Aug. 4, 1942. A. RAMSEY 2,291,646

CUTOUT

Filed July 9, 1934 4 Sheets-Sheet 1

Fig. 1.

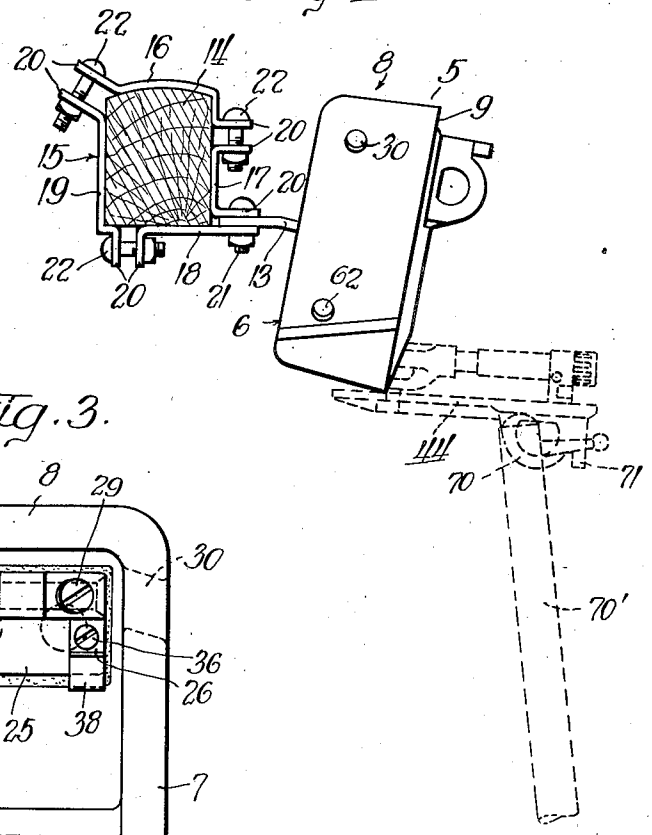


Fig. 3.

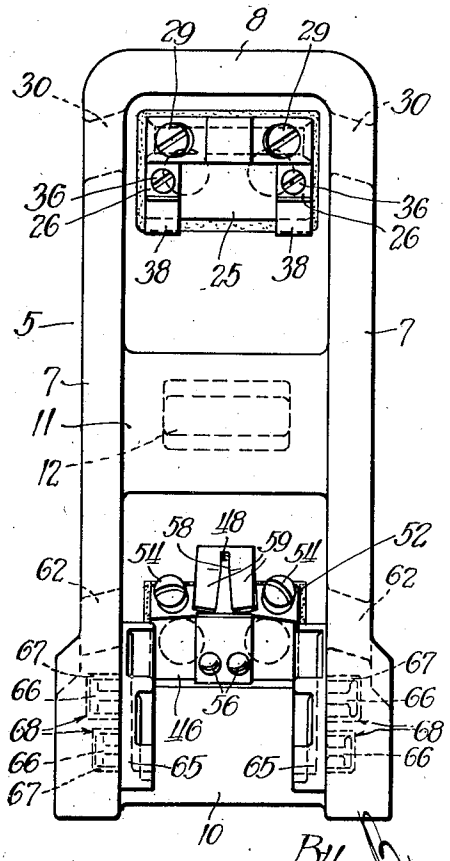
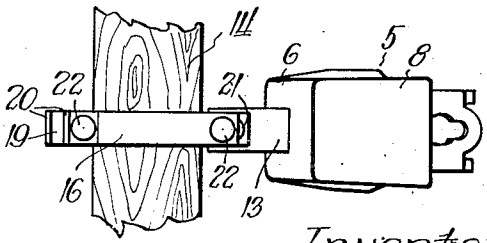


Fig. 2



Inventor:
Allan Ramsey.

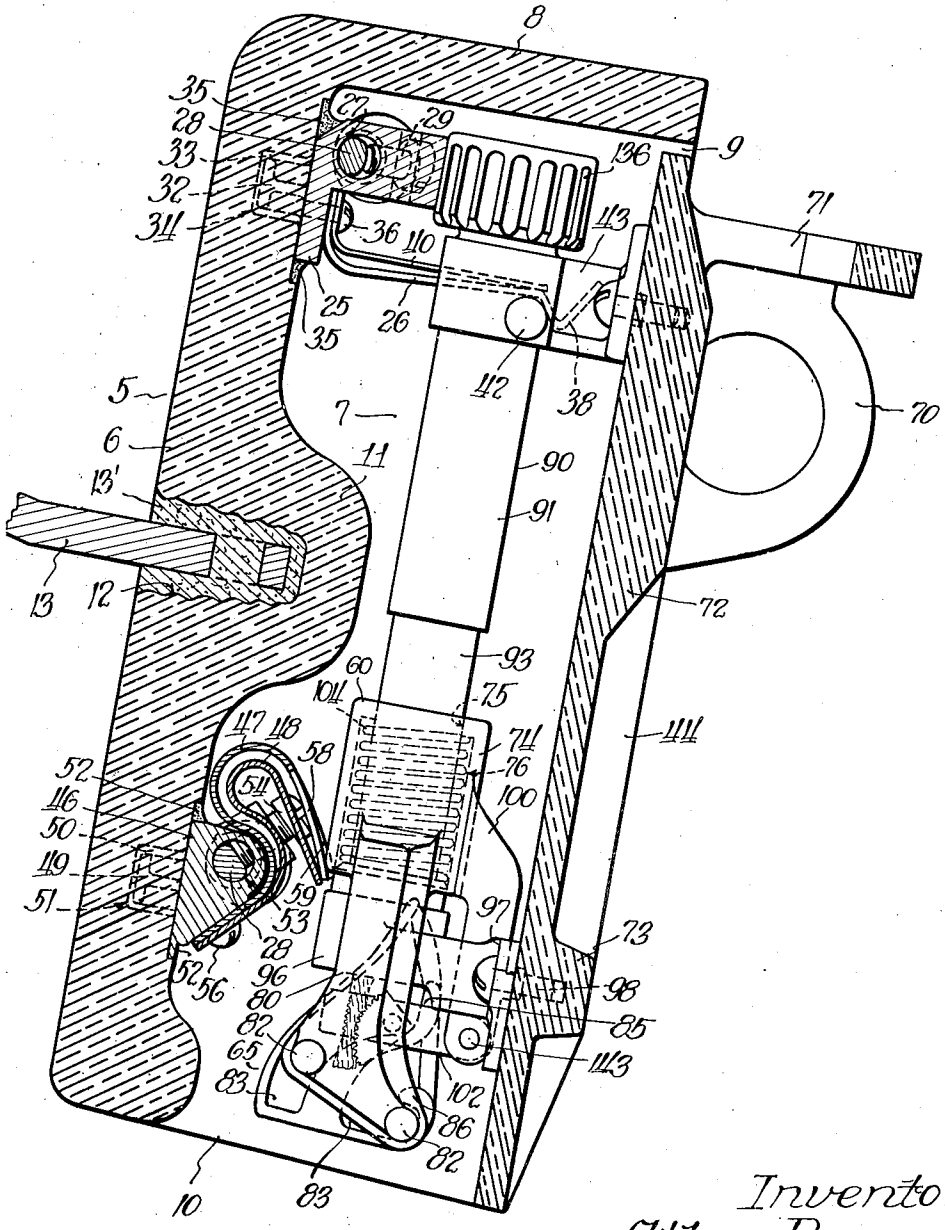
By Brown, Jackson, Boettcher & Dienner
Attys.

Aug. 4, 1942. A. RAMSEY 2,291,646

CUTOUT

Filed July 9, 1934 4 Sheets-Sheet 2

Fig. 4.



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Aug. 4, 1942. A. RAMSEY 2,291,646

CUTOUT

Filed July 9, 1934 4 Sheets-Sheet 3

Fig. 6.

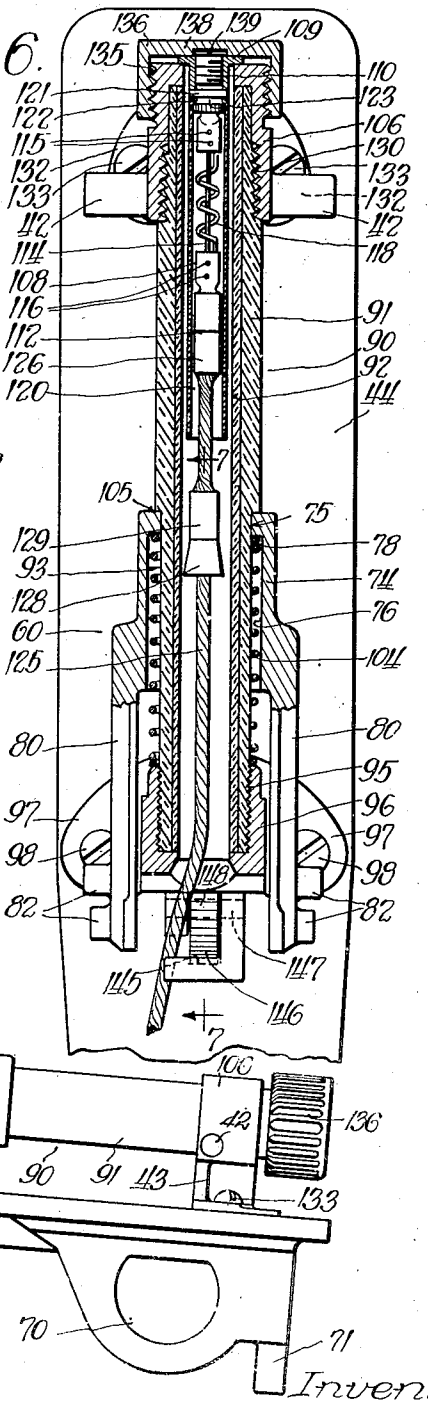
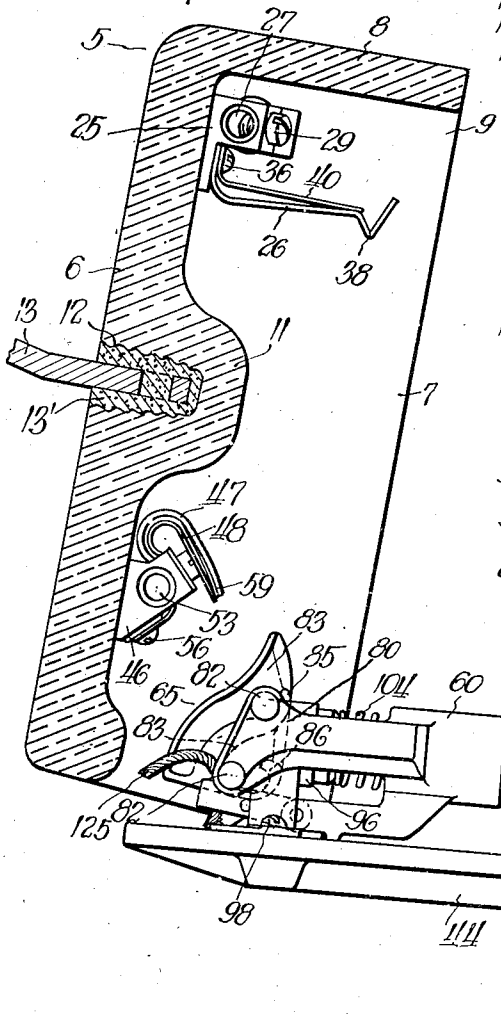


Fig. 5.



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Aug. 4, 1942. A. RAMSEY 2,291,646

CUTOUT

Filed July 9, 1934 4 Sheets-Sheet 4

Fig. 8.

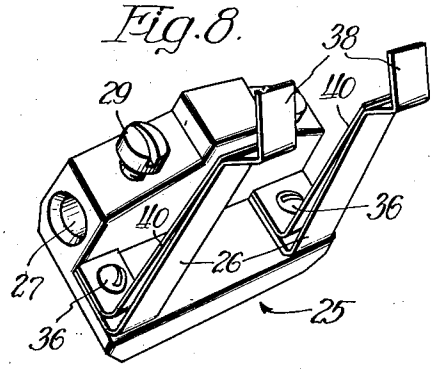


Fig. 10.

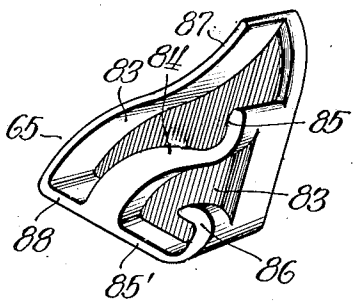


Fig. 7.

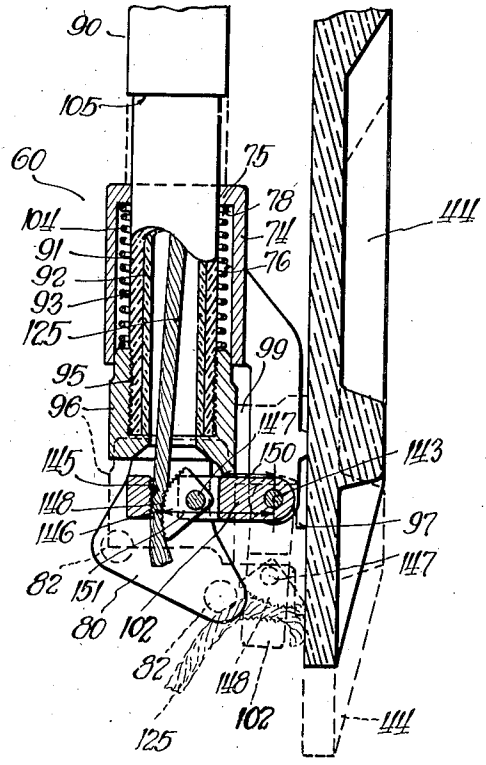
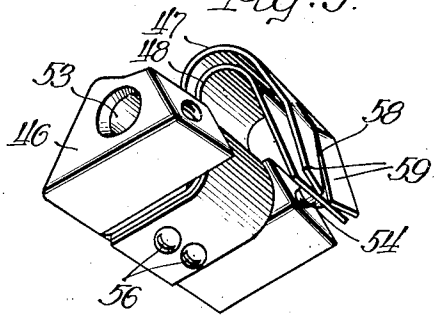


Fig. 9.



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Patented Aug. 4, 1942 2,291,646

UNITED STATES PATENT OFFICE

2,291,646

CUTOUT

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

Application July 9, 1934, Serial No. 734,262

73 Claims. (Cl. 200—114)

My invention relates to cutouts for electrical circuits.

More particularly, my invention relates to an improved cutout for the primary circuits of an electrical distribution system. Primary circuits usually extend from electrical substations, or transformer stations on a high potential line, out over the immediate vicinity, and supply current to the service transformers for light and power distribution. Such circuits commonly carry potentials in the neighborhood of 7,500 volts, the voltage being sometimes less than this and sometimes slightly higher.

It is common practice to install primary cutouts in the primary leads of the distribution transformer. The function of the cutout is automatically to disconnect from and isolate from the feeder circuit a transformer which breaks down or is otherwise either partially or completely short-circuited. By thus isolating a defective transformer or a defective section of the circuit, outage of the entire feeder with its many transformer stations is prevented. That is, if the cutout were not there to disconnect the faulty transformer, the oil circuit breaker at the substation end of the feeder would be tripped out, thereby disconnecting service from a large number of customers.

A form of automatic disconnecting or circuit interrupting means used extensively in these circuits is the ordinary type of boxed fuse or cutout comprising a housing having terminals for connection to the line conductors and a cover hinged to the housing and carrying an expulsion fuse adapted for connecting the terminals within the housing when the cover is closed.

While the particular device which I shall describe hereinafter in connection with the drawings is a cutout of the type referred to in the preceding paragraph, it is to be understood that the invention is not limited in all respects to cutout devices of this type, but may be employed in similar or equivalent devices as suitable or desired.

One of the objects of my invention is to provide improved means for producing a positive arcing gap and for extending the same when the fuse melts. This positive formation and extension of the gap upon melting of the fuse is of great virtue. With the present invention the action is not dependent upon the amount of current melting the fuse, as in ordinary expulsion fuses which depend on gas pressure generated by the arcing to extend and quench the arc, and positive and dependable operation, during either light overload of heavy short circuit, is assured.

Another object is to provide means for locking the fuse, or other device, to at least one of the contacts and/or the cover for the housing, in closed position, and improved means for releasing this locking means upon an interruption in current flow, or when the fuse melts.

Another object is to provide means which will serve the dual purpose of producing a positive gap and extending the same when the fuse melts, and which means will also serve to release the means for locking the fuse, or other device, to at least one of the contacts and/or the cover in closed position.

Another and more specific object is to provide leverage means for normally holding the gap producing and extending and/or lock releasing means against operation, and which will produce and extend the gap rapidly upon melting of the fuse, positively to open the circuit and stop the flow of current before too much heat is developed.

Another object is to provide for normally restraining the gap producing and extending and/or lock releasing means, and more particularly the leverage means referred to in the preceding paragraph, by means of the fuse link.

Another object is to provide an improved anchorage for anchoring the fuse link in restraining relation, and more particularly to the leverage means for normally holding the device against operation and for extending the gap rapidly when the fuse melts.

Another object is to provide a combination hinge and drop-out stop and recoil stop, preferably remote from the charged terminal, although it may be adjacent or a part of the terminal, within the broader aspects of this feature of the invention. This combination hinge and drop-out and recoil stop prevents the cover and fuse from dropping out, and takes the recoil action.

Another object is to provide an improved contact and locking clip, an improved tube terminal arrangement with contact and locking means for engagement with the contact and locking means of the clip, and an improved contact spring arrangement for pressing the clip into firm engagement with the cooperating means on the terminal.

Another object is to provide an improved lower contact assembly having an improved arrangement of the contact fingers for yieldingly engaging the terminal which cooperates therewith, and an improved contact spring arrangement for pressing the contact fingers into firm contacting engagement with the cooperating terminal.

The fuse link assembly which I employ is preferably of the type described and claimed in my Patent No. 2,091,453, with means attached to the terminal to which the closely surrounding inner sleeve of the fuse link is secured for anchoring or holding this terminal electrically to the upper terminal of the outer sleeve.

In the illustrated embodiment of the invention, the outer fuse sleeve or tube is secured to the

cover for the housing and is, in turn, carried for movement slidably by a hinge member hinged to the housing. The upper end of the fuse has contact and locking means for engagement with the contact and locking clips in the housing when the cover is closed, and a compression spring is coiled externally about the tube and reacts against the hinge member and one of the tube brackets to move the tube and cover in a direction to reduce the distance between the hinge member and the contact and locking means on the tube, whereby to release the locking means and permit the fuse and cover to drop, by gravity, to open position when the fuse blows. The fusible link is anchored at its upper end to the upper fuse terminal and extends downwardly through the tube and from the lower open end thereof for anchorage to a lever which is adapted to restrain the spring in compression by cooperating with one of the fuse brackets through a relatively short lever arm and anchorage to the fuse link through a relatively long lever arm. This gives the fuse link mechanical advantage over the spring and at the same time, upon blowing of the fuse, the lever operates to extend the gap rapidly, or with great speed.

Further features and advantages, and a concrete understanding of the present invention, will be more apparent from the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is a view illustrating my improved form of cutout mounted upon a cross-arm, with the cutout in side elevation and the cover thereof in closed position, the open position being shown by broken lines;

Figure 2 is a top plan view of the same;

Figure 3 is a front elevational view of the cutout with the cover removed;

Figure 4 is a vertical longitudinal section through the housing and cover of the cutout, showing the cover in closed position, and the fuse carried thereby in elevation;

Figure 5 is a view similar to Figure 4, with the contact parts and cover in elevation and the cover in open position;

Figure 6 is a longitudinal section through the fuse device, showing the same in position on the cover;

Figure 7 is a fragmentary detail section taken on the line 7—7 of Figure 6;

Figure 8 is a perspective view of the upper contact block, clip and spring assembly;

Figure 9 is a perspective view of the lower contact block, clip and spring assembly; and

Figure 10 is a perspective view of one of the hinge members.

The embodiment of the invention illustrated in the drawings comprises a housing 5 which is adapted to be exposed to the weather, and houses the main contact terminals.

The housing 5 comprises a unitary body consisting of a back wall 6 from which extends forwardly an integral rim forming substantially parallel side walls 7, 7 and a top wall 8, leaving the front open at 9 and the bottom open at 10. The back wall 6 has an arched portion 11 extending forwardly toward the open front and transversely between the side walls 7, 7 approximately midway of the height of the housing 5. The back wall 6, forwardly extending rim and arched portion 11 are preferably formed as a unitary piece of dense wet process porcelain or other suitable insulation, and the entire housing is preferably finished with a chocolate glaze inside and outside. The forwardly arched portion 11 is integral with the back wall 6, and at its opposite ends with the side walls 7, 7, and acts as a spacer to reenforce the side walls 7, 7 against convergence, particularly in firing.

Extending inwardly into the arched portion 11 from the back of the housing is a pocket 12 in which a mounting tongue 13 is secured by means of cement or a suitable alloy 13'. The inner surface of the pocket 12 is preferably grooved, as shown in Figure 5, to bond the cement or alloy securely in place. The tongue 13 is attached, for example, to the cross-arm 14 of a transformer pole or other support by a bracket 15. This bracket 15 comprises four bracket parts 16, 17, 18 and 19, and is similar to the bracket described and claimed in my Patent No. 2,108,348. The bracket part 16 fits upon the top of the cross-arm 14 and has one end turned down along one side of the cross-arm. The part 19 fits against the opposite side of the cross-arm and has its lower portion offset or turned in beneath the bottom of the cross-arm. These parts 16 and 19 have outwardly directed flanges 20 at their opposite ends. The part 18, which is of L-shaped form, is fitted against the bottom of the cross-arm with its flange 20 in spaced relation to the flange on the adjacent end of the part 19 and its free end extending out from the opposite side of the cross-arm, and the part 17 is applied with its base against the side of the cross-arm between the flange 20 on the part 16 and the extending end of the clamp part 18, and with one of its flanges 20 in spaced relation to the flange 20 on the adjacent end of the clamp part 16 and its other flange 20 adjacent the extending end of the part 18. The tongue 13 is swiveled between the extending end of the clamp part 18 and the flange on the adjacent end of the clamp part 17 upon a carriage bolt 21 which may be loosened to permit the cutout to be adjusted or swung to any angular position about the axis of the bolt 21 and tightened to clamp the cutout firmly in the position in which it is arranged. Carriage bolts 22 pass through the other pairs of spaced flanges 20 for gripping the bracket firmly in place about the cross-arm 14.

The upper contact disposed within the housing 6 comprises a contact block 25 and a pair of contact clips 26. The block 25 is preferably constructed of cast hard bronze, or other suitable conducting material. This block 25 is provided integrally along the top with a thickened lug having a transverse opening 27 for receiving, from either side, the bared end of one line wire 28, and a pair of screws 29 are provided for binding the inserted end of the line wire 28 in place. Openings 30 are formed in the side walls 7, one adjacent each side of the contact block 25 to permit leading the conductor 28 into the housing 5 from either side. The inner ends of these openings 30 are preferably inclined upwardly for the purpose of preventing moisture from entering the housing through these openings. The base of the block 25 has a pair of laterally spaced integral studs 32 which may be fluted or formed irregular within their length, and are secured by cement or alloy at 33 in laterally spaced recesses 34 in the back wall 6. The inner surface of the back wall 6, upon which the base of the block 25 seats, may be finished as shown in Figure 4, and fillets of cement or alloy may be provided at 35.

The clips 26 are preferably constructed of phosphor bronze or other material of good con-

ductivity. Each clip **26** is of generally L-shaped form with its short up-turned base end secured by a screw **36** to the contact block **25**. The clips **26** are spaced apart transversely of the housing **5**, as shown in Figure 3, to receive between them the upper end of the fuse, and the outer end of each clip **26** terminates in a V-shaped contacting and locking end **38**. L-shaped contact springs **40** have their up-turned base ends secured with the clips **26** to the contact block **25** by the screws **36**. These springs **40** are formed of strips of suitable spring stock, and their longer outstanding arms bear downwardly on the respective clips **26** to force, when the cover **44** is in closed position, the contacting and locking ends **38** of the clips **26** into firm contacting and locking engagement with contact and locking studs **42** extending laterally in opposite directions from the upper fuse tube bracket **43**.

The lower contact means comprises a contact block **46**, contact clip **47** and contact spring **48**. The block **46**, which is preferably constructed of cast hard bronze or other suitable conducting material, is mounted upon the back wall **6** below the arched portion **11** by means of a pair of integral laterally spaced studs **49** which may be fluted or formed irregular within their length and are secured by cement or alloy at **50** in recesses **51** in the back wall **6**. The inner side of the wall **6** may be finished to provide a flat mounting for the base of the block **46** in position properly correlated with respect to the upper contact, and fillets of cement or alloy may be provided at **52**. The block **46** has a transverse opening **53** for receiving from either side the bared end of the other line wire **28**, and the opposite sides of the top of the block are thickened to receive screws **54** provided for binding the inserted end of the line wire **28** in place.

The clip **47**, which is preferably formed of a strip of phosphor bronze or other suitable conducting material, has a flat end secured to the forwardly and downwardly directed inclined surface on the block **46** intermediate its opposite sides by means of a pair of screws **56**. At the upper end of its flat lower portion, the clip **47** is rounded around the correspondingly rounded surface of the block **46** intermediate its opposite sides, and the free upper end of the clip is of generally inverted U-shaped or goose-neck form. The free end of the goose-neck contact part of the clip is slotted at **58** to form spring contact fingers **59** for relatively great resiliency of contact with the hinge sleeve member **60** which constitutes the lower terminal of the fuse. The contact spring **48** is formed of a strip of suitable spring stock and has its flat lower end secured with the lower end of the clip **47** to the block **46** by the screws **56**. The upper portion of this spring **48** is of generally goose-neck form corresponding with the form of the upper end of the clip **47**, and is nested within the upper end of the clip **47** with its substantially flat free end bearing against the free ends of the contact fingers **59** to force these fingers outwardly into firm contacting engagement with the terminal forming hinge sleeve **60** when the cover **44** is closed. The upper portion of the block **46** is slotted intermediate its opposite sides to receive the adjacent portions of the clip **47** and spring **48**, and the side walls **7**, **7** of the housing **5** have openings **62** adjacent the opposite sides of the block **46** for leading the lower line wire **28** into the opening **53** in the block **46** from either side. The inner ends of the openings **62** are preferably inclined upwardly for the purpose of preventing moisture from entering the housing through these openings.

Secured in transversely aligned positions to the inner surfaces of the side walls **7**, adjacent their lower ends and beneath the lower contact block **46**, are a pair of hinge members **65**. These hinge members **65** are preferably constructed of cast hard bronze or other suitable material, and each member **65** has a pair of studs **66** integral with the member and extending from its base. These studs **66**, which may be fluted or otherwise formed irregular within their length, are secured by cement or alloy at **67** in recesses **68** in the side walls **7**, **7**. The lower ends of the side walls **7**, **7** are thickened outwardly to accommodate adequately the recesses **68**, and the back wall **6** may be thickened to accommodate adequately the recesses **34** and **51**.

Referring now to the detailed construction of the cover and fuse assembly, the cover **44**, which is preferably formed of brown "Bakelite" or other suitable insulating material, loosely fits, when in closed position, within the front opening **9** of the housing **5**. The upper end of the cover has a pair of outwardly extending and laterally spaced manipulating eyes or rings **70**, one adjacent each of the opposite sides of the cover, to receive the end of a hook stick **70'** (Fig. 1), for manipulating the cover to open or closed position with the hook stick. A third manipulating eye or ring **71**, disposed laterally along the top of the cover and extending outwardly between the upper end of the eyes **70**, is also adapted to receive the end of the hook stick for manipulating the cover in removing the same from and inserting it into hinged engagement with the hinge member **65**. The eye-carrying upper portion of the cover is thickened at **72**, and the thinner lower portion of the cover may be provided with strengthening ribs **73**.

The tube **90** and the attached cover **44** are hinged at the lower end by means of the hinge sleeve member **60**. This member constitutes the lower fuse terminal and is preferably constructed of cast hard bronze or other suitable material. It comprises a sleeve portion **74**, bored at **75** and counterbored at **76** to form, at its upper end, an internal shoulder **78**. Integral with the opposite sides of the sleeve portion **74** and disposed in diametrically opposite positions are a pair of arms **80** which extend downwardly below the sleeve portion **74**. The lower ends of these arms **80** are flared to widened form, and the widened lower end of each has a pair of integral hinge studs **82** projecting outwardly therefrom. The two studs of each pair are disposed obliquely with respect to each other and are adapted to engage in grooves or ways **83** in the hinge members **65**.

Each hinge member **65** constitutes a combination hinge and drop-out and recoil stop. The wall **84**, separating the two grooves **83** of each hinge member, is turned up at its forward end to form a stop **85**. These stops **85** cooperate with the inwardly and upwardly disposed pins or studs **82** to prevent the cover and fuse from dropping out of place when in the open position of the cover as shown in Figure 5. The lower wall **85'**, which closes the lower end of the lower and outwardly disposed groove **83**, is turned up and hooked in at its outer end at **86** to take the recoil of the tube upon blowing of the fuse and to hold the cover and fuse from dropping out, particularly when the cover is in closed position,

as shown in Figure 4. The upper side of the upper groove 83 is bordered by an integral wall or flange 87, the lower end of which extends in at 88 and closes the lower end of the upper groove 83. Walls 84 and 87 also serve to guide the hinge pins 82 into place in hingedly attaching the fuse tube and cover to the housing.

The rear walls 87 of the hinge members 65 have a further and important function. As the cover and tube are raised from open position, as shown in Figure 5, the wall 87 of each hinge member, by engagement with the upper pin 82, forces the lower pin 82 outwardly under the inwardly hooked upper end of the recoil and drop-out stop 86 which, thereupon, by its hooked engagement with the lower pins 82, prevents lifting the cover out of the hinge in the closing and opening movements. This hooked engagement also prevents lifting the cover out of the hinge when the cover is closed. The cover may be lifted out of the hinge only in substantially full open position of the cover. As the cover reaches full open position the lower pins 82 move inwardly to position, clear of the inwardly hooked ends of the stops 86, and in this position the contour of the wall 84 permits the lower pin 82 to be lifted to clear the upper pin 82 of the stop 85, whereupon the cover is lifted out of the hinge.

The fuse which I employ in my improved cut-out comprises an insulating outer sleeve or tube 90, preferably formed of linen "Bakelite" tubing 91, rolled on a fiber liner 92. The lower end of the sleeve 90 is reduced at 93, and this reduced end 93 passes slidably through the sleeve portion 74 of the hinge sleeve 60 and is threaded at its lower end at 95 into the internally threaded sleeve or ferrule part of the lower fuse sleeve or tube bracket 96.

The bracket 96 is preferably formed of cast hard bronze or other suitable material, and has integral mounting portions 97 secured firmly to the inner surface of the cover 44 by screws 98. These mounting portions 97 are spaced transversely to form an opening 99 through which a pair of arms 100, integral with the front of the sleeve part 74 and depending downwardly therefrom, and a contact lever 102, are adapted to operate.

A spring wire compression spring 104, coiled about the reduced lower end of the fuse tube 90 and having its upper portion disposed within the counterbore 76, reacts between the ferrule or sleeve part of the lower tube bracket 96, secured to the cover 44 and to the slidable fuse tube 90, and the shoulder 78 at the upper end of the hinge sleeve 60, and tends normally to move the fuse tube and cover downwardly with respect to the hinge sleeve 60. This downward movement is limited by engagement of the upper end of the hinge sleeve 60 with the shoulder 105 formed in the tube 90 by the reduced lower portion thereof. The shoulder 105 may be omitted and the tube formed of reduced diameter throughout its length. However, by pulling the fuse sleeve 90 from the hinge sleeve 60 to the position shown in Figure 4, the spring 104 is put into compression and the contact or locking pins 42 are separated from the hinge pins 82 to such an extent that when the hinge pins 82 are engaged in the grooves 83 in the hinge members 65, and the cover 44 swung to closed position, the contact and locking pins 42 will snap in behind the contact and locking ends 38 of the upper contact clips 26 to lock the cover closed and the clips 26 in firm contacting engagement with the pins 42 of the upper terminal forming tube bracket 43. The spring 104 is normally restrained in compression by the fuse link 108.

The fuse link, designated in its entirety at 108, is identical with the fuse link described and claimed in my Patent No. 2,144,707, with the button 109, of suitable conducting material and flanged radially, threaded upon the upper end of the upper fuse terminal 110. By removing the button 109, the threaded upper end of the terminal 110 is adapted for threaded engagement with the lower cable terminal and spring fastener shown in my Patent No. 2,144,707. The terminal 110 is formed of copper or other suitable or preferred material.

The lower fuse terminal 112 is formed of similar material, and this terminal and the terminal 110 are connected by a strain wire or tensile element 114 arranged to bear the mechanical strain. The upper end of the wire 114 is inserted in a socket or opening in the lower end of the terminal 110 and is secured rigidly in place as by punching at 115 the stock of the terminal 110 into firm binding engagement with the wire, or by flattening the socket firmly upon the wire. The lower end of the wire 114 is inserted in a socket or opening in the terminal 112 and is secured rigidly in place as by punching at 116 the stock of this terminal into firm binding engagement with the wire, or, as before, by flattening the socket upon the wire.

The fuse wire 118 is preferably of silver, and the strain wire is preferably of nickel chromium wire. The upper end of the fuse wire 118 is inserted in an opening in the terminal 110 and is secured firmly in place therein as by punching the adjacent side of the terminal into firm engagement therewith or flattening the same thereon. The lower end of the wire 118 is inserted in an opening in the terminal 112, and may be secured firmly in place therein as by punching the adjacent sides of the terminal 112 into firm engagement therewith, or flattening the same thereon. Intermediate its ends, the fuse wire 118 is coiled about the strain wire 114.

It has been found that silver, as used in devices of this sort, has unusual characteristics. First, there is not an appreciable absorption of oxygen until temperatures close to the melting point are reached, and this oxygen is released again upon a slight drop in temperature. Even if there is some oxidation, the oxide has conducting properties similar to those of silver. Also, it has been found that under certain circumstances silver will form undesirable compounds with other elements, on blowing. In some of the experiments and tests made on fuses under various conditions, the blowing of the fuse appeared to be more violent than the power current would seem to account for.

By a combination of the silver fusible element with the outer insulating sleeve and the inner insulating sleeve closely surrounding the inner fuse terminals and closed by and attached to the upper fuse terminal, the silver fusible element is excluded from too free access to atmosphere and, by the close surrounding of the lower fuse terminal by this inner sleeve, and with the movement of this lower terminal within the sleeve, this exclusion is maintained upon blowing of the fuse. The lower fuse terminal is movable within the inner sleeve for elongation of the arc within this sleeve, and is movable from the inner sleeve to release the pressure and permit an outward flow of gases from the inner sleeve.

Applicant thereby utilizes the highly advantageous character of the silver, namely, that it appears to produce less metallic vapor for a given rating; that it will retain its form up to a very high temperature; that it will not oxidize and change its rating, for the oxide appears to be conductive, and that the time current characteristic, which is an all-important factor under certain circumstances, can readily be maintained over long periods.

The fuse wire 118 of silver or other fusible conducting material, preferably whose oxide is a conductor, and the comparatively high resistance strain wire 114 both are completely enclosed and shielded from atmosphere, gases and moisture, by the inner tube 120 formed of fiber or other insulating material. The upper end of the tube 120 closely surrounds the upper fuse terminal 110 beneath the integral flange 121 thereon, and is shrunk or crimped at 122 into the annular groove 123 to close the upper end of the tube 120 against access of atmosphere to the silver fusible element and to secure the tube 120 to the upper fuse terminal 110. The lower end of the tube 120 passes freely over and closely surrounds the lower fuse terminal 112. The bore of the sleeve 120 along the terminal 112 is of substantially the size of the stress sustaining and fusible link surrounding portion of said bore and substantially closed by the terminal 112, yet unrestricted when the terminal 112 moves from the sleeve 120. The tube or sleeve 120 offers no impairment to free separation of the terminals 110 and 112 upon blowing of the fuse, yet, at the same time, it is rigid throughout its length and by its engagement at the upper end with the terminal 110, and its cooperation with the terminal 112 holds the terminals 110 and 112 rigidly against relative lateral movement such as otherwise might result in movement, or even crimping or twisting, of the fuse wire 118 and/or strain wire 114.

For the purpose of holding the fuse set with the spring 104 in compression and the tube 90 and cover 44 extended upwardly from the hinge sleeve 74 as shown in Figure 4, the lower end of the terminal 112 is provided with an extension 125 formed of stranded conducting cable or other suitable material. Several strands of copper cable, preferably tinned, or "depth" cable, are employed in the illustrated embodiment, although this may, of course, vary widely. The upper end of this cable is inserted in a socket 126 on the lower end of the terminal 112, and this socket is flattened into firm engagement with the cable to secure the same therein. Within its length, the stranded cable 125 may be provided with a conical bushing 128 securely anchored in position upon the cable as by flattening the upper end of the bushing into firm engagement with the cable at 129. The purpose of this bushing is for holding the fuse set where the fuse link is employed in the plug and socket type of cutout described and claimed in my copending application above identified.

The upper fuse tube bracket 43 is preferably formed of cast hard bronze or other suitable material. Its sleeve portion 106 is internally threaded at 130 for threaded engagement with the upper end of the tube 90, and it has an integral mounting bracket 132, the laterally extending base flanges of which are secured by screws 133 to the inner side of the cover 44. The bracket 106 also has an upwardly extending tubular portion coaxial with the sleeve portion threaded upon the tube 90, and this upwardly extending portion is externally threaded at 135 to receive a contact cap 136 formed of cast hard bronze or other suitable material. The button 109 abuts the upper end of this tubular portion and anchors the upper end of the fuse link thereon, and the under side of the top wall of the cap 138 is recessed centrally at 139 to assure clearance of the threaded upper end of the terminal 110 should this terminal project slightly from the top of the button 109.

The extension or stranded cable 125 constitutes a tail extension which, when the spring 104 is in compression with the fuse tube and cover extended, extends down below the lower end of the fuse tube or casing 90 so that it may be gripped conveniently for restraining the spring and holding the tube 90 and cover 44 in extended position.

For the purpose of anchoring the fusible element and connnecting the same electrically at its lower end to the terminal forming hinge sleeve 60, the contact lever 102, preferably formed of cast hard bronze or other suitable material, is pivoted at 143 between the lower ends of the arms 100. This lever has an L-shaped slot 145, one leg of which opens from one side of the lever, and positioned in the other leg of the slot is an eccentric clamp or segment 146 pivoted at 147 to the lever 102. The arcuate surface of the eccentric clamp or segment 146 is knurled at 148 and the opposed side of the L-shaped slot 145 is also preferably knurled for firm gripping engagement with the cable 125.

With the parts in the positions shown in Figure 6, the tube 90 is drawn from the hinge sleeve 60 to the extended position shown in Figure 4, whereupon the eccentric clamp 146 is swung into position so that the cable 125 may be inserted into the slot 145 into position beneath the clamp 146. The clamp 146 is then swung about its pivot 147 to bring its eccentric portion toward the underlying part of the lever 102, and its knurled edge into firm wedging and biting engagement with the cable 125.

In anchoring the cable to the lever 102, this lever is swung into position underlying the sleeve part of the tube bracket 96 and cooperates with the tube bracket 96 through a relatively short radius at 150 to hold the fuse set. The anchorage of the fuse link to the lever 102 is through a relatively long radius at 151, and the fuse is thereby given a mechanical advantage over the spring 104. At the same time, when the fuse blows and the lever 102 is freed, the downward movement of the tube and cover acting on the lever 102 through the relatively short radius and the lever being connected to the fuse link through the relatively long radius, a compound leverage is produced which forms and extends the arcing gap rapidly.

Upon blowing of the fuse, the restraining action of the fuse link is released and the spring 104 moves the fuse tube 90, cover 44 and contact and locking pins 42 downwardly, thereby shortening the distance between the hinge pins 82 and the contact and locking pins 42 and releasing the pins 42 from their contacting and locking engagement with the contact and locking clips 26. The cover 44 is off-center with respect to the hinge mounting of the member 74, so that, when the pins 42 are released from the latch 38, the fuse and cover drop by gravity to the open

position shown in Figure 5. The opening movement is limited by engagement of the inwardly and upwardly disposed pins 82 with the stop 85 on the hinge members 65.

To reset the fuse after blowing, the cover and blown fuse are removed from the housing and a new fuse applied. The fuse and cover are moved upwardly to extended position with respect to the hinge bracket and the tail extension is anchored between the knurled surfaces as previously described. The hinge pins 82 are then inserted into the grooves in the hinge members in the housing and the cover may then be swung to closed position, snapping the pins 42 into locking engagement and firm contact with the clips 26. A circuit is thus established from the upper clips 26 through the pins 42 and upper tube bracket 43, upper fuse terminal 110, strain wire and fuse link assembly 114 and 116, lower fuse terminal 112, stranded conductor 125, lever and latch 102, 146, and lower hinge sleeve or hinge bracket 60 to the lower contact clip 47.

The fuse clears minor, or low current faults, as positively as it clears more severe faults, as during short circuit or heavy overload. Its operation does not require explosive action, but in all cases the instantaneous freeing of the spring 104 establishes a definite and sufficient gap, regardless of the amount of fault current. At the same time, short circuit and heavy overload faults are cleared without attendant danger that excessive pressure may cause destruction of the equipment. Heavy pressures occur within a small cylinder or chamber which is a part of the fuse link, and the tube proper is freely vented. Preheating or corrosion does not deteriorate and result in "causeless" operation of the fuse element, because this element is made of metal which has proved to be vastly superior from the standpoint of its resistance to corrosion and its ability to operate at a higher percentage of its melting point without deterioration. It is not necessary to replace unblown fuse links after an over-current has blown other fuses in the same circuit, and a permanent and exceptional accuracy of fuse ratings is obtained. The time delay characteristic and short arcing time make the fuse exceptionally suitable for selective operation.

In the illustrated embodiment of the invention, the spring 104 and lever means 102 work in the same direction to produce a positive gap and to elongate rapidly the gap, but it is to be understood that the spring and lever means may work in opposite directions within the scope of the present invention.

It is to be understood further that, instead of anchoring the fuse link to the lever 102 by means of the eccentric clamp 146, the link may be anchored by means of a screw, or in any other suitable or preferred manner.

While I have shown and described my invention with reference to the particular details of construction of one embodiment, it is to be understood that the invention may appear in different forms and with numerous modifications and variations such as will suggest themselves to one skilled in the art, and it is to be further understood that I consider all such modifications and variations to be included within the scope of my invention.

I claim:

1. In a fuse, an insulating outer sleeve having spaced terminals, a fuse link connected between said terminals and disposed within said sleeve, and means for producing a positive gap and for extending the gap when the fuse blows, said means comprising lever means and a coaxial coiled spring embracing the outside of the sleeve and reacting against the lever.

2. In a fuse, an outer fuse tube having spaced terminals, there being relative movement between said tube and one of said terminals, a fuse link in the tube, and means for translating the relative movement between said tube and terminal to produce a positive gap and extend said gap when the fuse link blows said means comprising a lever pivoted to the relatively movable terminal, said link being attached to the lever.

3. In combination, a sleeve member constituting a terminal, a fuse tube slidable in said sleeve member, a second terminal for said fuse tube, a bracket for said tube, a compression spring coiled about said tube and reacting between the sleeve member and said bracket to move the tube with respect to said sleeve member, a lever pivoted to said sleeve member, and a fuse link held in electrical connection with said second terminal and adapted to be anchored to said lever for electrical connection with the sleeve member and to restrain said spring.

4. In combination, a fuse link, a pivoted lever, a self energizing clamp pivoted to said lever and having a knurled surface for wedging the link into engagement with the lever to anchor the link to the lever and spring means for placing the link under tension to facilitate parting of the link and for energizing the clamp.

5. In combination, a fuse link, a pivoted lever having a knurled surface, a self energizing clamp pivoted to said lever and having a knurled surface for wedging the link into engagement with the knurled surface of the lever to anchor the link to the lever and spring means for placing the link under tension to facilitate parting of the link and to energize the clamp.

6. In combination, a fuse link, a pivoted lever having a generally L-shaped slot with one leg of said slot opening from one side of the lever to receive said link, cam means in the other leg of said slot for engaging the link to anchor the same to the lever and spring means for placing the link under tension to facilitate parting of the link and to energize the clamp.

7. In combination, a pair of contacts, a fuse for connecting said contacts, said fuse comprising a fuse tube having spaced terminals and being movable relative to one of them, means for locking the fuse to at least one of said contacts, and means for moving the fuse tube longitudinally relative to said one of said fuse terminals to release said locking means.

8. In combination, a pair of contacts, a fuse for connecting said contacts, said fuse comprising a fuse tube having spaced ferrules providing terminals, said tube being movable relative to one of said ferrules, means for locking the fuse to at least one of said contacts, and means for releasing said locking means by relative movement between the fuse tube and said one of the ferrules of said tube.

9. In combination, a hinge member, a bracket member, a fuse having a tube slidable in said hinge member and secured to said bracket member, and means for producing relative movement between the hinge member and the bracket member to form a positive gap and extend said gap when the fuse blows.

10. In combination, a housing, a cover for said housing, a fuse on said cover, said fuse comprising a fuse tube open at one end and having

spaced terminals, locking means for the cover, and means for moving the fuse tube longitudinally to release said locking means.

11. In combination, a housing, a cover for said housing, a fuse on said cover, said fuse comprising a slidably mounted fuse tube having spaced fuse tube terminals adapted to be interconnected by a fuse link within said fuse tube, locking means for said fuse tube, and spring means for producing relative movement between said fuse tube and one of said fuse tube terminals to release said locking means upon parting of said fuse link.

12. In combination, a housing, a hinge member hinged to said housing, a cover for said housing, a pair of tube brackets on said cover, and a fuse tube carried by said brackets and slidably movable in said hinge member.

13. In combination, a housing, a hinge member hinged to said housing, a cover for said housing, a pair of tube brackets on said cover, a fuse tube carried by said brackets and slidably movable in said hinge member, and a compression spring coiled about the tube and reacting between the hinge member and one of said tube brackets.

14. In combination, a housing, a hinge member hinged to said housing, a cover for said housing, a pair of tube brackets on said cover, one of said brackets forming a terminal for a fuse tube, a fuse tube carried by said brackets and slidably movable in said hinge member, a compression spring coiled about the tube and reacting between the hinge member and one of said tube brackets, said hinge member constituting a second terminal for said tube, and a fuse link connected between the terminal forming bracket and the hinge member and adapted to be anchored to restrain said spring.

15. In combination, a housing, a hinge member hinged to said housing, a cover for said housing, a pair of tube brackets on said cover, one of said tube brackets forming a terminal for a fuse tube, a fuse tube carried by said brackets and slidably movable in said hinge member, a compression spring coiled about the tube and reacting between the hinge member and one of said tube brackets, said hinge member constituting a second terminal for said tube, a lever pivoted to said hinge member, and a fuse link held electrically to the terminal forming tube bracket and adapted for anchorage to said lever to restrain said spring in compression.

16. In combination, a slidable fuse tube having spaced terminals and adapted to receive a fuse link for interconnecting said terminals, and a pivoted lever operated through a relatively short radius by the movement of said tube and adapted to be restrained by said link through a relatively long radius normally to restrain sliding movement of said tube and to produce a positive gap and extend the same rapidly upon blowing of the fuse.

17. In combination, a pair of contacts, a fuse for connecting said contacts, hinge means for said fuse, the fuse being slidable relative to said hinge means, means for locking said fuse to at least one of said contacts, and means operable upon blowing of the fuse for sliding the tube endwise relative to said hinge means for reducing the distance between said hinge means and said locking means to release said locking means.

18. In combination, a housing, a cover for said housing, a fuse on said cover, hinge means for said cover, means slidably mounting said fuse on said hinge means, locking means for said cover, and means operable upon blowing of the fuse for reducing the distance between said hinge means and said locking means to release the locking means for said cover.

19. In combination, a housing, a pair of contact clips disposed in transversely spaced relation in said housing and having contacting and locking portions, a hinge member hinged to said housing, a cover for said housing, a pair of tube brackets on said cover, one having a portion movable into position between said clips when said cover is closed, a fuse tube carried by said brackets and slidably movable in said hinge member, a compression spring coiled about the tube and reacting between the hinge member and one of said tube brackets, the other tube bracket having lateral studs electrically a part thereof and engageable with the contacting and locking portions of the clip when the cover is closed, a lever pivoted to the hinge member and operated by the movement of the tube in said hinge member, and a fuse link held electrically to the tube bracket with the lateral studs for engaging said clips and adapted to be anchored to said lever to restrain said spring.

20. In combination, a housing, a pair of contact clips disposed in transversely spaced relation in said housing and having contacting and locking portions, a hinge member hinged to said housing, a cover for said housing, a pair of tube brackets on said cover, one having a portion movable into position between said clips when said cover is closed, a fuse tube carried by said brackets and slidably movable in said hinge member, a compression spring coiled about the tube and reacting between the hinge member and one of said tube brackets, the other tube bracket having lateral studs electrically a part thereof and engageable with the contacting and locking portions of the clip when the cover is closed, a lever pivoted to the hinge member and operated by the movement of the tube in said hinge member, a fuse link held electrically to the tube bracket with the lateral stuls for engaging said clips, and a pivoted wedge member for anchoring said link to said lever.

21. In combination a contact comprising a contact base and a contact clip secured to said base and having a generally goose-neck portion presenting a contact portion along its free end, a pivotally mounted conducting member adapted to swing against said free end to flex the clip, and a fuse for holding said pivotally mounted member in said clip flexing position.

22. In combination a fuse device mounted for swinging motion, said device having a terminal element a contact comprising a contact base mounted adjacent said terminal element, a clip secured to said base and having a generally goose-neck portion presenting a contact portion along its free end, and a contact spring secured to said base and having a generally goose-neck portion nested within the generally goose-neck portion of said clip and bearing against the clip to press the contact portion of the clip to firm engagement with said terminal element, said device comprising fusible means for holding said element in position to be engaged by said contact portion of the clip.

23. In combination, a housing, a hinge member hinged to said housing, a fuse having a tube slidably movable in said hinge member, and a cover for the housing attached to said tube.

24. In combination, a housing, a hinge member

hinged to said housing, a fuse having a tube slidably movable in said hinge member, a cover for the housing attached to said tube, and a spring for moving said tube slidably in said hinge member.

25. In combination, a housing, a hinge member hinged to said housing, a fuse having a tube slidably movable in said hinge member, a cover for the housing attached to said tube, a spring for moving said tube slidably in said hinge member, a fuse link within said tube, and a pivoted lever for anchoring said link and operated by movement of the tube in said hinge member.

26. In a cutout, a housing having opposite side walls, hinge brackets, one on each of said side walls and each having two substantially parallel grooves for engaging a pair of hinge pins, a cover for said housing, a fuse tube on said cover, and a hinge member slidably receiving said tube and having at each of its opposite sides a pair of hinge pins engaging in said grooves.

27. In a cutout comprising a housing, a fuse having a tube and a cover for the housing attached to said fuse tube, the combination of a pair of hinge brackets each adapted for engagement with a pair of hinge pins and each having a pair of tracks, one of which includes means to stop the tube and cover in an open position, and the other having means to take the recoil upon blowing of the fuse and two pairs of hinge pins for the cover, each pair cooperating with one of the hinge brackets.

28. In a cutout comprising a housing, a fuse having a tube and a cover for the housing attached to said tube, the combination of a pair of hinge brackets each adapted for engagement with a pair of hinge pins and each having a pair of tracks arranged to permit lifting the cover and tube from the bracket in an open position and including means for holding the cover and tube against removal in closed position and in movement toward open and closed positions and two pairs of hinge pins for the cover, each pair cooperating with one of the hinge brackets.

29. In a cutout comprising a housing and a cover for the housing, a pair of hinge brackets each provided with two stop means, one to engage against drop-out when the cover is open and the other to engage against recoil when the cover is closed and two pairs of hinge pins for the cover, each pair cooperating with one of the hinge brackets.

30. In a cutout having a fuse and a cover, a pair of hinge brackets arranged to permit lifting the fuse and cover from the bracket in an open position of the cover, and having stop means for taking the recoil and preventing lifting of the tube and cover from the bracket in closed and intermediate positions, the cover having a pair of hinge pins and a pair of stop pins cooperating with said brackets.

31. In a cutout having a fuse, a hinge bracket having a pair of adjacent curved grooves, a member having a pair of hinge pins engaging in said grooves, a track between said grooves and including an upturned stop to prevent said member from dropping out in an open position and permitting lifting of said member from said bracket in open position, a track along the other groove extending upwardly and hooked inwardly to take the recoil upon blowing of the fuse, and a second track along said first groove for forcing one of said hinge pins under the inwardly hooked portion of said last track to prevent lifting the member out of the bracket in closed and intermediate positions.

32. In a device of the class described, a housing having a pair of contacts, a cover for said housing, a fuse on said cover for connecting said contacts in closed position of said cover, means slidably mounting said fuse in said housing, means for locking said cover closed and said fuse to one of said contacts and against sliding movement, and spring means to release said locking means and simultaneously elongate the arc upon blowing of the fuse.

33. In a device of the class described, a housing having a pair of contacts, a cover for said housing, a fuse on said cover for connecting said contacts in closed position of said cover, means slidably mounting said fuse in said housing, means for locking said cover closed and said fuse to one of said contacts and against sliding movement, spring means to release said locking means and simultaneously elongate the arc upon blowing of the fuse, said fuse including a fuse link for restraining said spring means, and a lever for giving the fuse link mechanical advantage over said spring means and operable upon blowing of the fuse to multiply the speed of elongation of the arc.

34. In a fuse, an insulating outer sleeve having spaced terminals, a fuse link connected between said terminals and disposed within said sleeve, a coiled compression spring externally surrounding the sleeve for producing a positive gap and elongating the gap when the fuse blows, said spring being normally restrained by said fuse link, and lever means for giving the fuse link a mechanical advantage over said spring means and operable upon blowing of the fuse to multiply the speed of elongation of the arc.

35. In a fuse, an outer insulating member having a bore of relatively large diameter, a pair of terminals comprising a stationary terminal and a movable terminal and a fusible element connecting said terminals, an inner insulating member having a bore of relatively small diameter closely surrounding said terminals and fusible element, said inner insulating member terminating immediately below the movable terminal and being closed at one end by said stationary terminal and secured to said stationary terminal, and being fully open at the other end to permit free expulsion of the movable fuse terminal and means for moving the movable terminal when the fusible element fuses to lengthen the arc first within the bore of the inner insulating member and later within the bore of the outer insulating member.

36. In a fuse, an outer insulating member having a bore of relatively large diameter, a pair of fuse terminals comprising a stationary terminal and a movable terminal and a fusible element connecting said terminals, an inner insulating member having a bore of relatively small diameter closely surrounding said terminals and fusible element, said inner insulating member being closed at one end by said stationary terminal and secured to said stationary terminal, said inner insulating member terminating below the movable terminal and well within the bore of the outer insulating member and having an open end through which the movable member is adapted to be expelled, and spring means externally of the outer insulating member for moving the movable terminal when the fusible element fuses to lengthen the arc first within the bore of the inner insulating member and later

within the bore of the outer insulating member.

37. In a fuse, an outer insulating member having a bore of relatively large diameter, a pair of fuse terminals comprising a stationary terminal and a movable terminal and a fusible element connecting said terminals, an inner insulating member having a bore of relatively small diameter closely surrounding said terminals and fusible element, said inner insulating member terminating approximately midway of the length of the outer member and being closed at one end by said stationary terminal and secured to said stationary terminal, and being fully open at the other end to permit free expulsion of the movable fuse terminal spring means externally of the outer insulating member for moving the movable terminal when the fusible element fuses to lengthen the arc first within the bore of the inner insulating member and later within the bore of the outer insulating member, and lever means for giving the fusible element a mechanical advantage over said spring means and operable upon blowing of the fuse to multiply the speed of elongation of the arc.

38. In a fuse, an outer insulating sleeve, an inner insulating sleeve having a bore of relatively small diameter, a pair of terminals and a fusible element closely surrounded by the bore of the inner sleeve, means on one of said terminals for anchoring the same upon the adjacent end of the outer sleeve, one end of the inner sleeve being closed by and attached to said latter terminal the other end terminating substantially midway of the length of the bore of the outer sleeve and being open for the free expulsion of the other fuse terminal, means extending from the other terminal outside of said outer insulating sleeve, and spring means externally of the outer sleeve operatively connected to said means extending from said other terminal for moving the same when the fusible element fuses to lengthen the arc first within the bore of the inner sleeve and later within the bore of the outer sleeve.

39. In combination, a fuse tube member, a tube terminal closing one end, a sleeve-like tube terminal member slidable on the other end of the tube, a coiled compression spring embracing the tube and tending to move the sleeve-like terminal member along the tube member, a fuse link in said tube connected at its upper end to the said tube terminal, and a second class lever pivoted at one end to one of the members and anchored at its free end to the fuse link and being engaged intermediate its ends by the other of said members to put the link under tension.

40. In a dropout boxed fuse, the combination of a box having back, side and top walls, the box being open at the front and bottom, a lid for closing the open front, upper and lower line terminals on said back wall, an expulsion fuse tube carried by said lid, tube terminals for said fuse tube adapted to engage said line terminals one closing the upper end of said fuse tube and the other slidably mounting said fuse tube, said fuse tube being biased for sliding movement downwardly through said other tube terminal and adapted to receive a fuse link therein for interconnecting said tube terminals, a lever pivoted on said other tube terminal and restrained by said fuse link as long as it remains intact for holding said one tube terminal in contact engagement with said upper line terminal and preventing said fuse tube from sliding downwardly, and separable hinge means for mounting said lid and fuse tube carried thereby at the lower end of said box whereby they can be detached from said box as a unit for replacing a blown fuse link.

41. In a dropout boxed fuse, the combination of a box having back, side and top walls, the box being open at the front and bottom, a lid for closing the open front, upper and lower line terminals on said back wall, an expulsion fuse tube carried by said lid, tube terminals for said fuse tube adapted to engage said line terminals one closing the upper end of said fuse tube and the other slidably mounting said fuse tube, said fuse tube being biased for sliding movement downwardly through said other tube terminal and adapted to receive a fuse link therein for interconnecting said tube terminals, a lever pivoted on said other tube terminal and restrained by said fuse link as long as it remains intact for holding said one tube terminal in contact engagement with said upper line terminal and preventing said fuse tube from sliding downwardly, the force biasing said fuse tube downwardly acting through said lever to tension said fuse link, and separable hinge means for mounting said lid and fuse tube carried thereby at the lower end of said box whereby they can be detached from said box as a unit for replacing a blown fuse link.

42. In a dropout boxed fuse, the combination of a box having an open front, a lid for closing said open front, an expulsion fuse carried on the inside of the lid, said fuse comprising a tube having an upper terminal for normally closing the upper end of the tube, said terminal being fixed to the tube and having a lower terminal member loosely embracing and slidable on the lower end of the tube, a coil spring encircling the tube and tending to produce movement of the tube relative to the lower terminal, a fuse link for restraining movement of said fuse tube relative to said lower terminal, and a pair of contact springs mounted in the box, one of said springs engaging the upper terminal to hold the lid on the box so long as said fuse link is intact and another of said contact springs engaging the lower terminal member.

43. In combination in a boxed dropout fuse, a box having an opening in its front, a lid for covering said opening, a separable hinge between the lid and the box comprising a box hinge member and a lid hinge member, a fuse carried on the lid, said fuse having a fuse tube with an upper terminal fixed on the upper end of the tube and a lower terminal slidable on the lower end of the tube, a compression spring surrounding the tube for sliding the tube relative to the lower terminal, a fuse link for the tube for connecting said tube terminals, said link when intact holding said spring compressed to keep the tube terminals from approaching each other by expansion of said spring, a spring mounted fixedly in the box and adapted to engage and hold the upper fuse terminal when the fuse tube is in extended position relative to the lower terminal and to release the upper fuse terminal when the tube is in retracted position relative to the fuse terminal, and a spring mounted fixedly in the box and adapted to engage the lower tube terminal, said springs mounted in the box having a fixed spacing relative to the box hinge member and the lower tube terminal having a fixed spacing relative to the lid hinge member.

44. In a fuse device, a mounting comprising a support having an upper contact and a lower contact, said upper contact having a portion

serving as a spring detent, a hinge member on said support, a fuse tube having a closed upper terminal fixed thereupon and provided with a shoulder cooperating with the spring detent portion of the upper contact, a lower tube terminal slidably mounted on the lower end of the tube, a collar on the tube adjacent the lower terminal, a coiled spring surrounding the tube and disposed between the lower terminal and said collar, a fuse link for restraining movement of said tube relative to said lower terminal, and a hinge member fixed relative to said lower tube terminal.

45. The combination of claim 44 wherein said hinge members are separable and have cooperating shoulders to stop the fuse tube when it has travelled through substantially ninety degrees, said hinge members being disengageable only upon raising the fuse tube angularly to disengage said shoulders and lifting the fuse hinge member from the hinge member on the support.

46. The combination of claim 44 wherein the lower terminal member has snubbing means for clamping the lower end of the fuse link, said snubbing means being energized by the action of said coiled spring.

47. In a fuse of the class described, a fuse tube, a fuse link in the tube provided with a terminal lead, a sleeve movable with respect to the tube, a spring for producing relative movement of the sleeve and tube when the link is melted, an arm pivoted to the sleeve and cooperating with the terminal lead for retracting it at an accelerated rate when the link melts, and means on said tube engaging said arm to cause it to swing away from the adjacent end of the tube when the link is melted.

48. In a circuit interrupter, in combination, a first and a second stationary terminal, a fuse tube having fuse terminals and a fuse link therein electrically interconnecting them, one of said fuse terminals being in contact engagement with said first stationary terminal, the other of said fuse terminals comprising a metallic sleeve through which said fuse tube is relatively movable and being electrically connected to said second stationary terminal, and a spring biasing said fuse tube for relative movement through said sleeve, said fuse link being tensioned by said spring and releasing the same on blowing to produce said relative movement for disengaging said one fuse terminal from said first stationary terminal.

49. A circuit interrupting switch structure comprising a housing having an open bottom and having contacts, guiding means mounted within the housing, an arcing tube slidably supported within said guiding means, a spring encircling said tube and urging said tube towards said open bottom, said tube having spaced contacts normally electrically connected to said first mentioned contacts, a flexible conductor in said tube electrically joining said spaced contacts, a lever for releasably latching said tube in operative position, said lever being urged to releasing position by means of said spring and pulling said conductor from said tube when released, and current controlled means for releasing said lever under overload conditions.

50. In a circuit interrupter, in combination, a first and a second stationary terminal, a fuse tube having fuse terminals and a fuse link therein electrically interconnecting them, one of said fuse terminals being in contact engagement with said first stationary terminal, the other of said fuse terminals comprising a metallic sleeve through which said fuse tube is relatively movable and being electrically connected to said second stationary terminal, means providing a hinged support for said sleeve adjacent said second stationary terminal, and means for producing relative movement between said fuse tube and said sleeve in response to blowing of said fuse link to disengage said one fuse terminal from said first stationary terminal and permit said fuse tube to swing with said sleeve about said hinged support.

51. In a circuit interrupter, in combination, a first and a second stationary terminal, a fuse tube having fuse terminals and a fuse link therein electrically interconnecting them, one of said fuse terminals being in contact engagement with said first stationary terminal, the other of said fuse terminals comprising a metallic sleeve through which said fuse tube is relatively movable and being electrically connected to said second stationary terminal, a spring biasing said fuse tube for telescopic movement relative to said sleeve, and a lever pivotally mounted on said sleeve and cooperating with said fuse tube to prevent said relative movement, said lever being biased toward released position by said spring and being restrained by connection of said fuse link thereto at a point remote from its axis of rotation until said fuse link blows and being arranged and adapted to give said fuse link a mechanical advantage over said spring and operable upon blowing of said fuse link to multiply the speed of elongation of the arc.

52. In a circuit breaker, spaced contact terminals, means for mounting a fuse housing connected between said terminals including a hinged support for the fuse housing arranged to provide for longitudinal sliding of the fuse housing relative to the hinged support, latching means for normally holding the fuse housing against such longitudinal sliding, said latching means being arranged to be released by operation of a fuse in the fuse housing thereby to permit longitudinal sliding of the fuse housing, means arranged to be released by longitudinal movement of the fuse housing for holding the fuse housing between said terminals, and means for swinging said housing from between said terminals upon release of said last mentioned holding means.

53. In a circuit interrupter, a container, a closure member therefor pivotally mounted on the container, holding means normally preventing pivotal movement of said closure member, a fuse tube mounted in said container for movement out of said container upon pivotal movement of said closure member, said fuse tube being movable without pivotal movement of said closure member to cause release of said holding means and permit pivotal movement of said closure member, and a fusible member in said fuse tube for controlling the said release movement of the fuse tube.

54. In a fuse device, a housing, a door for said housing pivotally mounted thereon, a fuse tube having a fusible link therein movably supported within said housing, said fuse tube being movable without pivotal movement of said door to cause said door to open, and means controlled by said fusible link for restraining said fuse tube against motion.

55. In a circuit opener, a container, a closure therefor connected by a pivotal connection onto the container, said closure being slidable relative to the container when the closure is in closed position, a fusible element in the container normally preventing said sliding movement but permitting said sliding movement when fused, and

latching means normally holding the closure in closed position, said latching means cooperating with said pivotal connection to hold said closure against rotation about said pivotal connection upon fusion of said fusible element during predetermined sliding movement of said closure and being released following said predetermined sliding movement to enable said closure to rotate about said pivotal connection to the open position.

56. In a circuit interrupter, a housing, a door for said housing, a fuse assembly mounted on said door including a fusible element, pivot means supporting said door and fuse assembly, said door being slidable between predetermined limits with respect to said housing, a control member carried by said door movable between predetermined positions, said control member being restrained in one position by said fusible element for holding said door against sliding movement, biasing means for moving said control member to another position upon fusion of said fusible element to cause said predetermined sliding movement of said door, and latching means for normally holding said door in closed position, said latching means holding said door against rotation about said pivot means upon fusion of said fusible element during a portion of said sliding movement and being adapted to release said door upon the completion of said sliding movement to cause the door to rotate about said pivot means to the open position.

57. In a fuse device, a housing, a door pivotally supported by said housing, said door being slidable relative to said housing when the door is in closed position, stationary contacts within said housing, a fuse tube carried by said door and having a fuse link electrically connecting said stationary contacts, and latch means for holding said door closed, said door being slidably moved with respect to said housing upon rupture of said fuse link for detaching said latching means.

58. In a fuse device, a housing, a door for said housing, pivot means supporting said door for swinging movement with respect to said housing, said door being slidable relative to said housing when the door is in closed position, a fuse tube carried by said door, a fusible link within said fuse tube, latch means normally operative to hold said door closed when the latter is in a predetermined position, and biasing means for sliding said door from said predetermined position to detach said latch means, said fusible link normally restraining said door against movement by said biasing means.

59. In a fuse device, a housing, a door for said housing pivotally mounted thereon, holding means normally preventing pivotal movement of said door, a fuse tube within said housing carried by said door and adapted to be moved out of said housing upon pivotal movement of said door, said door and fuse tube being slidable relative to said housing without pivotal movement of said door to cause release of said holding means and permit pivotal movement of said door to the open position, and a fuse link in said fuse tube for controlling the said release movement of said door and fuse tube.

60. A fuse construction comprising a stationary support having stationary contacts, a fuse tube slidably supported from said stationary support and having an open end, a fuse link within said fuse tube projecting from said open end and normally electrically connecting said stationary contacts, and means controlled by said fuse link and located adjacent the open end of said fuse tube for normally holding said fuse tube against sliding motion and for extracting said fuse link when said fuse link is ruptured, said means having a portion for drawing said fuse link outwardly substantially in line with said fuse tube.

61. A fuse construction comprising a stationary support having stationary contacts, a fuse tube slidably supported from said stationary support and having an open end, a fuse link within said fuse tube projecting from the open end of said fuse tube and normally electrically connecting said stationary contacts, and means biased towards releasing motion normally holding said fuse tube against sliding motion and controlled by said fuse link, said means having motion substantially directly away from the open end of said fuse tube and substantially in line with said fuse tube, said member engaging said fuse link for withdrawing said fuse link from said fuse tube upon rupture of said fuse link.

62. A fuse construction comprising a stationary support having stationary contacts, a fuse tube slidably supported from said stationary support and having an open end, a fuse link within said fuse tube and projecting from the open end thereof, fuse link extracting means having one portion thereof located adjacent the open end of said fuse tube and movable substantially directly outwardly from the open end of said fuse tube in approximate line with said fuse tube for a part of the motion of said fuse link extracting means, said fuse link extracting means engaging the projecting portion of said fuse link, and means for clamping said fuse link to said fuse link extracting means.

63. In a dropout boxed fuse, the combination of a box having back, side and top walls, the box being open at the front and bottom, a lid for closing the open front, upper and lower line terminals on said back wall, an expulsion fuse tube carried by said lid, tube terminals for said fuse tube adapted to engage said line terminals one closing the upper end of said fuse tube and the other slidably mounting said fuse tube, said fuse tube being biased for sliding movement downwardly through said other tube terminal and adapted to receive a fuse link therein for interconnecting said tube terminals, a lever pivoted on said other tube terminal and restrained by said fuse link as long as it remains intact for holding said one tube terminal in contact engagement with said upper line terminal and preventing said fuse tube from sliding downwardly, and separable hinge means for mounting said lid and fuse tube carried thereby at the lower end of said box whereby they can be detached from said box as a unit for replacing a blown fuse link, said hinge means comprising a pair of hinge members secured to said side walls adjacent their lower outer ends and hinge pins detachably cooperating therewith.

64. In a dropout boxed fuse, the combination of a box having back, side and top walls, the box being open at the front and bottom, a lid for closing the open front, upper and lower line terminals on said back wall, an expulsion fuse tube carried by said lid, tube terminals for said fuse tube adapted to engage said line terminals one closing the upper end of said fuse tube and the other slidably mounting said fuse tube, said fuse tube being biased for sliding movement downwardly through said other tube terminal and adapted to receive a fuse link therein for inter-

connecting said tube terminals, a lever pivoted on said other tube terminal and restrained by said fuse link as long as it remains intact for holding said one tube terminal in contact engagement with said upper line terminal and preventing said fuse tube from sliding downwardly, the force biasing said fuse tube downwardly acting through said lever to tension said fuse link, and separable hinge means for mounting said lid and fuse tube carried thereby at the lower end of said box whereby they can be detached from said box as a unit for replacing a blown fuse link, said hinge means comprising a pair of hinge members secured to said side walls adjacent their lower outer ends and hinge pins detachably cooperating therewith.

65. In a fuse, a slidably mounted insulating sleeve having spaced terminals, said sleeve being adapted to receive therein a fuse link for interconnecting said terminals, and means for producing a positive gap and for extending the gap when the fuse link blows, said means comprising lever means disposed transversely of and opposing movement of the sleeve and a spring disposed externally and at one end of said outer sleeve.

66. In a fuse, a fuse tube having spaced terminals, there being relative movement between said tube and one of said terminals, said fuse tube being adapted to receive a fuse link therein for interconnecting said terminals, and means for translating the relative movement between said tube and terminal to produce a positive gap and extend said gap when the fuse link blows, said means comprising a lever pivoted to said one terminal and restrained from movement by said fuse link.

67. In combination, a fuse tube member, a tube terminal closing one end of said fuse tube member the other end being open, a sleeve-like tube terminal member slidable on the other end of the tube, spring means tending to slide said tube member relative to said sleeve-like terminal member, said fuse tube member being adapted to receive a fuse link therein for connection at one end to said tube terminal with the other end of the fuse link extending out of the open other end of said fuse tube member for connection to said sleeve-like tube terminal member, and a second class lever pivoted at one end to one of said members and restrained at its free end by the fuse link and being engaged intermediate its ends by the other of said members to put the fuse link under tension.

68. A circuit interrupting switch structure comprising a housing having an open bottom and having contacts, an arcing tube slidably supported within said housing, spring means urging said tube towards said open bottom, said tube having spaced contacts normally electrically connected to the first mentioned contacts, a flexible conductor in said tube electrically joining said spaced contacts, a lever releasably latching said tube in operative position, said lever being urged to releasing position by said spring means and pulling said conductor from said tube when released, and current controlled means for releasing said lever under overload conditions.

69. A circuit interrupting switch structure comprising a housing having an open bottom and having contacts, an arcing tube slidably supported within said housing, spring means urging said tube towards said open bottom, said tube having spaced contacts normally electrically connected to the first mentioned contacts, a flexible conductor in said tube electrically joining said spaced contacts, a lever releasably latching said tube in operative position, said lever being urged to releasing position by said spring means and pulling said conductor from said tube when released, and current controlled means for releasing said lever under overload conditions comprising a fusible element and a parallel strain element, said strain element relieving said fusible element of stress otherwise applied thereto by said spring means.

70. In a circuit interrupter, in combination, a first and a second stationary terminal, a fuse tube having fuse terminals and a fuse link therein electrically interconnecting them, one of said fuse terminals being in contact engagement with said first stationary terminal, the other of said fuse terminals comprising a metallic sleeve through which said fuse tube is relatively movable and being electrically connected to said second stationary terminal, and a spring biasing said fuse tube for relative movement through said sleeve, said fuse link being tensioned by said spring and releasing the same on blowing to produce said relative movement for disengaging said one fuse terminal from said first stationary terminal, said fuse link including a fusible section and a parallel strain section, said strain section relieving said fusible section of stress otherwise applied thereto by said spring.

71. In a circuit interrupter, in combination, a pair of terminals in insulated spaced relation, and a fuse device for interconnecting said terminals including a fuse tube adapted in its normal position to receive a replaceable fuse link, means slidably mounting said fuse tube, said fuse tube being biased from said normal position and the force biasing said fuse tube being restrained by said fuse link, and a lever restrained in its normal position by said fuse link and biased to an alternate position for withdrawing a remaining portion of said fuse link after the same blows for extending and extinguishing the arc incident to blowing of the fuse link.

72. In a circuit interrupter, in combination, a fuse tube having terminals at its ends and adapted to receive a replaceable fuse link for interconnecting said terminals, one of said terminals closing one end of said fuse tube, the other end of said fuse tube being open, a lever mounted on the other of said terminals and extending across said open end of said fuse tube and having an opening through which said fuse link is passed, and means biasing said lever away from said open end of said fuse tube, said lever being restrained by said fuse link as long as the same remains intact and adapted to withdraw a remaining portion of said fuse link when the same blows substantially in line with said fuse tube.

73. In combination, a slidable fuse tube having spaced terminals and adapted to receive a fuse link for interconnecting said terminals, a lever pivoted to one of said terminals and operated through a relatively short radius by the movement of said fuse tube and adapted to be restrained by said link through a relatively long radius normally to restrain sliding movement of said fuse tube, and an auxiliary lever pivoted on said lever and cooperating therewith to produce a positive gap and extend the same rapidly on blowing of said fuse link.

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