July 21, 1942. A. RAMSEY 2,290,382

FUSE CONSTRUCTION

Original Filed Oct. 2, 1937 4 Sheets-Sheet 1

Fig. 1.

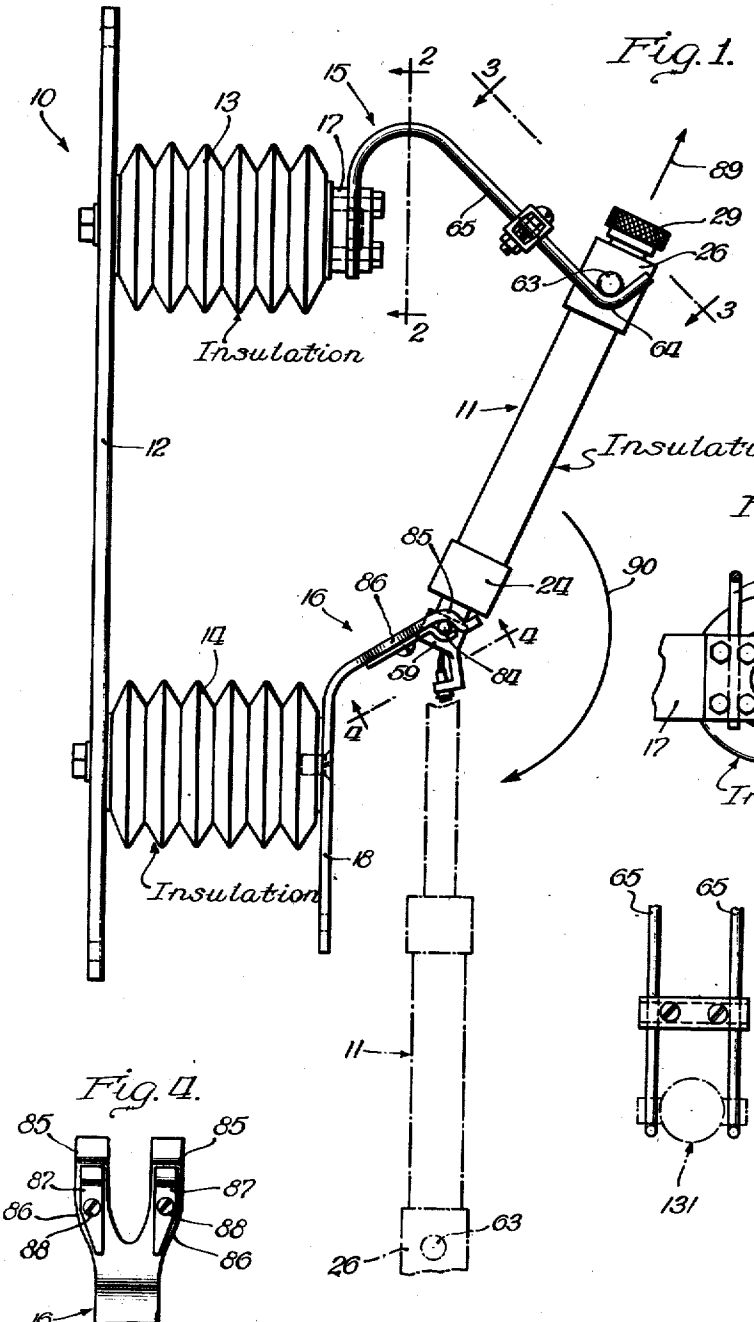


Fig. 2.

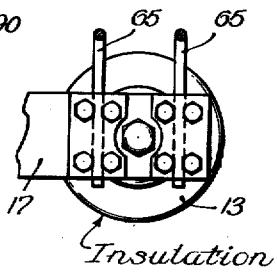


Fig. 3.

Fig. 4.

INVENTOR.
Allan Ramsey
BY Thompson Bailey Tolan
Attys.

July 21, 1942. A. RAMSEY 2,290,382

FUSE CONSTRUCTION

Original Filed Oct. 2, 1937 4 Sheets-Sheet 2

Fig. 5.

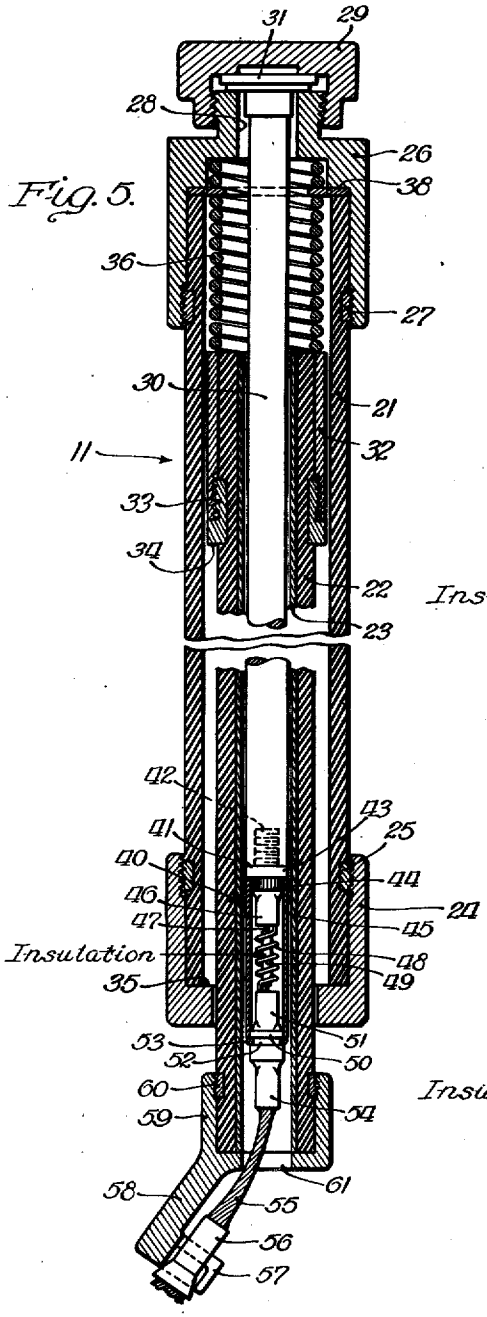


Fig. 6.

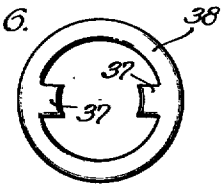


Fig. 7.

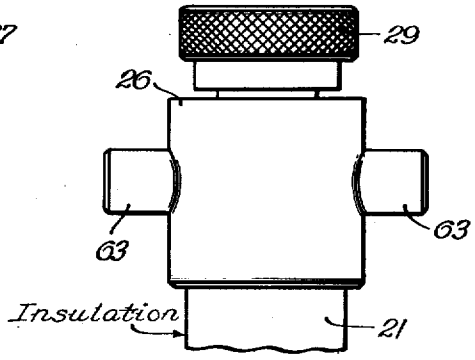
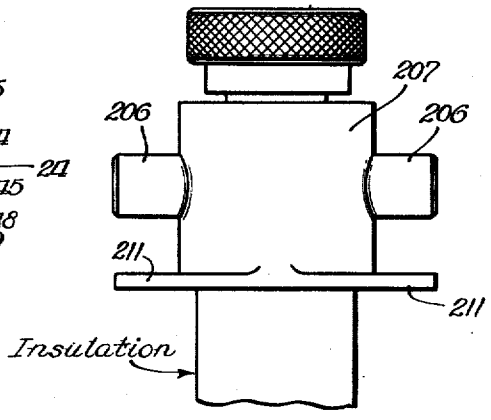


Fig. 8.



INVENTOR.
Allan Ramsey
BY Brown Jackson Boettcher Dienner
Attys.

July 21, 1942. A. RAMSEY 2,290,382

FUSE CONSTRUCTION

Original Filed Oct. 2, 1937 4 Sheets-Sheet 3

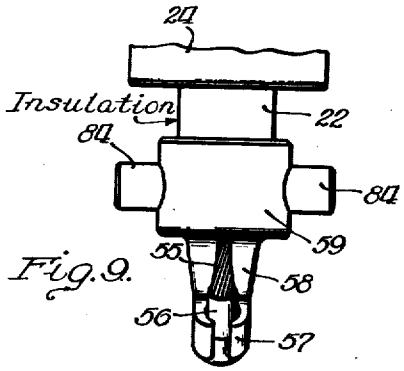


Fig. 9.

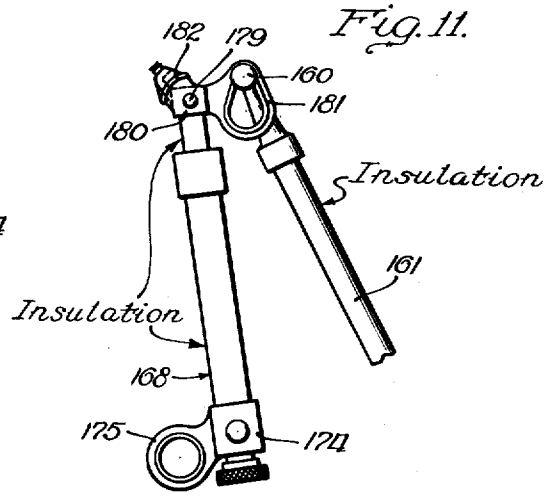


Fig. 11.

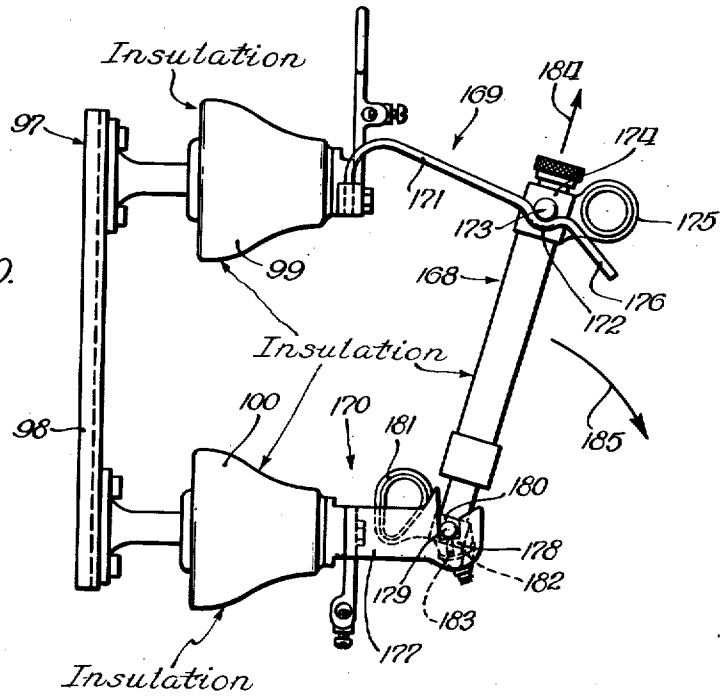


Fig. 10.

INVENTOR.
Allan Ramsey
BY
Attys.

July 21, 1942. A. RAMSEY 2,290,382

FUSE CONSTRUCTION

Original Filed Oct. 2, 1937 4 Sheets-Sheet 4

Fig. 12.

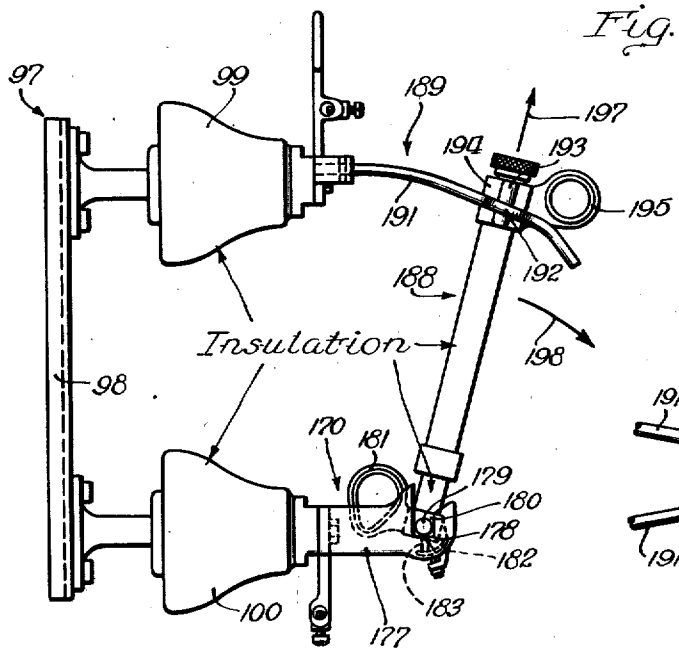


Fig. 13.

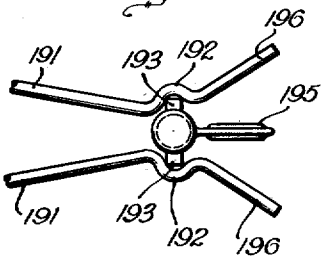


Fig. 14.

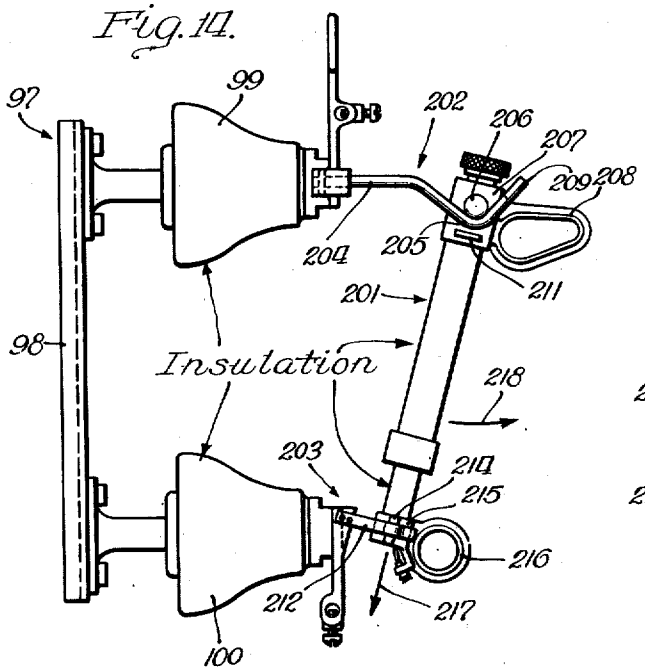


Fig. 15.

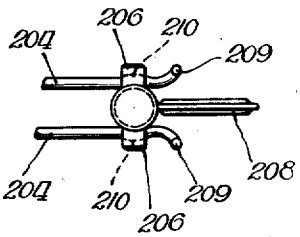
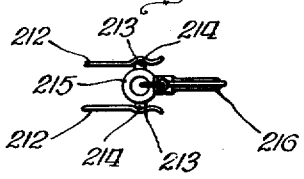


Fig. 16.



INVENTOR.
Allan Ramsey
BY
Macfarlane Bowie Deane
Attys.

Patented July 21, 1942

2,290,382

UNITED STATES PATENT OFFICE

2,290,382

FUSE CONSTRUCTION

Allan Ramsey, Evanston, Ill., assignor to Schweitzer & Conrad, Inc., Chicago, Ill., a corporation of Delaware

Original application October 2, 1937, Serial No. 166,945. Divided and this application May 2, 1941, Serial No. 391,489

22 Claims. (Cl. 200—114)

My invention relates, generally, to the construction of electric circuit interrupters and it has particular relation to the construction of dropout fuses. This application is a division of my copending application, Serial No. 166,945, filed October 2, 1937, now Patent No. 2,247,701.

An object of my invention is to provide in a dropout fuse for extinguishing an arc in a bore formed by material capable of evolving an arc extinguishing medium due to the heat of the arc in a new and improved manner.

Another object of my invention is to provide a relatively long rod-like terminal in the bore of such diameter that it substantially fills the same so that the products of the arc are caused to be expelled from the other end of the bore.

A further object of my invention is to provide for moving the rod-like terminal upwardly in the bore by a coil compression spring surrounding the rod-like terminal.

Still another object of my invention is to provide for unlatching the dropout fuse at its upper end by the coil compression spring when it is released on blowing of the fusible means which restrains the upward movement of the rod-like terminal.

Other objects of this invention will, in part, be obvious and in part appear hereinafter.

For a more complete understanding of the nature and scope of this invention reference may be had to the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is a view, in side elevation, of one embodiment of my invention;

Figure 2 is a detail sectional view of a portion of the upper circuit terminal taken along the line 2—2 of Figure 1;

Figure 3 is a detail view taken along the line 3—3 of Figure 1;

Figure 4 is a detail view taken along the line 4—4 of Figure 1 and showing the construction of the lower circuit terminal;

Figure 5 is a longitudinal sectional view of the preferred form of fuse device that is employed in practicing this invention;

Figure 6 is a top plan view of a retaining washer that is employed for holding the coil compression spring in place as shown in Figure 5;

Figure 7 is a fragmentary view, in front elevation, of the upper end of the fuse device shown in Figure 5, this construction being used when the fuse device rotates about its lower end;

Figure 8 is a view similar to that shown in Figure 7, but showing the construction of the upper end of the fuse device when it is arranged to rock about this end on blowing of the fusible element;

Figure 9 is a fragmentary view, in front elevation, of the lower end of the fuse device shown in Figure 5;

Figure 10 illustrates another form of mounting device for the fuse device shown in Figure 5;

Figure 11 illustrates how the fuse device for mounting in the mounting device shown in Figure 10 may be carried by a fuse stick;

Figure 12 illustrates another embodiment of the mounting device in which the upper terminal of the fuse device is provided with a pair of oppositely extending ribs and is arranged to rock relative to the lower circuit terminal;

Figure 13 is a detail view in top plan of the upper circuit terminal shown in Figure 12 with the fuse device mounted therein;

Figure 14 shows a mounting device, similar to that shown in Figure 12, but having the fuse device arranged to rock relative to the upper circuit terminal and the lower fuse terminal being provided with ribs;

Figure 15 is a detail top plan view of the upper circuit terminal shown in Figure 14; and

Figure 16 is a detail bottom plan view of the lower circuit terminal shown in Figure 14.

Referring now to Figure 1 of the drawings, it will be observed that the reference character 10 designates, generally, a mounting device for a fuse device, shown generally at 11. The mounting device 10 comprises a suitable support member, such as the plate 12, and it has mounted at opposite ends thereof insulators 13 and 14 for supporting thereon upper and lower circuit terminals shown generally at 15 and 16 respectively. Each of these circuit terminals is provided with a circuit terminal plate 17 and 18, respectively, to which the circuit conductors may be connected, as will readily be understood.

In Figure 5 of the drawings the details of construction of the fuse device 11 are more clearly illustrated. As there shown the fuse device 11 comprises an outer fuse tube 21 with which is telescoped an inner fuse tube 22 having a liner 23. The fuse tubes 21 and 22 may be composed of suitable insulating material, such as "Bakelite," while the liner 23 may be composed of fiber, which, as is now well known, evolves an arc extinguishing medium when subjected to the heat of an arc that assists in extinguishing the same. At its lower end the outer fuse tube 21 is provided with a ferrule 24 that is threaded onto an externally threaded snap ring 25 which is mounted in a suitable peripheral groove, as shown, in the

outer tube 21. At its uper end the outer fuse tube 21 is provided with an upper fuse terminal 26 that is threaded onto a suitable externally threaded snap ring 27 which, like the snap ring 25, is disposed in a suitable peripheral groove in the outer fuse tube 21. The upper fuse terminal 26 is apertured as indicated at 28 and has threaded thereon a suitable cap 29. A rod-like terminal 30 extends from the upper fuse terminal 26 into the bore of the liner 23 inside of the inner fuse tube 22. A flanged head 31 is provided on the upper end of the rod-like terminal 30 and securely holds the rod-like terminal 30 in the aperture 28 when the cap 29 is screwed tightly into place.

The construction of the inner fuse tube 22 is similar to that of the outer fuse tube 21. At its upper end it is provided with a ferrule 32 that is threaded on a suitable snap ring 33 located in a peripheral groove in the inner fuse tube 22. The snap ring 33 is provided with a shoulder 34 for engaging the inwardly projecting shoulder 35 of the ferrule 24 at the lower end of the outer fuse tube 21 for limiting the outward movement of the inner fuse tube 22, as will be described hereinafter. The snap ring 33 is located in such position on the inner fuse tube 22 that, when the shoulder 34 thereof engages the inwardly projecting shoulder 35 of the ferrule 24, the lower end of the rod-like terminal 30 projects into the bore of the liner 23. In this position the upper end of this bore is substantially closed and the building up of high gas pressure in the outer fuse tube 21 is prevented.

With a view to biasing the inner fuse tube 22 outwardly with respect to the outer fuse tube 21, a coil compression spring 36 is interposed between the inner end of the fuse tube 22 and the underside of the upper fuse terminal 26 that closes the upper end of the outer fuse tube 21. It will be observed that the spring 36 bears generally against the ferrule 32 rather than against the upper end of the inner fuse tube 22 itself. This construction prevents abrasion of the upper end of the inner fuse tube 22. It is desirable that the spring 36 be held in the upper closed end of the outer fuse tube 21 when the inner fuse tube 22 moves downwardly. For this purpose the upper end turns of the spring 36 are threaded past the inwardly extending ears 37 of a washer 38, Figure 6, that is clamped between the underside of the upper fuse terminal 26 and the upper end of the outer fuse tube 21.

The fuse tubes 21 and 22 are prevented from movement apart under the influence of the coil spring 36 by a fuse link, shown generally at 40, and positioned adjacent the open lower end of the inner fuse tube 22 which, it will be understood, forms an arcing chamber lined with a material capable of evolving an arc extinguishing medium, i. e., the fiber liner 23. The fuse link 40 is of the replaceable type, and it is provided at the upper end with a fuse link terminal 41 having a stud 42 integrally formed therewith for threading into the lower end of the rod-like terminal 30. Intermediate the ends of the fuse link terminal 42 a flange 43 is provided, the diameter of which is that of the stock from which the terminal is machined and underneath it there is a knurled portion 44 for receiving a sleeve 45, preferably formed of fiber, and preventing rotation thereof relative to the link terminal. The lower end 46 of the link terminal 41 is deformed onto the upper ends of strain and fusible elements 47 and 48. The strain element 47 is preferably formed of a high strength wire, such as "Nichrome," while the fusible element 48 is preferably formed of silver. A sleeve 49 of suitable insulation may be positioned, as shown, around the strain element 47 to prevent the fusible element 48 from coming into contact engagement therewith. The fuse link 40 is provided with a lower fuse link terminal 50, the upper end 51 of which is deformed onto the lower ends of the strain and fusible elements 47 and 48. The fuse link terminal 50 is provided with a peripheral groove 52 in which is positioned a snap ring 53 for preventing the sleeve 45 from slipping out of position over the terminal 50. The lower end 54 of the fuse link terminal is deformed onto a flexible conductor 55 that is provided with a cone terminal 56 deformed thereon intermediate its ends. The lower fuse link terminal 50 will be free to move out of the lower end of the arcing chamber within the fuse tube 22 under the expulsion action of the blast of arc extinguishing medium on blowing of the strain and fusible elements 47 and 48. When this occurs the arc is drawn between the lower end of the rod-like terminal 30 and a lower fuse terminal 59, described hereinafter, that is carried by and movable with the fuse tube 22.

It will be observed that the cone terminal 56 constitutes an anchor means for the lower end of the fuse link 40 and that it is positioned between ears 57 that are integrally formed with the rearwardly extending portion 58 of the lower fuse terminal 59 threaded on a suitable split ring 60 in a peripheral groove adjacent the lower end of the inner fuse tube 22. The mechanical interconnection provided by the flexible conductor 55 between the lower link terminal 50 and the lower fuse terminal 59 insures conjoint movement of these terminals and separation of the former from the rod-like stationary terminal 30.

As illustrated, the lower fuse terminal 59 is provided with an aperture 61 which leaves the bore of the liner 23 and the inner fuse tube 22 open and through which the flexible conductor 55 extends. By leaving the lower end of the inner fuse tube 22 open, the products of the arc formed on blowing of the fuse link 40 can readily escape and dangerous pressures are not built up within the fuse device 11, as might otherwise be the case if both ends of it were closed. By the provision of the ears 57 on the rearwardly extending portion 58, it will be observed that the cone terminal 56 is positioned out of the direct path of the products of the arc that are blown out of the aperture 61 when the fuse link 40 blows. Whatever pressure from the arc blast that may be generated within the bore of the movable arcing chamber formed by the liner 23 on blowing of the strain and fusible elements 47 and 48 does not react against the movable arcing chamber since the bore is smooth and is vented at its lower end directly to the atmosphere. The relative movement of the arcing chamber and the rod-like terminal 30 is thus unaffected by the pressure incident to the blast and is solely under the control of the spring 36 modified, of course, by the force of gravity.

It will be obvious that any other suitable form of fuse link, instead of the particular form of fuse link 40 shown in the drawings, may be employed without departing from the present invention. However, it is preferable to employ a fuse link of the type such as is illustrated in order to obtain the best results.

It will now be apparent that the fuse tubes

21 and 22 and the fuse terminals 26 and 59 at their ends are restrained from movement apart under the influence of the coil spring 36 or external biasing means, as will be hereinafter described, as long as the fuse link 40 remains intact or until sufficient current flows through it to cause the fusible and strain elements 47 and 48 to be melted. This is due to the fact that the conductor, formed by the rod-like terminal 30, the fuse link 40, and the flexible conductor 55, both mechanically and electrically interconnects the fuse terminals 26 and 59. At the upper end this composite conductor is held by the flanged head 31 and at its lower end the cone terminal 56 is wedged between the ears 57. As soon as the fuse link 40 blows, i. e., when the fusible element 48 and strain element 47 melt, and this composite conductor is no longer intact, the fuse tubes 21 and 22 are no longer restrained from movement apart. Consequently, the inner fuse tube 22 moves outwardly with respect to the outer fuse tube 21 until it is stopped by engagement of the shoulder 34 with the shoulder 35.

As will hereinafter appear, either the outer fuse tube 21 or the inner fuse tube 22 may be held stationary while the other fuse tube moves on blowing of the fuse link 40. Either the upper fuse terminal 26 or the lower fuse terminal 59 may be rockably mounted to permit swinging of both of the fuse tubes 21 and 22 therewith on blowing of the fuse link 40 in order to interpose an air gap between the other fuse terminal and the circuit terminal with which it is normally associated. Suitable latching means is provided with the fuse terminal that is not rockably mounted and it is arranged to be unlatched by movement apart of the fuse tubes 21 and 22.

In order to re-fuse the fuse device 11, once it has operated, it is removed from the mounting device 10, Figure 1, or any of the mounting devices described hereinafter. The remaining portion of the flexible conductor 55 and the cone terminal 56 are removed from the ears 57. The cap 29 is then unscrewed and the rod-like terminal 30 is withdrawn. A new fuse link 40 of the desired current rating is screwed into the lower end of the rod-like terminal 30 and then the assembly is inserted through the aperture 28 in the upper fuse terminal 26 and through the bore of the fiber liner 23. The flexible conductor 55 is long enough to extend out of the lower open end of the inner fuse tube 22 when it is in the extended position. The inner fuse tube 22 is moved inwardly against the biasing force of the coil spring 36 to such position that the cone terminal 56 may be inserted between the ears 57 and then the excess portion of the conductor 55 is cut off. The cap 29 is then screwed into place and the fuse device 11 is ready for reinsertion in the mounting device, such as the device 10, Figure 1.

The telscoped construction of the fuse tubes 21 and 22 not only provides an efficient means for unlatching the fuse device 11 so that it operates as a drop-out fuse device in removing one of the fuse terminals from its associated circuit terminal, but also it provides an increased dielectric between the circuit terminals. As soon as the fuse link 40 blows and before the inner fuse tube 22 is moved relative to the outer fuse tube 21, the arcing distance between the lower end of the rod-like terminal 30 or the fuse link terminal 41 and the lower fuse terminal 59 is relatively short. Since the lower fuse terminal 59 moves relative to the rod-like terminal 30 on movement apart of the fuse tubes 21 and 22, this arcing distance is considerably increased. As a result of this construction, the likelihood of an arc persisting for an appreciable time is quite remote.

The factors involved in effecting the circuit interruption are: first, the blowing of the fuse link 40 and the resultant expulsion action in the sleeve 45 and the liner 23; next, the separation of the lower fuse terminal 59 from the lower end of the rod-like terminal 30 or the fuse link terminal 41 to assist in effecting arc extinction; and, finally, the dropping out of the fuse device 11 itself, after the arc has been completely extinguished in the bore of the liner 23 in the inner fuse tube 22, with the consequent removal of one of the fuse terminals 26 or 59 from its associated circuit terminal, for example, the removal of the upper fuse terminal 26 from the circuit terminal 15, Figure 1, in order to insure that a leakage path through the fuse tubes 21 and 22 which might be dangerous, will not be provided between the circuit terminals 15 and 16.

The movement apart of the fuse tubes 21 and 22 or the movement of the fuse device 11 to the dropped out position or both indicates that the fuse link 40 has blown. Such changes from the normal condition of the fuse device 11 are readily apparent from the ground and a lineman can quickly detect which of the fuse devices 11 it is necessary to re-fuse.

The upper fuse terminal 26 is provided with oppositely extending arms 63, Figure 7, for mounting in the upwardly opening hook-shaped outer end portions 64 of wires 65 forming a part of the upper circuit terminal 15. The wires 65 are inherently resilient and, when the fuse device 11 is in operative position, they are biased away from the lower circuit terminal 16.

As shown in Figure 1, the fuse device 11 is mounted on the lower circuit terminal 16 so as to rock with respect to the same and is latched to the upper circuit terminal 15. For this purpose the lower fuse terminal 59 is provided with oppositely extending arms 84 which are arranged to interfit with the downwardly opening hook-shaped outer end portions 85 of a resilient strap member 86 which forms the lower circuit terminal 16. Clips 87, secured by screws 88 to the underside of the strap portion 86 serves to hold the arms 84 in place and yet permit them to rotate as in a bearing.

As long as the fuse link 40 of the fuse device 11 remains intact, the relative positions of the various parts shown in Figure 1 of the drawings will be as illustrated by the full lines. It will be apparent that the fuse link 40 not only restrains the movement apart of the fuse tubes 21 and 22 as biased apart by the spring 36, but also it prevents movement of them apart as biased by the resilient circuit terminals 15 and 16. That is, as long as the fuse link 40 remains intact the rod-like terminal 30 is prevented from moving endwise in a direction indicated by the arrow 89.

As soon as the fuse link 40 blows, the rod-like terminal 30 is no longer restrained and it moves upwardly under the influence of the coil compression spring 36 and the biasing action of the circuit terminals 15 and 16. As soon as the arms 63 clear the outer end portions of the upper circuit terminal 15, the fuse device 11 pivots about the lower circuit terminal 16 as indicated by the curved arrow 90 and finally comes to rest in the position indicated by the broken lines.

As the rod-like terminal 30 moves upwardly through the bore in the fiber liner 23 the arc

formed on blowing of the fusible and strain elements 46 and 47 will be elongated therein and extinguished partly due to its extension and partly due to the arc extinguishing medium that is evolved from the liner 23. The lower fuse link terminal 50 and the parts attached thereto will be expelled from the lower open end and the arc will thus be further extended. Since the upper fuse tube terminal 26 moves entirely away from the upper circuit terminal 15 there is interposed in the circuit an air gap in addition to the gap that is formed in the liner 23 on blowing of the fuse link 40.

In Figure 10 of the drawings there is illustrated a mounting device which is similar to that shown in Figure 1 in certain respects. The mounting device is designated, generally, at 97 and comprises a channel base 98 at the ends of which are mounted suitable pin insulators 99 and 100. A fuse device, designated generally at 168, is carried by the mounting device 97. Except as hereinafter noted, the construction of the fuse device 168 is the same as that shown in Figures 5, 6, 7, and 9 of the drawings and described hereinbefore. The fuse device 168 is rockably mounted at its lower end and is latched in place at its upper end. Upper and lower circuit terminals 169 and 170 are mounted on the insulators 99 and 100, respectively. As illustrated, the fuse device 168 is mounted therebetween.

The upper circuit terminal 169 comprises a pair of spring wires 171 having upwardly curved hook-shaped portions 172 for receiving therein arms or trunnions 173 of an upper fuse terminal 174 of the fuse device 168. An eye 175, preferably integrally formed with the upper fuse terminal 174, is provided for receiving the prong 160 of a fuse stick 161 (Figure 11) for placing the fuse device 168 in operative position. The outer ends 176 of the spring wires 171 slope downwardly to provide an inclined surface for receiving the trunnions 173 and permitting movement thereof into the upwardly opening hook-shaped portions 172.

The lower circuit terminal 170 comprises a pair of spaced apart relatively rigid arms 177 having upwardly opening hook-shaped portions 178 at their outer ends for receiving therein arms or trunnions 179 that extend from opposite sides of a lower fuse terminal 180 carried by the inner fuse tube of the fuse device 168. An eye 181, preferably integrally formed with the lower fuse terminal 180, is provided for receiving the prong 160, Figure 11, of the fuse stick 161. As shown in this figure, the prong 160 is inserted in the eye 181 for positioning the trunnions 179 in the upwardly opening hook-shaped portions 178. After the fuse device 168 has been placed on the lower circuit terminal 170, the prong 160 is inserted in the eye 175 and the fuse device 168 is rotated to the position shown in Figure 10.

In order to prevent the fuse device 168 from being blown out of the lower circuit terminal 170 when the fuse link blows, the lower fuse terminal 180 is provided on opposite sides with curved flanges 182 that are arranged to interfit with inwardly extending ribs 183 from the inner surfaces of the arms 177.

On blowing of the fuse link in the fuse device 168, the upper fuse terminal 174 and the outer fuse tube move upwardly as indicated by the arrow 184 until the trunnions 173 have cleared the outer ends of the spring wires 171. The fuse tubes forming the fuse device 168 then rotate as indicated by the arrow 185 with the lower fuse terminal 180 to the dropped-out position. In this position it will be understood that the desired air gap is provided between the upper fuse terminal 174 and the upper circuit terminal 169. As a matter of fact, in the dropped-out position, since the upper fuse terminal 174 is below the lower fuse terminal 180, the air gap in the circuit is that represented by the distance between the circuit terminals 169 and 170.

In Figure 12 of the drawings a mounting device is illustrated for suitably mounting the fuse device shown generally at 188. The details of construction of the fuse device 188 are similar to those shown in Figure 5 of the drawings. It is arranged to be mounted between an upper circuit terminal 189 on an insulator 99 and a lower circuit terminal 170 that is similar in construction to the lower circuit terminal 170 shown in Figure 10 of the drawings. In this embodiment of the invention a fuse device 188 is arranged to rock relative to the lower circuit terminal 170 and and to be unlatched from the upper circuit terminal 189.

It will be observed that the upper terminal 189 comprises a pair of relatively rigid wires 191, the outer end portions of which are provided with inwardly opening hook-shaped portions 192 for receiving therebetween longitudinally extending ribs 193 from an upper fuse terminal 194 of the outer fuse tube of the fuse device 188. An eye 195, preferably integrally formed with the upper fuse terminal 194, is provided to permit insertion of the prong of fuse stick for placing the fuse device 188 in operative position. The outer ends of the wires 191 are turned outwardly as indicated at 196 (Figure 13) in order to provide for receiving the ribs 193 and guiding them into the inwardly opening hook-shaped portions 192.

Since the details of construction of the lower circuit terminal 170 and the manner in which the fuse device 188 is mounted therein are similar to those shown in Figure 10 and described hereinbefore, a detailed description thereof will not be set forth.

When the fuse link in the fuse device 188 blows, the upper fuse terminal 194 and the outer fuse tube on which it is mounted move in the direction indicated by the arrow 197 until the ribs 193 have cleared the inwardly opening hook-shaped portions 192. The fuse device 188 is then free to rotate about the trunnions 179 on the lower circuit terminal 170 in the direction indicated by the arrow 198.

In Figure 14 of the drawings a mounting device is illustrated for rockably mounting a fuse device, shown generally at 201, on an upper circuit terminal 202 that is carried by the insulator 99. The fuse device 201 is latched at its lower end to a lower circuit terminal 203 that is carried by the insulator 100.

The upper circuit terminal 202 includes a pair of relatively rigid wires 204 that are provided with upwardly opening hook-shaped portions 205 adjacent their outer ends for receiving arms or trunnions 206 of an upper fuse terminal 207 that is mounted on the upper end of the outer fuse tube which forms a part of the fuse device 201. It will be understood that the fuse device 201 is similar in internal construction to the fuse device 11 shown in Figure 5. An eye 208 is preferably integrally formed with the upper fuse terminal 207 for receiving the prong of a fuse stick to permit placing the fuse device 201 in operative position. As shown in Figure 15 the outer end portions 209 of the wires 204 are flared outwardly

and the portions 210 are curved outwardly for guiding and gripping respectively the upper fuse terminal 207 as it is placed in operative position. This gripping action of the portons 210 that is provided by the spreading apart slightly of the wires 204 when the upper fuse terminal 207 is placed therebetween provides the required contact pressure therewith. Flanges 211, Figure 8, extending from the opposite sides of the upper fuse terminal 207 serve to prevent disengagement thereof from the upper circuit terminal 202 when the fuse device operates.

With a view to latching the lower end of the fuse device 201 to the lower circuit terminal 203, the latter is provided with a pair of spaced apart spring fingers 212, the outer ends of which are provided with inwardly opening hook-shaped portions 213 for receiving therebetween ribs 214 formed integrally with a lower fuse terminal 215 carried at the lower end of the inner fuse tube forming a part of the fuse device 201. An eye 216, forming a part of the lower fuse terminal 215, is provided for receiving the prong of a fuse stick.

When the fuse link in the fuse device 201 blows, the lower fuse terminal 215 and inner fuse tube move in the direction indicated by the arrow 217. As soon as the ribs 214 have cleared the spring fingers 212, the fuse device 201 is free to swing in the direction indicated by the arrow 218. This movement places an air gap between the lower circuit terminal 203 and the lower fuse terminal 215.

Since certain further changes can be made in the above constructions and different embodiments of the invention can be made without departing from the scope thereof, it is intended that all matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. Circuit interrupting means comprising, in combination, a first circuit terminal having a first support means extending therefrom the outer end of which is bifurcated and hook-shaped opening upwardly, a second circuit terminal having a second support means extending therefrom the outer end of which is bifurcated and hook-shaped opening upwardly, a first fuse tube, a second fuse tube telescoped with said first fuse tube, a first fuse terminal closing one end of said first fuse tube and having a pair of oppositely extending arms for mounting in said upwardly opening hook-shaped end of said first support means, a second terminal at one end of said second fuse tube but leaving the same open, said second terminal having a pair of oppositely extending arms for mounting in said upwardly opening hook-shaped end of said second support means, said fuse tubes being biased apart, and a conductor including a fusible section interconnecting said first and second fuse terminals and restraining said fuse tubes from movement apart as long as said fusible section remains intact, said first fuse terminal on blowing of said fusible section moving out of engagement with said first support means and said second fuse terminal rotating in said second support means with said fuse tubes, whereby an air gap is formed between said first terminal and said first support means.

2. Circuit interrupting means comprising, in combination, a first circuit terminal having a first support means extending therefrom the outer end of which is bifurcated and hook-shaped opening upwardly, a second circuit terminal having a second support means extending therefrom the outer end of which is bifurcated and hook-shaped opening upwardly, a first fuse tube, a second fuse tube telescoped with said first fuse tube, a first fuse terminal closing one end of said first fuse tube and having a pair of oppositely extending arms for mounting in said upwardly opening hook-shaped end of said first support means, a second terminal at one end of said second fuse tube but leaving the same open, said second terminal having a pair of oppositely extending arms for mounting in said upwardly opening hook-shaped end of said second support means, flange means on said second fuse terminal interfitting with said second support means and arranged and adapted to prevent separation thereof except when the former is moved to a predetermined position relative to the latter, said fuse tubes being biased apart, and a conductor including a fusible section interconnecting said first and second fuse terminals and restraining said fuse tubes from movement apart as long as said fusible section remains intact, said first fuse terminal on blowing of said fusible section moving out of engagement with said first support means and said second fuse terminal rotating in said second support means with said fuse tubes, whereby an air gap is formed between said first terminal and said first support means.

3. Circuit interrupting means comprising, in combination, a first circuit terminal having a first support means extending therefrom the outer end of which is bifurcated and hook-shaped opening inwardly, a second circuit terminal having a second support means extending therefrom the outer end of which is bifurcated and hook-shaped opening upwardly, a first fuse tube, a second fuse tube telescoped with said first fuse tube, a first fuse terminal closing one end of said first fuse tube and having a pair of oppositely extending ribs for mounting in said inwardly opening hook-shaped end of said first support means, a second terminal at one end of said second fuse tube but leaving the same open, said second terminal having a pair of oppositely extending arms for mounting in said upwardly opening hook-shaped end of said second support means, said fuse tubes being biased apart, and a conductor including a fusible section interconnecting said first and second fuse terminals and restraining said fuse tubes from movement apart as long as said fusible section remains intact, said first fuse terminal on blowing of said fusible section moving out of engagement with said first support means and said second fuse terminal rotating in said second support means with said fuse tubes, whereby an air gap is formed between said first terminal and said first support means.

4. Circuit interrupting means comprising, in combination, a first circuit terminal having a first support means extending therefrom the outer end of which is bifurcated and hook-shaped opening inwardly, a second circuit terminal having a second support means extending therefrom the outer end of which is bifurcated and hook-shaped opening upwardly, a first fuse tube, a second fuse tube telescoped with said first fuse tube, a first fuse terminal closing one end of said first fuse tube and having a pair of oppositely extending ribs for mounting in said inwardly opening hook-shaped end of said first support means, a second terminal at one end of said second fuse tube but leaving the same open,

said second terminal having a pair of oppositely extending arms for mounting in said upwardly opening hook-shaped end of said second support means, flange means on said second fuse terminal interfitting with said second support means and arranged and adapted to prevent separation thereof except when the former is moved to a predetermined position relative to the latter, said fuse tubes being biased apart, and a conductor including a fusible section interconnecting said first and second fuse terminals and restraining said fuse tubes from movement apart as long as said fusible section remains intact, said first fuse terminal on blowing of said fusible section moving out of engagement with said first support means and said second fuse terminal rotating in said second support means with said fuse tubes, whereby an air gap is formed between said first terminal and said first support means.

5. Circuit interrupting means comprising, in combination, upper and lower line terminals mounted in insulated spaced relation, a dropout fuse device interconnecting said terminals, means pivotally mounting said dropout fuse device at its lower end, means latching said dropout fuse device in operative position at its upper end, a relatively long rod-like terminal slidably mounted in said dropout fuse device, fusible means restraining upward movement of said rod-like terminal, and spring means biasing said rod-like terminal upwardly and restrained as long as said fusible means remains intact for extending the arc formed on blowing of said fusible means and unlatching said latching means whereby said dropout fuse device is permitted to pivot about its lower end away from said upper line terminal to inoperative position.

6. Circuit interrupting means comprising, in combination, upper and lower line terminals mounted in insulated spaced relation, a dropout fuse device interconnecting said terminals and having a longitudinally extending bore therein the lower end of which is open during operation of the interrupter and formed by material capable of evolving an arc extinguishing medium due to the heat of an arc, means pivotally mounting said dropout fuse device at its lower end, means latching said dropout fuse device in operative position at its upper end, a relatively long rod-like terminal slidably mounted in said bore and substantially filling the greater portion of its length and closing its upper end, fusible means located at the open end of said bore and restraining upward movement of said rod-like terminal, and spring means in said dropout fuse device biasing said rod-like terminal upwardly and restrained as long as said fusible means remains intact for extending in said bore the arc formed on blowing of said fusible means and unlatching said latching means whereby said dropout fuse device is permitted to pivot about its lower end away from said upper line terminal to inoperative position.

7. Circuit interrupting means comprising, in combination, upper and lower line terminals mounted in insulated spaced relation, a dropout fuse device interconnecting said terminals, means pivotally mounting said dropout fuse device on said lower line terminal, means latching said dropout fuse device in operative position to said upper line terminal, a relatively long rod-like terminal slidably mounted in said dropout fuse device, fusible means restraining upward movement of said rod-like terminal, and spring means biasing said rod-like terminal upwardly and restrained as long as said fusible means remains intact for extending the arc formed on blowing of said fusible means and unlatching said latching means whereby said dropout fuse device is permitted to pivot about its lower end away from said upper line terminal to inoperative position.

8. Circuit interrupting means comprising, in combination, upper and lower line terminals mounted in insulated spaced relation, a dropout fuse device interconnecting said terminals and having a longitudinally extending bore therein the lower end of which is open during operation of the interrupter and formed by material capable of evolving an arc extinguishing medium due to the heat of an arc, means pivotally mounting said dropout fuse device on said lower line terminal, means latching said dropout fuse device in operative position to said upper line terminal, a relatively long rod-like terminal slidably mounted in said bore and substantially filling the greater portion of its length and closing its upper end, fusible means located at the open end of said bore and restraining upward movement of said rod-like terminal, and spring means in said dropout fuse device biasing said rod-like terminal upwardly and restrained as long as said fusible means remains intact for extending in said bore the arc formed on blowing of said fusible means and unlatching said latching means whereby said dropout fuse device is permitted to pivot about its lower end away from said upper line terminal to inoperative position.

9. Circuit interrupting means comprising, in combination, upper and lower line terminals mounted in insulated spaced relation, a dropout fuse device interconnecting said terminals, means pivotally mounting said dropout fuse device at its lower end, means latching said dropout fuse device in operative position at its upper end, a relatively long rod-like terminal slidably mounted in said dropout fuse device, fusible means restraining upward movement of said rod-like terminal, and a coil compression spring in said fuse device surrounding said rod-like terminal and biasing the same upwardly and restrained as long as said fusible means remains intact for extending the arc formed on blowing of said fusible means and unlatching said latching means whereby said dropout fuse device is permitted to pivot about its lower end away from said upper line terminal to inoperative position.

10. Circuit interrupting means comprising, in combination, upper and lower line terminals mounted in insulated spaced relation, a dropout fuse device interconnecting said terminals and having a longitudinally extending bore therein the lower end of which is open during operation of the interrupter and formed by material capable of evolving an arc extinguishing medium due to the heat of an arc, means pivotally mounting said dropout fuse device at its lower end, means latching said dropout fuse device in operative position at its upper end, a relatively long rod-like terminal slidably mounted in said bore and substantially filling the greater portion of its length and closing its upper end, fusible means located at the open end of said bore and restraining upward movement of said rod-like terminal, and a coil compression spring in said fuse device surrounding said rod-like terminal and biasing the same upwardly and restrained as long as said fusible means remains intact for extending in said bore the arc formed on blowing of said fusible means and unlatching said

latching means whereby said dropout fuse device is permitted to pivot about its lower end away from said upper line terminal to inoperative position.

11. Circuit interrupting means comprising, in combination, upper and lower line terminals mounted in insulated spaced relation, a dropout fuse device interconnecting said terminals, means pivotally mounting said dropout fuse device on said lower line terminal, means latching said dropout fuse device in operative position to said upper line terminal, a relatively long rod-like terminal slidably mounted in said dropout fuse device, fusible means restraining upward movement of said rod-like terminal, and a coil compression spring in said fuse device surrounding said rod-like terminal and biasing the same upwardly and restrained as long as said fusible means remains intact for extending the arc formed on blowing of said fusible means and unlatching said latching means whereby said dropout fuse device is permitted to pivot about its lower end away from said upper line terminal to inoperative position.

12. Circuit interrupting means comprising, in combination, upper and lower line terminals mounted in insulated spaced relation, a dropout fuse device interconnecting said terminals and having a longitudinally extending bore therein the lower end of which is open during operation of the interrupter and formed by material capable of evolving an arc extinguishing medium due to the heat of an arc, means pivotally mounting said dropout fuse device on said lower line terminal, means latching said dropout fuse device in operative position to said upper line terminal, a relatively long rod-like terminal slidably mounted in said bore and substantially filling the greater portion of its length and closing its upper end, fusible means located at the open end of said bore and restraining upward movement of said rod-like terminal, and a coil compression spring in said fuse device surrounding said rod-like terminal and biasing the same upwardly and restrained as long as said fusible means remains intact for extending in said bore the arc formed on blowing of said fusible means and unlatching said latching means whereby said dropout fuse device is permitted to pivot about its lower end away from said upper line terminal to inoperative position.

13. Circuit interrupting means comprising, in combination, upper and lower line terminals mounted in insulated spaced relation and biased apart, a dropout fuse device interconnecting said terminals and restraining movement thereof apart, means pivotally mounting said dropout fuse device at its lower end, means latching said dropout fuse device in operative position at its upper end, a relatively long rod-like terminal slidably mounted in said fuse device, fusible means restraining upward movement of said rod-like terminal and movement apart of said line terminals, and spring means biasing said rod-like terminal upwardly and restrained as long as said fusible means remains intact for extending the arc formed on blowing of said fusible means and unlatching said latching means whereby said dropout fuse device is permitted to pivot about its lower end away from said upper line terminal to inoperative position.

14. Circuit interrupting means comprising, in combination, upper and lower line terminals mounted in insulated spaced relation, a dropout fuse device interconnecting said terminals, means pivotally mounting said dropout fuse device at its lower end, means latching said dropout fuse device in operative position at its upper end, a relatively long rod-like terminal slidably mounted in said dropout fuse device, fusible means restraining upward movement of said rod-like terminal, spring means biasing said rod-like terminal upwardly and restrained as long as said fusible means remains intact for extending the arc formed on blowing of said fusible means and unlatching said latching means whereby said dropout fuse device is permitted to pivot about its lower end away from said upper line terminal to inoperative position, an eye on the lower end of said dropout fuse device for receiving a fuse stick for placing said fuse device in its pivot mounting, and an eye on the upper end of said dropout fuse device for receiving the fuse stick to swing said fuse device about its lower end upwardly to operative position.

15. Circuit interrupting means comprising, in combination, upper and lower line terminals mounted in insulated spaced relation, a dropout fuse device interconnecting said terminals, means pivotally mounting said dropout fuse device on said lower line terminal, means latching said dropout fuse device in operative position to said upper line terminal, a relatively long rod-like terminal slidably mounted in said dropout fuse device, fusible means restraining upward movement of said rod-like terminal, spring means biasing said rod-like terminal upwardly and restrained as long as said fusible means remains intact for extending the arc formed on blowing of said fusible means and unlatching said latching means whereby said dropout fuse device is permitted to pivot about its lower end away from said upper line terminal to inoperative position, an eye on the lower end of said dropout fuse device for receiving a fuse stick for placing said fuse device in operative position on said lower line terminal, and an eye on the upper end of said dropout fuse device for receiving the fuse stick to swing said fuse device about its lower end upwardly into latching engagement with said upper line terminal.

16. Circuit interrupting means comprising, in combination, upper and lower line terminals mounted in insulated spaced relation, a dropout fuse device interconnecting said terminals, means pivotally mounting said dropout fuse device at its lower end, means latching said dropout fuse device in operative position at its upper end, a relatively long rod-like terminal slidably mounted in said dropout fuse device, spring means biasing said rod-like terminal upwardly, and fusible means including a fusible element and a strain element electrically interconnecting the lower end of said rod-like terminal and said lower line terminal, said fusible means restraining said spring means and said strain element relieving said fusible element of the strain imposed thereby, said spring means on blowing of said fusible means moving said rod-like terminal upwardly to extend the arc and unlatching said latching means whereby said dropout fuse device is permitted to pivot about its lower end away from said upper line terminal to inoperative position.

17. A fuse comprising a fixed line terminal and a movable line terminal spaced therefrom, said movable line terminal comprising a springing cantilever biased in a direction away from the fixed line terminal, a fuse holder, a fixed terminal-engaging element on one end of the fuse holder having a rotary support on the fixed line

terminal, a movable terminal-engaging element at the other end of the fuse holder, a fuse link in the holder connecting the fixed and movable terminal-engaging elements and holding them relatively closely together, the parts being arranged so that upon rotation of the fuse holder with respect to the fixed line terminal, said movable terminal-engaging element will deflect the cantilever toward the fixed line terminal to tension the fuse link in the fuse holder.

18. A fuse comprising a fixed line terminal and a movable line terminal spaced therefrom, said movable line terminal comprising a springing cantilever biased in a direction away from the fixed line terminal, a fuse holder, a fixed terminal-engaging element on one end of the fuse holder having a rotary support on the fixed line terminal, a movable terminal-engaging element at the other end of the fuse holder, a fuse link in the holder connecting the fixed and movable terminal-engaging elements and holding them relatively closely together, the parts being arranged so that upon rotation of the fuse holder with respect to the fixed line terminal, said movable terminal-engaging element will deflect the cantilever toward the fixed line terminal to tension the fuse link, the contact between the movable terminal-engaging element and said cantilever line terminal being substantially non-frictional, and the movement of the movable terminal-engaging element being such as to clear the biased position of the cantilever when the fuse link is broken, whereby the fuse holder may thereafter rotate to an open position.

19. A fuse comprising a lower fixed line terminal, an upper springing cantilever line terminal which normally biases to assume a position relatively distant from the fixed line terminal, a fuse holder, a lower fixed terminal-engaging element on the fuse holder attachable to and rotary with respect to the fixed line terminal, said fuse holder having an open lower end, an axially movable terminal-engaging element at the upper end of the fuse holder, a fuse link connecting said terminal-engaging elements and holding them relatively closely together, the upper cantilever line terminal and the movable terminal-engaging element being related so that when the fuse holder is rotated into closed-circuit position the cantilever is deflected to bias the movable terminal-engaging element upwardly and to tension the fuse link, the movement of the movable terminal-engaging element being such as to clear the cantilever in its normal operating position when the fuse link separates.

20. A fuse comprising a lower fixed line terminal, an upper springing cantilever line terminal which normally biases to assume a position relatively distant from the fixed line terminal, a fuse holder, a lower fixed terminal-engaging element on the fuse holder rotary with respect to the fixed line terminal, said fuse holder having an open lower end, an axially movable terminal-engaging element at the upper end of the fuse holder, a fuse link connecting said terminal-engaging elements and holding them relatively closely together, the upper cantilever line terminal and the movable terminal-engaging element being related so that when the fuse holder is rotated into closed-circuit position the cantilever is deflected to bias the movable terminal-engaging element upwardly and to tension the fuse link, the movement of the movable terminal-engaging element being such as to clear the cantilever in its normal operating position when the fuse link separates, and spring means reacting between the fuse holder and its movable terminal-engaging element to maintain the latter in maximum spaced relationship from the fixed terminal-engaging element after the fuse has broken.

21. A fuse comprising a fixed line terminal, a springing cantilever line terminal having a cam end and an adjacent notch and normally biased to a position away from the fixed line terminal, a fuse holder, a fixed terminal-engaging element on one end of the fuse holder rotary with respect to the fixed line terminal, an axially movable terminal-engaging element at the other end of the fuse holder, a fuse link joining the terminal-engaging elements to hold the movable engaging element relatively near the fixed engaging element, means on the movable engaging element engageable with said cam end upon rotation of the fuse holder and cooperative with the notch in final position to deflect said cantilever toward the fixed line terminal whereby the fuse link is tensioned, the movement of the movable terminal-engaging element being enough that when the fuse link separates and the cantilever line terminal biases the movable terminal-engaging element said terminal-engaging element will clear the notch.

22. A fuse comprising a fixed line terminal, a springing cantilever line terminal having a cam end and an adjacent notch and normally biased to a position away from the fixed line terminal, a fuse holder, a fixed terminal-engaging element on one end of the fuse holder rotary on the fixed line terminal, an axially movable terminal-engaging element at the other end of the fuse holder, a fuse link joining the terminal-engaging elements to hold the movable engaging element relatively near the fixed engaging element, means on the movable engaging element engageable with said cam end upon rotation of the fuse holder and cooperative with the notch in final position to deflect said cantilever toward the fixed line terminal whereby the fuse link is tensioned, the movement of the movable terminal-engaging element being enough that when the fuse link separates and the cantilever line terminal biases the movable terminal-engaging element said terminal-engaging element may clear the notch, and a spring reacting between the fuse holder and the movable terminal-engaging element to maintain said clearance.

ALLAN RAMSEY.