Aug. 29, 1933. N. J. CONRAD 1,924,484

FUSE

Filed March 15, 1930

Fig. 1.

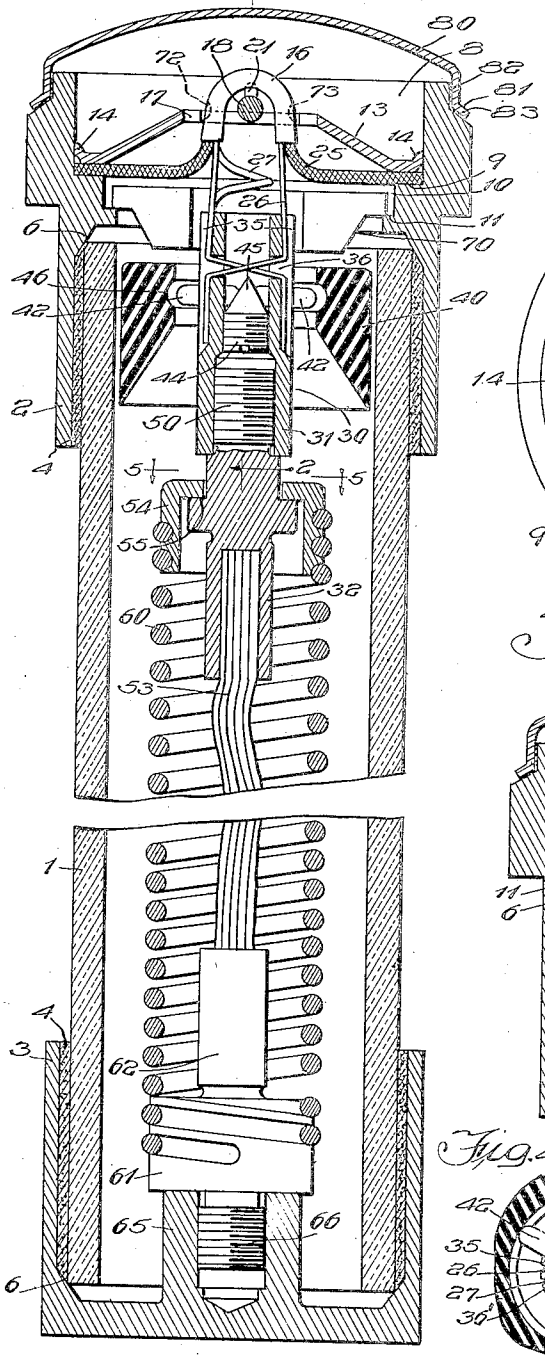


Fig. 3.

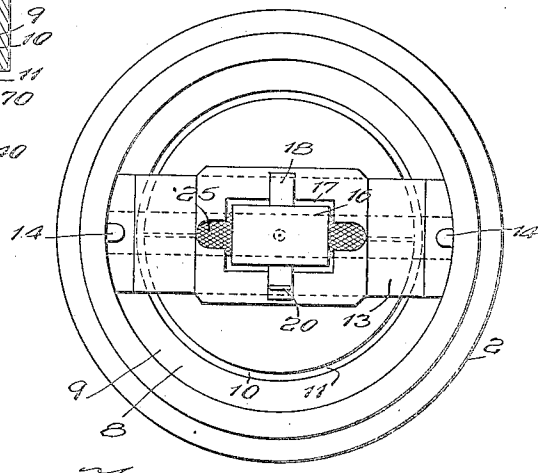


Fig. 2.

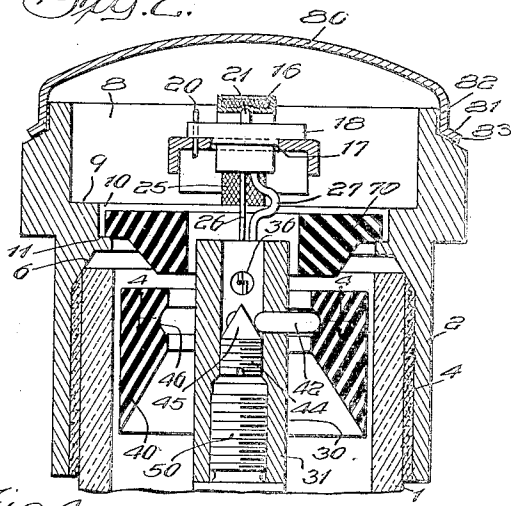


Fig. 4

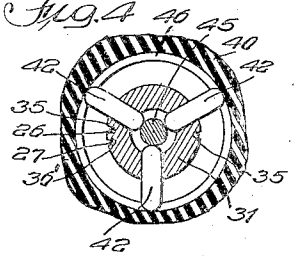
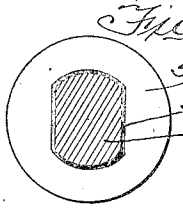


Fig. 5.



Witness:
William P. Kilroy

Inventor:
Nicholas J. Conrad

By Brown Jackson Boettcher & Dremer
Attys

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UNITED STATES PATENT OFFICE

1,924,484

FUSE

Nicholas J. Conrad, Winnetka, Ill., assignor, by mesne assignments, to Schweitzer & Conrad, Inc., Chicago, Ill., a corporation of Delaware

Application March 15, 1930. Serial No. 436,012

35 Claims. (Cl. 200—117)

This invention relates to circuit interrupters and more particularly to such interrupters as are particularly adapted for use on high voltage systems, although not limited to such systems. The circuit interrupter of the present invention is of the fused type, that is it is one wherein the circuit is opened by the blowing of a fuse, and it is one of the objects of the present invention to provide a device of this character which is exceedingly rapid in its action and simple and economical in construction.

In the embodiment of my invention herein described for illustrative purposes the invention is incorporated in a fuse of the well known type comprising a glass tube or container having metallic ferrules at its opposite ends for establishing a circuit through the fuse within. A movable terminal member is mounted within the container and adjacent one end thereof and a spring is provided for rapidly moving it towards the other end upon the blowing of the fuse. The container is filled with an insulating liquid of high arc extinguishing properties into which the arc is drawn by the terminal member as it moves under the action of the spring, thereby quickly extinguishing the arc. This type of fuse is known as the "Schweitzer & Conrad" fuse and one form thereof is shown in the United States patent to Edmond O. Schweitzer and Nicholas J. Conrad Number 1,135,548 issued April 13, 1915. It is however to be understood that the present invention is not limited to such fuse structures but is of general application.

In the fuse herein shown the upper ferrule is provided with a shoulder upon which a bridge member rests, and the movable portion of the fuse is suspended from the bridge member by means of a point suspension to allow for a universal movement of the suspended parts. It is of course understood that any other form of universal joint could be used if desired.

The movable system comprises a terminal to which the fuse is connected and to which a wire is connected for supporting the same. A spring holder is mounted on the terminal and is provided with a helical groove for receiving the end of a coiled spring that pulls upwards on the lower ferrule. It is one of the objects of the present invention to provide a novel and improved means for supporting the terminal and a novel means for connecting the spring to the terminal. Another feature of novelty of the present structure resides in the means for establishing the electrical connection between the fuse and the upper ferrule.

When an arc is quenched by an insulating liquid, such as is here used, some of the liquid is volatilized by the heat of the arc. Since the vapor occupies a greater volume than is occupied by the liquid from which it is generated the pressure within the fuse rises. The amount of liquid volatilized by the blowing of a fuse element in a fuse of a given construction on a line of a given voltage depends upon the amount of current flow being interrupted. In the case of a very large current flow the amount of liquid volatilized may be sufficient to shatter the fuse unless some means is provided for permitting the escape of the vapor. For this reason a vent cap is provided, which vent cap blows when the pressure reaches a predetermined value, that value being below that at which the glass of the fuse would shatter.

The vent cap is sealed to the upper ferrule and it is one of the objects of the present invention to provide an improved means for sealing the vent cap. To prevent the liquid within the fuse from creeping outward along the joint between the cap and the upper ferrule I provide a seal consisting of plastic bakelite or the like, and to prevent the entrance of moisture into the fuse I provide an additional seal of asphaltum. The bakelite constitutes the inner seal and the asphaltum the outer seal, whereby the bakelite prevents the liquid within the fuse from contacting with and attacking the asphaltum.

The attainment of the above and further objects of the present invention will be apparent from the following specification taken in connection with the accompanying drawing forming a part thereof.

In the drawing:

Figure 1 is a longitudinal sectional view of my improved fuse structure;

Figure 2 is a sectional view taken along the line 2—2 of Figure 1;

Figure 3 is a top view of the fuse structure with the vent cap removed;

Figure 4 is a fragmentary sectional view taken along the line 4—4 of Figure 2; and

Figure 5 is a sectional view taken along the line 5—5 of Figure 1.

Referring now more particularly to the drawing, the fuse shown comprises a glass tube 1 the ends of which fit into the upper and lower ferrules 2 and 3 respectively, the ferrules being secured in position by a suitable alloy filling 4 which also serves as a packing for producing a fluid tight closure. While the tube shown is cylindrical in shape and is formed of glass it may, if desired, be made of any other suitable

shape and likewise may be of any other preferred insulating material such as for example, fiber impregnated with bakelite or the like. The ferrules 2 and 3 are made of suitable conducting metal and constitute the terminals for making or breaking a circuit through the fuse. The upper and the lower ferrules are provided, on their inner side, with tapered or conical shoulders 6 for centering the tube 1 and for providing a minimum contacting area between the tube and the ferrules. The top of the upper ferrule 2 has a cylindrical bore 8 formed therein and terminating in a shoulder 9. Beyond the bore 8 there is a cylindrical bore 10 of reduced diameter, which bore terminates in a shoulder 11. The fuse mechanism as a whole is suspended within the tube 1 by means of an upwardly arched bridge 13 that rests upon the shoulder 9. The bridge member fits snugly within the cylindrical bore 8 and is provided at its opposite ends with a pair of upwardly extending projections 14—14 which bear against the cylindrical wall of the bore 8, increasing the depth of cooperation of the ends of the bridge member with the wall of the bore 8 and preventing the bridge member from working up and out of its desired position in the bore 8. The projections 14 may be made by merely stamping a small bulge in the bottom of the bridge member at the ends thereof.

An inverted U-shaped bail member 16 extends through a central opening 17 in the bridge member and is supported by a bridge bar 18 which rests across the opening 17 in the bridge member 13 and which may be held in place by means of a wire cotter pin 20. A very short pin 21 is secured to the bridge bar 18 and constitutes a single point support for the bail member. A shallow spherical depression is formed in the bail member for providing a seat for the bail member on the pin 21. The bail member has complete freedom of motion on the supporting pin 21. The bail member 16 constitutes a short length of copper tubing through which is passed a flexible braided wire 25, of copper or the like, and a strain wire 26 of nichrome or the like, said wire having a high tensible strength and a rather high electrical resistance. The end of a fuse wire 27 is likewise extended into the copper tube. The tube is then flattened in a punch press or the like to firmly secure the braided wire 25, the wire 26 and the fuse 27 in the tube. The flattened tube is then bent to form an arch shape or U-shape member as shown in the drawing. A terminal assembly 30 is supported by the wire 26. The terminal 30 comprises an internally threaded sleeve 31 and a cable securing member 32 secured in the sleeve 31. The terminal 30 is made of brass or other suitable current conducting material. The sleeve 31 has a set of longitudinally extending grooves 35 formed therein and has a hole 36 drilled therethrough near the end of the sleeve.

The strain wire 26 is inserted in the grooves 35, the ends of the wire being passed through the opening 36 in crossed relationship and then again extending into the grooves 35 on the opposite sides of the sleeve member, a similar groove 36' is formed for receiving the end of the fuse link 27. The sleeve is then compressed in a punch press so as to cause the walls of the grooves to come together and firmly grip the ends of the wire 26 and the end of the fuse link 27 in the sleeve member 30. A liquid director 40 is supported by the terminal 30 and for this purpose it has three holes, 120° apart, formed therein. Through these holes three pins or studs 42 are passed. These studs are freely movable within the holes in the sleeve member 31 and when they are fully inserted within the sleeve the liquid director 40 may be passed over the sleeve. After the liquid director has been placed over the sleeve 31 a screw 44 is threaded into the bore of the sleeve 31. The screw 44 is provided with a conical head 45 which forces the pins or studs 42 outward. The liquid director 40 has a groove 46 formed therein and the rounded or spherical ends of the studs 42 enter this groove and thereby support the liquid director in spaced relationship to the terminal. The cable terminal 32 has an upper screw threaded portion 50 which threads into the sleeve 31 and is thereby rigidly secured thereto and a lower hollow portion into which a cable 53 of suitable conducting material is rigidly secured.

A spring fastener 54 rests upon a shoulder 55 formed on the cable terminal 32. The portion of the cable terminal 32 between the top of the shoulder 55 and the lowermost thread of the threaded portion has flattened surfaces 56 as may be seen in Figure 5, and the cable fastener has an opening of a similar shape. As a result of this arrangement the spring fastener is held against rotation. There is a loose fit between the spring fastener 54 and the cable terminal 32, in order to permit a limited amount of side play between the two. In case of deflection of the spring fastener 54 laterally against the tube 1 this play between the fastener 54 and the terminal member 32 will relieve the tube of the inertia of the terminal member 32, to which it would be subjected if the spring fastener and terminal member were rigidly secured together. A helical groove is formed in the spring fastener 54 and said spring fastener is threaded into a helical coiled spring 60. The lower end of the spring 60 is threaded around a spring fastener 61 similar to the spring fastener 54 and secured to or formed integral with a lower cable terminal 62. The lower ferrule is provided with an inwardly extending boss 65 which is bored and internally threaded to receive a threaded portion 66 on the lower end of the cable terminal 62.

A washer 70 of bakelite or other suitable insulating material rests upon the shoulder 11 of the upper ferrule and is provided with a central opening through which the upper terminal 30 extends. The washer is of the split type and consists of two semi-circular halves which lie in the bore 10 and embrace the top of the terminal 30 after the terminal 30 has been assembled.

In assembling the fuse the spring 60 is first threaded into the lower spring holder 61 and the upper spring holder 54 is then placed above the upper cable terminal 30 and is threaded into the top of the spring 60 and then lowered onto the shoulder 55. Thereafter the assembly comprising the upper terminal 30 and the liquid director 40 are threaded onto the threaded portion 50. It is understood that at this time the spring is not under tension and therefore the two cable terminals are drawn rather closely together. The bail 16 is provided with suitable depressions 72 and 73 formed therein for pemitting the gripping of the bail member by a tool whereby the same may be lowered into the tube 1. The mechanism is lowered until the threaded portion 66 on the lower cable terminal enters the bore in the boss 65 of the lower ferrule. The threaded portion 66 is then threaded into the boss by means of a suitable tool. After this has been done the bail 16 is raised by means of the sep-

arate tool gripping the bail at the depressions 72 and 73, although other bail anchoring means may be employed and the bail is lifted until it extends through the opening 17 in the bridge member 13. After the tube is filled with a suitable arc quenching liquid the split collar 70 and the bridge bar 18 are then inserted into place and the bail 16 is thereafter lowered until it rests upon the bridge bar. The flexible braided conductors 25 are previously inserted beneath the ends of the bridge 13 so that the flexible conductor rests upon the shoulder 9 and in turn is pressed downward by the bridge member 13 which seats thereon. When the apparatus is in this position the spring is under a rather great tension and thereby exerts a considerable pressure upon the bridge member 13 which pressure is transmitted through the flexible conductor 25 to the shoulder 9 thereby maintaining a firm electrical contact between the flexible conductor 25 and the shoulder 9. Due to the fact that the bridge member 13 fits rather snugly within the ferrule, as previously stated, any tendency on the part of the bridge member to collapse downwardly under the action of the spring 60 will be resisted by the inner vertical wall of the ferrule and will result in an increase in the pressure of the bridge member against the inner vertical ferrule wall. It is to be noted the pin 21 and the bail 16 provide a universal mounting for the terminal member 30. The universal mounting support permits free movement of the terminal member 30 in all directions. It enables elimination of guide prongs or the like and it eliminates any possibility of kinking of the fuse or strain wire such as might occur with a rigid anchor at the upper end.

The arc extinguishing liquid is preferably introduced into the tube 1 before the split collar 70 is set in place.

The liquid within the tube is of high arc quenching properties. Any suitable insulating liquid may be used. This insulating liquid may comprise carbon tetra-chloride or any of the insulating liquids mentioned in the United States patent to Edmund O. Schweitzer and Nicholas J. Conrad, No. 1,319,907 of October 28, 1919, although any other preferred insulating liquid may be used.

A vent cap 80 is then mounted on the top of the upper ferrule in order to close the top of the fuse. The cap 80 is secured to the outside of the ferrule and is provided with an inclined shoulder 81 which overlies the ferrule. The cap is secured to the top of the ferrule by a suitable cement which, although it may take other forms, preferably consists of a rim of plastic bakelite or the like interposed between the vent cover and the sides of the ferrule as indicated at 82. This substance prevents the egress of the insulating liquid within the tube by creepage along the sides of the ferrule. In order to prevent the entrance of moisture into the tube there is further interposed between the vent cap and the ferrule a layer of suitable cement impenetrable to water. This cement is indicated at 83 and may consist of asphaltum or the like.

The asphaltum is provided due to the fact that moisture can creep into the fuse through the bakelite binder 82 if it were permitted to reach the bakelite. The bakelite 82 acts as an effective stop to prevent the liquid within the tube from reaching the asphaltum since the asphaltum is subject to attack by this liquid.

When an excessively large current flows through the fuse the fuse link 27 melts and, substantially simultaneously therewith the high resistance strain wire 26 likewise melts. The terminal 30 is then snapped downward by the spring 60 thereby drawing an arc between the top of the terminal and the remaining portion of the fuse link extending out of the bail member 16. The liquid director 40 is spaced from the terminal member 31 and is drawn downwardly therewith during its descent. As may be seen from the drawing, the liquid director 40 is provided with a conical opening having its largest diameter bottommost. As the liquid director moves downwardly with the terminal 30 the liquid within the tube 1 squirts through the conical opening, past the space between the liquid director and the terminals, into the region of the arc. This produces a violent agitation of the liquid in the region of the arc, constantly directing fresh, cool liquid into the arc to quickly extinguish it.

During the circuit interruption a certain amount of the liquid within the tube is volatilized. Since the gases that are formed by the volatilization of the liquid occupy a greater space than was occupied by the liquid from which the gases were formed, it is apparent that the pressure within the tube 1 will increase. When the fuse functions to interrupt a very severe short-circuit the amount of gas generated becomes appreciable and unless means is provided for permitting the escape of the gas the resulting pressure will shatter the glass tube and splash the contents and the broken glass around everything. To avoid such an occurrence the cap 80 is not secured to the upper ferrule very tightly, so that when the pressure within the tube becomes excessive the cap will be blown off, thus permitting the escape of the gases generated. Thus the shattering of the glass tube is avoided and with it the scattering of the glass throughout the region of the fuse.

The fuse element is in a substantially separate "explosion chamber" in the ferrule 2 above the split collar 70. Consequently the initial explosive effect upon blowing is substantially confined to the chamber above the collar 70 with the result that on short-circuit or very heavy overload the vent cap blows off before any extensive pressure can develop in the glass tube. When the arcing terminal is drawn down into the liquid the collar 70 is free to rise and this prevents any excessive pressure within the glass tube as the arcing terminal is drawn down into the liquid. Even the initial explosive effect in the chamber above the collar 70 is not transmitted through the ferrule 2 and through the wall of the tube 1, because in use the external shoulder means on the ferrule 2 is preferably seated against the fuse clip or an adjacent shoulder and the explosive effect through the ferrule is taken up by this seating engagement and not transmitted to the wall of the tube.

Upon violent blowing of the fuse, which results in removal of the cap 80, the upper terminal of the fuse, including bridge 13, is freely expelled, inasmuch as the release of the terminal from the spring tension which held it in position releases the grip which it had upon the inner walls of the ferrule. The fuse may be restored for service by unscrewing the sleeve 30 from the stud 50 and replacing the same with a fresh unit, including a new sleeve 30, liquid director 40, bridge 13 and shunting conductor 25, which are then readily dropped into place. The split washer 70, which

likewise was expelled by operation of the fuse, is replaced by a new one. The liquid is replaced with a fresh charge and the device sealed.

While I have herein shown and described a preferred embodiment of my invention it is to be understood that the invention is not limited to the precise construction herein shown but is capable of various modifications, the fuse here shown being merely illustrative of the invention.

What I consider new and desire to secure by Letters Patent is:

1. In a device of the class described, the combination of a tubular casing, a terminal ferrule on the casing, a movable terminal within the casing, a coiled spring normally under tension and connected with the movable terminal, a fuse connected between the movable terminal and the ferrule and means for anchoring said movable terminal under the tension of said spring, said anchoring means having universal mounting on said ferrule and including a bail member supported at a single point and in turn supporting the movable terminal and the fuse.

2. In combination, a frame, a terminal, a fuse connected between said terminal and said frame, a spring connected to said terminal and an anchor for said terminal including a bail member having universal mounting on said frame and a strain wire supporting the terminal from said bail member.

3. A circuit interrupter comprising a casing, a terminal member supported within the casing by means including a universal mounting, a spring exerting a pull on the terminal, a severable connection including a fuse element disposed between the terminal and the universal mounting and a strain wire for relieving the fuse of the spring tension.

4. A circuit interrupter comprising a casing, a bridge member supported in the casing, a terminal member suspended from the bridge member by a severable connection including a strain wire and a single point suspension having freedom of motion in all directions, said strain wire being severed upon the operation of the device to interrupt the circuit, spring means for rapidly separating the terminal from the supporting bridge upon the severing of the circuit, arc quenching liquid within the casing, and a liquid director carried by the terminal for directing the liquid to the point of circuit interruption upon movement of the terminal under the action of the spring.

5. A fuse having a terminal member, a sleeve into which the terminal member is threaded, a bridge member for supporting the sleeve and thereby supporting the terminal member, a joint permitting universal movement of the sleeve with respect to the supporting bridge member, and a fusible element establishing an electrical connection between the terminal and the bridge member and located between them.

6. A fuse comprising a hollow supporting member having embedded therein a connecting conductor, a fuse element, and a strain wire; and a terminal suspended from the supporting member by the strain wire, the other end of the fuse being connected to the terminal, thereby establishing a circuit between the terminal and the connecting conductor.

7. A fuse comprising a hollow supporting member having embedded therein a connecting conductor, a fuse element, and a strain wire; a terminal suspended from the supporting member by the strain wire, the other end of the fuse element being connected to the terminal, thereby establishing a circuit between the terminal and the connecting conductor, and means for pulling the terminal member away from the supporting member.

8. A fuse comprising a hollow supporting member having embedded therein a connecting conductor, a fuse element, and a strain wire; a terminal suspended from the supporting member by the strain wire, the other end of the fuse element being connected to the terminal, thereby establishing a circuit between the terminal and the connecting conductor, means for pulling the terminal member away from the supporting member, and a point support for the supporting member whereby the same has a limited degree of universal motion.

9. A fuse comprising a hollow supporting member having embedded therein a connection conductor, a fuse element, and a strain wire; a terminal suspended from the supporting member by the strain wire, the other end of the fuse element being connected to the terminal, thereby establishing a circuit between the terminal and the connecting conductor, and a joint support for the supporting member whereby the same has a limited degree of universal motion.

10. A fuse including a conducting cylinder having a groove therein, and a fuse wire embedded in the groove and rigidly held in place by compression of the sides of the groove thereon.

11. A fuse including a conducting cylinder having a longitudinal groove therein extending up to the end of the cylinder, and a fuse wire embedded in the groove and rigidly held in place by compression of the sides of the groove thereon.

12. In combination, a terminal having a plurality of grooves therein, wire supporting means for the terminal extending into at least one of the grooves, and a fuse wire extending into another one of the grooves, said fuse wire and said wire supporting means being secured in place by compression of the terminal to force the side walls of the grooves together.

13. A fuse comprising a casing, a fusible element in the casing, a cap for the casing extending over the outer periphery of the casing, said cap being adapted to be blown off of the casing upon an abnormal blowing of the fuse, and an air tight seal between the cap and the outer periphery of the casing, said seal comprising a plastic compound to prevent the leakage of the contents of the tube and a dissimilar compound to prevent the entrance of moisture into the tube.

14. A fuse comprising a casing, a fusible element in the casing, a cap for the casing, said cap being adapted to be blown off of the casing by an abnormal blowing of the fuse, a body of arc quenching liquid within the casing for extinguishing the arc of the fuse, and a seal between the cap and the casing for sealing the same, said seal comprising a compound impervious to the action of the arc quenching liquid on the inner side of the seal for preventing the outward creepage of the liquid, and a compound impervious to moisture on the outer side of the seal for preventing the entrance of moisture into the casing.

15. A fuse comprising a casing, a fusible element in the casing, a cap for the casing, said cap being adapted to be blown off of the casing by an abnormal blowing of the fuse, a body of arc quenching liquid within the casing for extinguishing the arc of the fuse, and a seal between the cap and the casing for sealing the same, said

seal comprising a phenol condensation compound impervious to the action of the arc quenching liquid on the inner side of the seal for preventing the outward creepage of the liquid, and an asphaltum compound impervious to moisture on the outer side of the seal for preventing the entrance of moisture into the casing.

16. A terminal member comprising, a fuse receiving portion, means for supporting said portion, a conductor receiving member threaded into said portion, said conductor receiving member having a shoulder thereon, and a spring fastener mounted on the terminal member and held thereon by the shoulder, said spring fastener having a helical groove therein adapted to be threaded into a coil spring for establishing connections therewith.

17. A circuit interrupter comprising a casing, a bridge member supported in the casing and having a central opening therethrough, a bridge bar extending across said opening, and a terminal suspended from the bridge bar by a single point suspension having freedom of motion in all directions.

18. A fuse device having a retraction spring and a universal support for anchoring said spring under tension, said support including a vertically extending pin having a well rounded upper edge, and a bail member resting thereon.

19. A fuse comprising a tubular member having contact ferrules at its upper and lower ends, means including a fuse link for maintaining an electrical connection between the ferrules, spring means normally under tension and released upon blowing of the fuse link and retractible within the tubular member to produce an extended gap in the connection, and means making a pressure electrical contact with the upper ferrule for establishing the electrical circuit between the fuse link and the upper ferrule, said last named means including a conductor electrically connected to the fuse link, and a transverse member extending across and resting on the conductor within the ferrule and maintaining the pressure contact between the conductor and the ferrule through the action of said spring.

20. A fuse comprising a tubular member having contact ferrules at its upper and lower ends, means including a fuse link for maintaining an electrical connection between the ferrules, spring means normally under tension and released upon blowing of the fuse link to produce an extended gap in the connection, said upper ferrule having a shoulder therein, and means making a pressure electrical contact with the upper ferrule for establishing the electrical circuit between the fuse link and the upper ferrule, said last named means including a conductor electrically connected to the fuse link, and a transverse member extending across and resting on the shoulder within the ferrule and maintaining the pressure contact between the conductor and the ferrule through the action of said spring, said fuse link and spring being supported from the transverse member.

21. A fuse comprising a tubular member having contact ferrules at its upper and lower ends, means including a fuse link for maintaining an electrical connection between the ferrules, spring means normally under tension and released upon blowing of the fuse link and retractible within the tubular member to produce an extended gap in the connection, said upper ferrule having a shoulder therein, and means making a pressure electrical contact with the upper ferrule for establishing the electrical circuit between the fuse link and the upper ferrule, said last named means including a transverse member extending across and resting on the shoulder within the ferrule and mechanically connected with the spring and pulled thereby inwardly of the tubular member and maintaining the pressure contact through the action of said spring, said transverse member being arched upwardly from the shoulder and bearing against the inner vertical side walls of the upper ferrule.

22. A fuse comprising a tubular member having contact ferrules at its upper and lower ends, means including a fuse link for maintaining an electrical connection between the ferrules, spring means normally under tension and released upon blowing of the fuse link to produce an extended gap in the connection, and means making a pressure electrical contact with the upper ferrule for establishing the electrical circuit between the fuse link and the upper ferrule, said last named means including a transverse member extending across and resting within the ferrule and maintaining the pressure contact through the action of said spring, said fuse and spring means being supported from said transverse member by means including a universal mounting.

23. A fuse comprising a tubular member having contact ferrules at its upper and lower ends, means including a fuse link for maintaining an electrical connection between the ferrules, spring means normally under tension and released upon blowing of the fuse link to produce an extended gap in the connection, said upper ferrule having a shoulder therein, and means making a pressure electrical contact with the upper ferrule for establishing the electrical circuit between the fuse link and the upper ferrule, said last named means including a transverse member extended across and resting on the shoulder within the ferrule and maintaining the pressure contact through the action of said spring, said transverse member extending upwardly from the shoulder and bearing against the inner side walls of the upper ferrule, said fuse and spring means being supported from said transverse member by means including a universal mounting.

24. A fuse comprising a tubular member having a contact ferrule at its upper end, a fuse link, spring means normally under tension and released upon blowing of the fuse link to produce an extended gap in the circuit through the fuse, and means making a pressure electrical contact with the ferrule for establishing an electric circuit between the fuse link and the ferrule, said last means including a transverse member extending across and resting upon a shoulder within the ferrule and maintaining the pressure contact through the action of said spring, said transverse member making a snug fit within the ferrule and being arched upwardly from said shoulder with the fuse and spring means located below the transverse member and supported therefrom and pulling the same against the shoulder.

25. A fuse comprising a tubular member having a contact ferrule at its upper end, a fuse link, spring means normally under tension and released upon blowing of the fuse link to produce an extended gap in the circuit through the fuse, and means making a pressure electrical contact with the ferrule for establishing an electric circuit between the fuse link and the ferrule, said last named means including a transverse member extending across and resting upon a shoulder within the ferrule and maintaining the pressure contact through the action of said spring, said

transverse member extending upwardly from said shoulder with the fuse and spring means located below the transverse member and supported therefrom by means including a universal mounting.

26. A fuse including a casing having a ferrule at its upper end, a bridge member supported on the inner side of the ferrule, a fuse link, a movable terminal, means supporting said movable terminal from said bridge member, spring means pulling said movable terminal away from the bridge member and pulling said bridge member inward of the fuse casing, and a conductor extending a circuit between the fuse and the ferrule, said bridge member bearing on the end of said conductor and through the action of the spring exerting a clamping action to clamp the conductor against the ferrule.

27. A fuse including a casing having a ferrule at its upper end, a bridge member supported on the inner side of the ferrule, a fuse link, a movable terminal, means supporting said movable terminal from said bridge member, said bridge member being upwardly arched from its supported ends and said terminal being suspended from the crown of the arched portion, spring means pulling said movable terminal inwardly of the casing and away from the bridge member, and a conductor extending a circuit between the fuse and the ferrule, said bridge member bearing on the end of said conductor and through the action of the spring exerting a clamping action to clamp the conductor against the ferrule.

28. A fuse including a casing having a ferrule at its upper end, a bridge member extending across the open end of the ferrule and supported on the inside thereof with its ends against the inner vertical peripheral wall of the ferrule, means for drawing a gap in the circuit extending through the casing, said means including a spring held under tension and a fuse link for effecting the release of the spring, said spring exerting a pull on the bridge member, and a conductor for extending a circuit from the fuse link to the ferrule, the two ends of the conductor being interposed between the wall of the ferrule and the opposite ends of the bridge member, whereby the pull of the spring on the bridge member produces a pressure contact between the conductor and the ferrule.

29. A fuse including a casing having an open ferrule at its upper end, an upwardly arched bridge member extending across the open end of the ferrule and supported on the inside thereof, and means for drawing a gap in the circuit through the casing, said means including a spring held under tension and a fuse link for effecting the release of the spring, said spring exerting its pull at the crown of the arched portion of the bridge and in a direction inward of the casing, the ends of the bridge member bearing against the inner side of the vertical peripheral wall of the ferrule whereby the ferrule holds the bridge member against being flattened by the action of the spring.

30. A fuse including a casing having an open ferrule at its upper end, an upwardly arched bridge member extending across the open end of the ferrule and supported on the inside thereof, means for drawing a gap in the circuit through the casing, said means including a spring held under tension and a fuse link for effecting the release of the spring, said spring exerting its pull at the crown of the arched portion of the bridge and in a direction inward of the casing, the ends of the bridge member bearing against the inner side of the vertical peripheral wall of the ferrule whereby the ferrule holds the bridge member against being flattened by the action of the spring, and a closure for the open end of the ferrule subject to be opened by internal pressure.

31. A fuse comprising a tubular member having a contact ferrule at one end, a conductor within the ferrule, means for establishing an electric connection between the conductor and the ferrule, said means including a transverse member extending across and resting within the ferrule with its opposite ends upon both ends of the conductor and pressing said conductor against the ferrule, a tension spring within the tubular member mechanically connected to the transverse member by means including a severable connection and exerting the pressure for pressing the conductor against the ferrule, said severable connection between the spring and the transverse member including a fuse connected to the conductor whereby upon blowing of the fuse the spring is retracted from the transverse member.

32. A fuse including a tube of insulation having contact ferrules at its opposite ends, a filling of arc quenching liquid within the tube, the upper ferrule having a shoulder therein at its upper end with the wall of the ferrule extending upward from said shoulder, a bridge member extending across the ferrule and resting against the shoulder with the ends of the bridge member held in position by the upward extending portion of the wall of the ferrule, means establishing an electrical connection between the ferrules, said means including a connecting device suspended from the bridge member by a severable connection including a fuse link, a tension spring secured at one end to the lower ferrule and at its other end to the connecting device and exerting a pull on said device, the pull of the spring being transmitted through the severable connection and the bridge member to the shoulder on the upper ferrule, said connection being severed upon blowing of the fuse, thereby permitting a retraction of the spring to produce an extended gap through the arc quenching liquid to promptly interrupt the circuit between the ferrules.

33. A fuse including a tube of insulation having contact ferrules at its opposite ends, a filling of arc quenching liquid within the tube, the upper ferrule having a shoulder therein at its upper end with the wall of the ferrule extending upward from said shoulder, a bridge member extending across the ferrule and resting against the shoulder with the ends of the bridge member held in position by the upward extending portion of the wall of the ferrule, means establishing an electrical connection between the ferrules, said means including a connecting device suspended from the bridge member by a severable connection including a fuse link, a tension spring secured at one end to the lower ferrule and at its other end to the connecting device and exerting a pull on said device, the pull of the spring being transmitted through the severable connection and the bridge member to the shoulder on the upper ferrule, a conductor interposed between the bridge member and the ferrule and pressed into firm contact with the ferrule by the pull of the spring on the bridge member, said conductor being electrically connected with the fuse link, said severable connection being severed upon blowing of the fuse, thereby permitting a retraction of the spring to produce an extended gap through the arc

quenching liquid to promptly interrupt the circuit between the ferrules.

34. In combination, a fuse housing having a metal ferrule with a longitudinal opening provided with an open end adapted to be releasably closed, a terminal member extending across the longitudinal opening of the ferrule and being supported by engagement with the walls thereof, a fuse under tension connected to the central part of said member, and a low resistance conductor connected at one point to the adjacent end of the fuse, said conductor having an end which is pressed by the terminal bar into good electrical contact with the ferrule to form a shunt about said terminal bar, said terminal bar and conductor being free to be expelled from the ferrule on violent blowing of the fuse.

35. A replacement unit for reconditioning a fuse, comprising an arched terminal bar with a fuse link connected to the central part thereof, shunting connections of low resistance connected centrally to the adjacent end of the fuse and extending under the ends of the terminal bar, and a terminal member connected to the opposite end of the fuse and having a coupling portion for ready connection to or disconnection from a tension spring.

NICHOLAS J. CONRAD.