bolts 143, 144.

The wire spring contacts 145, 146 may be similar in shape to those previously described, ex-

cept that the single turn 60*a* has its coils spread apart far enough so that the straight portion 59*a* extends under the grooves 141, while the hook 62*a* is disposed inwardly in a plane so that it can engage the side of the rectangular shank body 136.

The ends of the spring contacts 145, 146 are clamped under plates 147, which have embracing flanges 148 above and below the hook 62*a*, where the plates are clamped by extra nuts 149. The attaching flanges 26, 27 are on the same bolts outside of these nuts, where they are secured by additional nuts 150.

The shank 136 of the contact housing 135 in this case has a vertical hole 151 for passing the screw bolt 152, which also goes through a U-shaped connector plate 153. The conductor or tap-off wire 154 has its end formed into a hook or loop, passing about the bolt 152 inside the flanges of the connector plate 153 by means of which it is tightly clamped to the horizontal flange 137 of the contact housing 135.

All of the other details of the construction of the fuse unit or contacts may be the same as previously described.

The operation of the present fused cut-out is as follows. When the fuse tube unit has been provided with a new fuse, installed as shown in Fig. 1, the fuse tube unit is then hung by means of its lower ring 103 on the laterally projecting lug of a disconnect stick. It then hangs down like the lower dotted line position of Fig. 1, and may be moved over until its trunnions 92 engage below the curved surfaces 134 of the lower contact springs 59.

The fuse tube unit may be moved toward the lower contact housing until its trunnion 92 enters into the lower grooves 124, camming over the corner 126, where the trunnions are retained by the downward spring pressure of the springs 59.

The disconnect stick has its lug then removed from the ring 103 and placed in the upper ring 75, which is now hanging downward. The disconnect stick is then so manipulated that the fuse tube unit 35 will pivot clockwise in Fig. 1 on the lower trunnions 92 from the lower dotted line position to the full line position.

As the fuse tube unit has its upper end approaching the upper contact housing 30, the trunnion 45 will engage the camming surface 42 and cause this contact housing to be cammed upupwardly, the tail end 55 flexing the spring 56 as the upper contact housing pivots on the bolt 132. Thus provision has been made for fuse tube units in which the trunnions 92 and 45 may be at greater or less spacing, due to the inaccuracies of manufacture.

When the upper trunnion 45 passes into the groove 43, it is retained there by the corner 154 (Fig. 5) and by the upper contact spring 58, which holds the trunnion in its groove.

The present cut-out may be used as an ordinary disconnect by merely placing a disconnect stick in the upper ring 75 and pulling the upper trunnions 45 out of the groove 43. Then the fuse tube unit 35 will swing on the lower trunnions 92 to the lower dotted line position. When the fuse tube unit is in this position, it indcates the purposeful disconnection which might be for the purpose of repairs, or inspection, or any other reason.

When a fault occurs on the line of sufficient magnitude to melt the fuse, the cable leaders are parted at the fuse; and the lower leader, which is tensioned by the ejector lever spring 105, is pulled out of the tube 72 by the ejector lever 94. This ejector lever is held in its tensioned position of Fig. 1 by the cable and fuse; and upon rupture of the fuse the ejector lever pivots clockwise from the position of Fig. 1 to that of Fig. 11.

In addition to pullting out the fuse leader, the ejector lever has its curved camming surface 101 engaging the back wall 118 of the lower contact housing. As the ejector lever pivots down to the position of Fig. 11, surface 101 forces the lower end of the fuse tube unit toward the right; and the trunnions 92 are forced toward the right, out of the grooves 124, until they are free of the lower contact arm.

Then the fuse tube unit 35 pivots counterclockwise in Fig. 1 on the upper trunnions 45 until it is in the upper dotted line position. When the fuse tube unit hangs down from its upper contact arm, this is an indication that the circuit has been ruptured, due to a fault.

It should also be noted that as the fuse tube unit is swung into place at its upper end the lower end is always free to be ejected, if a fault should occur, or if the fault should still exist.

Thus the cut-out is "trip free" at its lower end, even while being installed at its upper end.

It will thus be observed that I have invented an improved drop-out cut-out which assures the extinguishment of the arc before the actual parting of the lower contacts; and this is brought about by increased travel of the ejector arm, wiping contact to delay the opening movement and keep the contacts clean, and by causing the jet action to hold the contacts in engagement with each other until the blast and the arcing period have terminated.

The present cut-out may be used both as a manual disconnect and for the automatic opening of the circuit on existence of faults; but in either case the position of the fuse tube unit, after opening of the circuit, indicates whether it has been opened manually or automatically.

The present device is "trip free," since the automatic opening may occur at the bottom, if the fault still exists, even while the operator is closing the top; and the blast chute diverts the major force of the blast away from the operator.

Better contact is assured over the devices of the prior art, regardless of casting alignment; and all closing stress on the fragile fuse elements has been substantially eliminated.

It is an additional advantage that the present cut-out utilizes standard fuse links made by many manufacturers; and in its installation it is handled in the same manner as is conventional with many devices of different construction, thus eliminating the necessity for learning any new technique.

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

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

1. In a fused drop-out cut-out, the combination of an insulating support with a pair of rigid contact arms carried by said support in spaced relation to each other, the said contact arms being provided at their ends with partially cylindrical grooves for engagement with contact trun-

nions carried by a fuse tube unit, the said partially cylindrical grooves being open on the side toward each other, and the contact arms having their grooves located to engage those parts of the trunnions which are outermost with respect to the fused tube, a fuse tube unit comprising an insulating tube for receiving a fuse, and upper and lower contact fixtures carried by said tube and bearing trunnions on each fixture, one of said contact arms having a pivotal mounting with a limited pivotal movement, to permit a spread of the contact arms relative to each other, and resilient means carried by said contact arm, for urging the same in a pivotal direction toward the other contact arm so that provision is made for receiving the trunnions of fuse tube units of different relative spacings which may occur due to inaccuracies of manufacture, the said resilient means comprising a leaf spring supported at both of its ends and engaged between its ends by a part of the pivotally mounted contact arm.

2. In a fuse tube assembly for a fused drop-out cut-out, the combination of an insulating support with a pair of outwardly extending contact arms carried by said support, and having partial bearings for receiving trunnions opposing each other, an insulating tube with a contact fixture at its upper end and a contact fixture at its lower end, the said upper contact fixture comprising a body having a bore for receiving the insulating tube, and having a pair of oppositely extending trunnions carried by said body outwardly of the body with respect to the location of the tube so that jet action occurring from the bottom of the tube will tend to cause the tube to pivot on said outwardly located trunnions in such manner as to keep the lower contact fixture in engagement with another contact arm.

3. In a fuse tube assembly for a fused drop-out cut-out, the combination of an insulating support with a pair of outwardly extending contact arms carried by said support, and having partial bearings for receiving trunnions opposing each other, an insulating tube with a contact fixture at its upper end and a contact fixture at its lower end, the said upper contact fixture comprising a body having a bore for receiving the insulating tube, and having a pair of oppositely extending trunnions carried by said body outwardly of the body with respect to the location of the tube so that jet action occurring from the bottom of the tube will tend to cause the tube to pivot on said outwardly located trunnions in such manner as to keep the lower contact fixture in engagement with another contact arm, the said upper contact fixture also having a laterally and outwardly extending flange carrying a ring for engagement with a disconnect stick or the like.

4. In a contact arm structure for a fused drop-out cut-out, the combination of an insulator with a clamping band embracing said insulator, said band having a pair of attaching flanges, and means to draw said flanges together to clamp said band on said insulator, with a contact housing member comprising a metal member having a body provided with a pair of apertures, and threaded members passing through said apertures and attaching flanges to secure the contact housing to said clamping band and insulator, said contact housing having a pair of forwardly extending parallel legs, and each leg being provided with a partially cylindrical groove for engagement with the trunnion of a fuse tube unit, when the fuse tube unit is located between said legs, the said threaded members also supporting on each side of said contact housing a resilient spring, each of said springs having a curved portion for engagement about each of said threaded members, and having a forwardly projecting portion which extends over and beyond said groove in position so that the forwardly extending portions of said springs are spread from the grooves by the trunnions of the fuse tube unit as the trunnions move into said groove, where they are held by said springs.

5. In a contact arm structure for a fused drop-out cut-out, the combination of an insulator with a clamping band embracing said insulator, said band having a pair of attaching flanges, and means to draw said flanges together to clamp said band on said insulator, with a contact housing member comprising a metal member having a body provided with a pair of apertures, and threaded members passing through said apertures and attaching flanges to secure the contact housing to said clamping band and insulator, said contact housing having a pair of forwardly extending parallel legs, and each leg being provided with a partially cylindrical groove for engagement with the trunnion of a fuse tube unit, when the fuse tube unit is located between said legs, the said threaded members also supporting on each side of said contact housing a resilient spring, each of said springs having a curved portion for engagement about each of said threaded members, and having a forwardly projecting portion which extends over and beyond said groove in position so that the forwardly extending portions of said springs are spread from the grooves by the trunnions of the fuse tube unit as the trunnions move into said groove, where they are held by said springs, the said springs being bent outwardly and away from the contact housing forwardly of said groove, and the said contact housing having an outwardly flaring guide surface for guiding the trunnions into said groove and guiding the fuse tube unit between said legs.

6. In a contact arm structure for a fused drop-out cut-out, the combination of an insulator with a clamping band embracing said insulator, said band having a pair of attaching flanges, and means to draw said flanges together to clamp said band on said insulator, with a contact housing member comprising a metal member having a body provided with a pair of apertures, and threaded members passing through said apertures and attaching flanges to secure the contact housing to said clamping band and insulator, said contact housing having a pair of forwardly extending parallel legs, and each leg being provided with a partially cylindrical groove for engagement with the trunnion of a fuse tube unit, when the fuse tube unit is located between said legs, the said threaded members also supporting on each side of said contact housing a resilient spring, each of said springs having a curved portion for engagement about each of said threaded members, and having a forwardly projecting portion which extends over and beyond said groove in position so that the forwardly extending portions of said springs are spread from the grooves by the trunnions of the fuse tube unit as the trunnions move into said groove, where they are held by said springs, one of said apertures for said threaded securing means being enlarged to permit a pivotal movement on the other securing member so that the contact housing and spring may be adjusted by pivotal move-

ment to engage the trunnions of fuse tube units of different lengths.

7. In a contact arm structure for a fused drop-out cut-out, the combination of an insulator with a clamping band embracing said insulator, said band having a pair of attaching flanges, and means to draw said flanges together to clamp said band on said insulator, with a contact housing member comprising a metal member having a body provided with a pair of apertures, and threaded members passing through said apertures and attaching flanges to secure the contact housing to said clamping band and insulator, said contact housing having a pair of forwardly extending parallel legs, and each leg being provided with a partially cylindrical groove for engagement with the trunnion of a fuse tube unit, when the fuse tube unit is located between said legs, the said threaded members also supporting on each side of said contact housing a resilient spring, each of said springs having a curved portion for engagement about each of said threaded members, and having a forwardly projecting portion which extends over and beyond said groove in position so that the forwardly extending portions of said springs are spread from the grooves by the trunnions of the fuse tube unit as the trunnions move into said groove, where they are held by said springs, one of said apertures for said threaded securing means being enlarged to permit a pivotal movement on the other securing member so that the contact housing and spring may be adjusted by pivotal movement to engage the trunnions of fuse tube units of different lengths, the said contact housing having a rearwardly extending tail, and resilient means carried by the first-mentioned means for drawing the attaching flanges together and by one of said threaded members, to be engaged by the said tail, for urging said contact housing in one direction of pivotal movement.

8. In a fused drop-out cut-out, a lower contact arrangement comprising a contact fixture carried by an insulating tube and a contact arm mounted upon an insulator, a contact housing secured to said contact arm, said contact housing having a pair of forwardly extending legs provided with an open slot between them, and said contact housing having a pair of partially cylindrical grooves, one in each leg for receiving a trunnion, said contact fixture being receivable in said open slot between said legs, and having a spring housing provided with a pair of oppositely extending trunnions to be received in said partially cylindrical grooves, said contact housing being provided with a rear wall which extends upwardly and over a part of the spring housing, to act as a stop, so that the lower contact fixture engages said stop upon the blowing of a fuse, due to the jet action of the gases escaping from said tube, the said contact housing being secured to said contact arm by a pair of threaded members, and said threaded members also supporting a pair of contact springs, each of said contact springs having a portion arranged around the threaded members, and having a forwardly extending portion extending across said grooves to hold the trunnions in said grooves.

9. In a fused drop-out cut-out, the combination of an insulating support with a pair of laterally projecting contact arms carried by said support, each of said contact arms being provided with forwardly open partially cylindrical grooves for receiving the upper and lower trunnions of a fuse tube unit, resilient means carried by each of said contact arms for removably holding the said trunnions in said grooves, one of said contact arms being mounted for a limited pivotal movement on said insulating support, the said contact arms and resilient means being flared outwardly to provide guides on either side of a tapered opening leading to said grooves, and a fuse tube unit provided at its upper and lower ends with contact fixtures, the said contact fixtures having laterally projecting trunnions, the said trunnions being guided into said tapered opening and into said grooves as the fuse tube unit is installed, and the said pivotally mounted contact arm moving to accommodate the spacing between the contact arms to the spacing between the upper and lower trunnions on the fuse tube unit.

10. In a fused drop-out cut-out, the combination of an insulating support with a pair of laterally projecting contact arms carried by said support, each of said contact arms being provided with forwardly open partially cylindrical grooves for receiving the upper and lower trunnions of a fuse tube unit, resilient means carried by each of said contact arms for removably holding the said trunnions in said grooves, one of said contact arms being mounted for a limited pivotal movement on said insulating support, the said contact arms and resilient means being flared outwardly to provide guides on either side of a tapered opening leading to said grooves, and a fuse tube unit provided at its upper and lower ends with contact fixtures, the said contact fixtures having laterally projecting trunnions, the said trunnions being guided into said tapered opening and into said grooves as the fuse tube unit is installed, and the said pivotally mounted contact arm moving to accommodate the spacing between the contact arms to the spacing between the upper and lower trunnions on the fuse tube unit, the said pivotally mounted contact arm being provided with spring biasing means for urging the grooved part of the contact arm toward the grooved part of the other contact arm, and the grooves of said contact arms extending outwardly slightly beyond the trunnions which they receive to form a retaining shoulder outwardly of the trunnions, over which the trunnions may be forced during installation or removal.

11. In a fused drop-out cut-out, the combination of an insulating support with a pair of rigid contact arms carried by said support in spaced relation to each other, the said contact arms being provided at their ends with partially cylindrical grooves opposing each other for opposing engagement with contact trunnions of complementary shape carried by a rigid fuse tube unit, the said rigid contact arms being secured by a pair of bolts to a clamping band carried by said insulating support, said clamping band having a pair of attaching flanges and said bolts passing through apertures in said contact arms and said atttaching flanges, one of said apertures being elongated about one bolt to permit a limited pivotal movement of the contact arm about the other bolt, a rigid fuse tube unit comprising an insulating tube for receiving a fuse, and upper and lower contact fixtures carried by said tube, and bearing laterally projecting trunnions for engagement with said contact arm, one of said contact arms having an extension extending beyond said attaching bolts, and resilient means engaging said extension to urge the contact arms toward each other for urging

the grooves of the contact arms into engagement with the trunnions to retain the trunnions.

12. In a fused drop-out cut-out, the combination of an insulating support with a pair of rigid contact arms carried by said support in spaced relation to each other, the said contact arms being provided at their ends with partially cylindrical grooves opposing each other for opposing engagement with contact trunnions of complementary shape carried by a rigid fuse tube unit, the said rigid contact arms being secured by a pair of bolts to a clamping band carried by said insulating support, said clamping band having a pair of attaching flanges and said bolts passing through apertures in said contact arms and said attaching flanges, one of said apertures being elongated about one bolt to permit a limited pivotal movement of the contact arm about the other bolt, a rigid fuse tube unit comprising an insulating tube for receiving a fuse, and upper and lower contact fixtures carried by said tube, and bearing laterally projecting trunnions for engagement with said contact arm, one of said contact arms having an extension extending beyond said attaching bolts, and resilient means engaging said extension to urge the contact arms toward each other for urging the grooves of the contact arms into engagement with the trunnions to retain the trunnions, the said fuse tube unit having its trunnions on its upper and lower contact fixtures extending oppositely from both sides, and the said contact arms being bifurcated to receive the contact fixture parts between the forks of the contact arms with the trunnions engaging grooves on both sides of the fuse tube unit.

13. In a fused drop-out cut-out, the combination of an insulating support with a pair of rigid contact arms carried by said support in spaced relation to each other, the said contact arms being provided at their ends with partially cylindrical grooves opposing each other for opposing engagement with contact trunnions of complementary shape carried by a rigid fuse tube unit, the said rigid contact arms being secured by a pair of bolts to a clamping band carried by said insulating support, said clamping band having a pair of attaching flanges and said bolts passing through apertures in said contact arms and said attaching flanges, one of said apertures being elongated about one bolt to permit a limited pivotal movement of the contact arm about the other bolt, a rigid fuse tube unit comprising an insulating tube for receiving a fuse, and upper and lower contact fixtures carried by said tube, and bearing laterally projecting trunnions for engagement with said contact arm, one of said contact arms having an extension extending beyond said attaching bolts, and resilient means engaging said extension to urge the contact arms toward each other for urging the grooves of the contact arms into engagement with the trunnions to retain the trunnions, said fuse tube unit being provided with a spring pressed fuse ejector lever pivotally mounted on the lower contact fixture and formed with a cam for engaging the contact arm between two spaced legs, the movement of the fuse ejector lever upon blowing of a fuse camming the lower trunnions out of their grooves to release the fuse tube unit at its lower end.

14. In a fused drop-out cut-out, the combination of an insulating support with a pair of rigid contact arms carried by said support in spaced relation to each other, the said contact arms being provided at their ends with partially cylindrical grooves opposing each other for opposing engagement with contact trunnions of complementary shape carried by a rigid fuse tube unit, the said rigid contact arms being secured by a pair of bolts to a clamping band carried by said insulating support, said clamping band having a pair of attaching flanges and said bolts passing through apertures in said contact arms and said attaching flanges, one of said apertures being elongated about one bolt to permit a limited pivotal movement of the contact arm about the other bolt, a rigid fuse tube unit comprising an insulating tube for receiving a fuse, and upper and lower contact fixtures carried by said tube, and bearing laterally projecting trunnions for engagement with said contact arm, one of said contact arms having an extension extending beyond said attaching bolts, and resilient means engaging said extension to urge the contact arms toward each other for urging the grooves of the contact arms into engagement with the trunnions to retain the trunnions, and a pair of contact springs, each spring being provided with looped portions for engagement about both of said bolts, and the spring having a forwardly extending portion resiliently engaging the adjacent trunnion and urging it into the groove in the contact arm.

15. In a fused drop-out cut-out, the combination of an insulating support with a pair of rigid contact arms carried by said support in spaced relation to each other, the said contact arms being provided at their ends with partially cylindrical grooves opposing each other for opposing engagement with contact trunnions of complementary shape carried by a rigid fuse tube unit, the said rigid contact arms being secured by a pair of bolts to a clamping band carried by said insulating support, said clamping band having a pair of attaching flanges and said bolts passing through apertures in said contact arms and said attaching flanges, one of said apertures being elongated about one bolt to permit a limited pivotal movement of the contact arm about the other bolt, a rigid fuse tube unit comprising an insulating tube for receiving a fuse, and upper and lower contact fixtures carried by said tube, and bearing laterally projecting trunnions for engagement with said contact arm, one of said contact arms having an extension extending beyond said attaching bolts, and resilient means engaging said extension to urge the contact arms toward each other for urging the grooves of the contact arms into engagement with the trunnions to retain the trunnions, and a pair of contact springs, each spring being provided with looped portions for engagement about both of said bolts, and the spring having a forwardly extending portion resiliently engaging the adjacent trunnion and urging it into the groove in the contact arm, the contact arm also supporting an upper leaf spring formed with a shoulder resting on the end of the fuse tube unit, the said shoulder hooking over the corner of the fuse tube unit when the fuse tube unit is released at the lower contact arm to hang vertically by gravity, to hold the fuse tube unit against swinging in that position.

16. In a contact arm structure for fuse tube units, the combination of an insulator with a partially cylindrical band extending about said insulator and having laterally projecting spaced attaching flanges, threaded means passing through said flanges adjacent the insulator for clamping the band on the insulator, said later-

ally projecting flanges being provided with a pair of holes in each flange, a contact arm comprising a metal member formed with a yoke and having two parallel outwardly extending legs, the said yoke carrying a pair of attaching flanges with apertures registering with the said holes, a pair of through bolts extending through the attaching flanges of the yoke and the attaching flanges of the band to secure the contact arm to the band, the legs of said contact arm being provided adjacent their ends with a partially cylindrical groove in each leg, the grooves facing toward the other end of the insulator, and a pair of spring retainers, each spring retainer comprising a wire having a pair of loops for looping about the latter bolts, the said wires extending outwardly along the legs of the contact arm and engaging the contact arm at the open side of said grooves, the legs of the contact arm having outwardly beveled surfaces extending away from the wires, outwardly of said grooves to guide a pair of trunnions into the grooves between the wires and the legs of the contact arm.

17. In a contact arm structure for fuse tube units, the combination of an insulator with a partially cylindrical band extending about said insulator and having laterally projecting spaced attaching flanges, threaded means passing through said flanges adjacent the insulator for clamping the band on the insulator, said laterally projecting flanges being provided with a pair of holes in each flange, a contact arm comprising a metal member formed with a yoke and having two parallel outwardly extending legs, the said yoke carrying a pair of attaching flanges with apertures registering with the said holes, a pair of through bolts extending through the attaching flanges of the yoke and the attaching flanges of the band to secure the contact arm to the band, the legs of said contact arm being provided adjacent their ends with a partially cylindrical groove in each leg, the grooves facing toward the other end of the insulator, and a pair of spring retainers, each spring retainer comprising a wire having a pair of loops for looping about the latter bolts, the said wires extending outwardly along the legs of the contact arm and engaging the contact arm at the open side of said grooves, the legs of the contact arm having outwardly beveled surfaces extending away from the wires, outwardly of said grooves to guide a pair of trunnions into the grooves between the wires and the legs of the contact arm, the said wires being also outwardly bent away from each other outwardly of said grooves to provide a flaring opening between the wires for guiding a fuse tube unit into the space between the legs of the contact arm.

18. In a contact arm structure for fuse tube units, the combination of an insulator with a partially cylindrical band extending about said insulator and having laterally projecting spaced attaching flanges, threaded means passing through said flanges adjacent the insulator for clamping the band on the insulator, said laterally projecting flanges being provided with a pair of holes in each flange, a contact arm comprising a metal member formed with a yoke and having two parallel outwardly extending legs, the said yoke carrying a pair of attaching flanges with apertures registering with the said holes, a pair of through bolts extending through the attaching flanges of the yoke and the attaching flanges of the band to secure the contact arm to the band, the legs of said contact arm being provided adjacent their ends with a partially cylindrical groove in each leg, the grooves facing toward the other end of the insulator, and a pair of spring retainers, each spring retainer comprising a wire having a pair of loops for looping about the latter bolts, the said wires extending outwardly along the legs of the contact arm and engaging the contact arm at the open side of said grooves, the legs of the contact arm having outwardly beveled surfaces extending away from the wires, outwardly of said grooves to guide a pair of trunnions into the grooves between the wires and the legs of the contact arm, the said yoke of the contact arm having an extension extending toward said insulator and provided with a spring engaging transverse flange extending in the same direction as the open side of the grooves, and spring means supported between the clamping bolt of the band and one of the other bolts and engaged by said transverse flange to urge the contact arm pivotally upon the adjacent bolt, in the direction in which the grooves are open, the other securing bolt for the contact arm having an elongated slot to permit a limited pivotal movement.

19. In a fused drop-out cut-out, the combination of an insulator with a pair of laterally projecting contact arms carried by the insulator, said contact arms having a pair of spaced parallel legs in each case and the legs of the contact arm having grooves in the top arm, and grooves in the bottom arm in both legs and the grooves facing toward each other, a fuse tube unit comprising an insulating tube and a contact fixture carried by each end of the tube, and oppositely extending trunnions on each side of each contact fixture for engaging in the partially open grooves of the contact arm legs when the fixture is between said legs, the upper contact arm having spring means below each groove for retaining the trunnions pivotally in the upper grooves, fuse actuated means for camming the lower contact fixture trunnions out of the lower grooves to permit the fuse tube unit to swing pivotally by gravity on its upper trunnions, the fuse tube being open at its lower end, resulting in jet action, and the upper trunnions being located on the outer side of the upper contact fixture so that the jet action on the tube tends to cause a clockwise rotation of the fuse tube unit on the upper trunnions, tending to retain the fuse tube unit in engagement with the lower contact arm until jet action has ceased.

DAVID C. HUBBARD.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,953,136	Steinmayer	Apr. 3, 1934
2,003,768	Boll et al.	June 4, 1935
2,212,633	Bodendieck	Aug. 27, 1940
2,247,701	Ramsey	July 1, 1941
2,310,466	Schultz et al.	Feb. 9, 1943
2,446,675	Yonkers	Aug. 10, 1948
2,461,898	Hubbard	Feb. 15, 1949