May 26, 1931. J. H. STARR 1,807,228

ELECTRIC FUSE

Filed Aug. 19, 1929

Fig. 2.

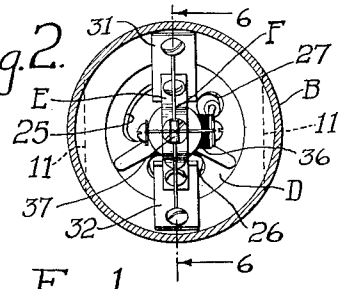


Fig. 5.

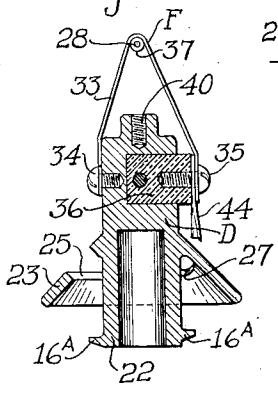


Fig. 1.

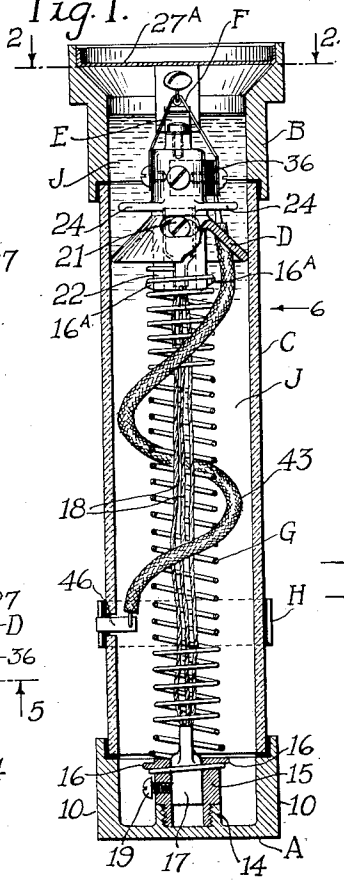


Fig. 6.

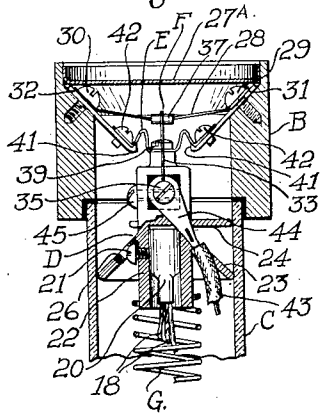


Fig. 4.

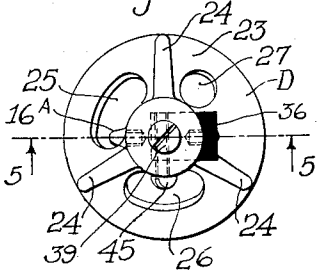


Fig. 8.

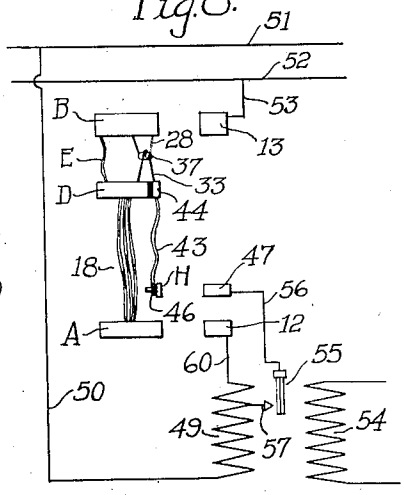


Fig. 7.

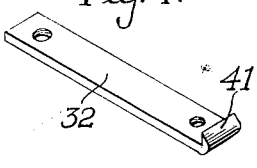
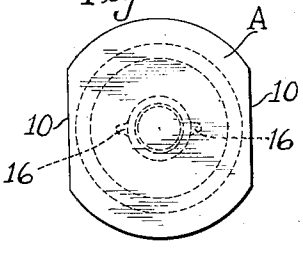


Fig. 3.



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1,807,228

UNITED STATES PATENT OFFICE

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ELECTRIC FUSE

Application filed August 19, 1929. Serial No. 386,791.

The present invenion relates to electric fuses of the type wherein the electric terminals of the fuses are forcibly separated. Sometimes in a fuse of this kind a quenching liquid contained in the fuse casing is projected violently against the resulting arc to extinguish it. Sometimes the quenching liquid is omitted. My invention may be embodied in either form.

There are many kinds of electrical apparatus which require to be protected against short circuits, sudden extra heavy overloads and prolonged and less severe overloads. Transformers should be thus protected and are mentioned here by way of illustration.

There have been efforts to meet these operating conditions by the use of circuit breakers and like expensive equipment. In many cases their cost has prevented any protective equipment of the kind being used.

One object of the present invention is to devise an electric fuse that will perform all these functions. Such a fuse will render the cost of the initial installation much more economical and will afford protection equal to that required of the more expensive control devices.

I believe I am the first to provide a fuse for the purpose stated.

In brief the new structure possesses main circuit terminals and connections, a main fuse strip, and auxiliary branch circuit contacts and connections for actuating the fuse under the prolonged less severe overloads.

Among the features of the invention is a novel fuse strip mounting by which a knife edge severs the strip when the fuse is operated on a prolonged overload. To bring this about the strip is mounted so as normally to have some slack in its length which permits relatively free movement of the separating terminals for some distance before the strip becomes taut. This brings the strip over the knife edge with considerable force which consummates its rupture.

There is also a novel arrangement of thread-like supports for the movable terminal. When these are broken then the spring is free to jerk the terminals apart and with this movement the fuse strip is ruptured.

The crossed wires, constituting these thread-like supports, provide for novel circuits through the fuse. In the embodiment illustrated, the main fuse is paralleled by a current path through the supporting wires while the path for the auxiliary circuit is independent of, or possibly, in some cases, in series with the fuse strip.

The structure has the usual cartridge form but the end caps which serve to connect the fuse with the circuit clips or other contacts on the support must share this function with a third contacting surface in the form of an intermediate ring about the casing. The latter is connected by a flexible electric conductor to a third terminal on the plunger or movable terminal and forms part of the auxiliary control circuit.

For a full understanding of these and other features of my invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, which description and drawing, taken together, disclose the preferred embodiment of the invention. For statements of the scope of the invention attention is directed to the appended claims.

In said drawings, Fig. 1 is a central longitudinal section of a fuse structure constructed and arranged in accordance with the present invention, parts being shown in elevation; Fig. 2 is a transverse section of the same, parts within the fuse at the fuse strip end being shown in elevation, the plane of section being indicated by the line 2—2 of Fig. 1; Fig. 3 is an end elevation of a cap at the opposite end of the fuse; Fig. 4 is a plan view of the plunger or movable fuse terminal; Fig. 5 is a longitudinal section of said plunger, the plane of section being indicated by the line 5—5 of Fig. 4; Fig. 6 is a longitudinal section of the fuse strip end of the fuse structure, parts being shown in elevation, the plane of section being indicated by the line 6—6 of Fig. 2; Fig. 7 is a perspective view of one of the knife edged supports of the main fuse strip; and Fig. 8 is an electrical diagram illustrating the fuse in association with a transformer which it protects. Throughout these views like characters refer to like parts.

Referring to said drawings in detail, A designates a clip-engaging terminal which also forms one end of the fuse structure, B a similar clip-engaging terminal at the other end of the fuse, C glass tubing for completing the cartridge-like casing, D the movable fuse terminal within the casing, E the main fuse strip, F a thread-like support for the terminal D, G a tension spring by which the freed terminal D is drawn away from the member B which constitutes the other fuse terminal of the structure, H an intermediate clip-engaging terminal by which the auxiliary circuit of the fuse is closed, and J the quenching liquid contained in the casing and operative when the fuse is blown to quench the arc formed between the movable terminal D and the fixed terminal B.

As before noted, the structure may be built up for use without the liquid J. In such case the tubing C is preferably made of bakelite or some similar material. However, the structure will be described herein as made for use with the liquid J and the tube C will be a glass tube.

The cap A is snugly fitted against the adjacent end of the tube C, and the parts are cemented together with a suitable cementitious material, such as litharge, or are leaded together with a metallic alloy. The opposite end of the tube C is similarly attached to the terminal B. Parallel surfaces 10, 10 on opposite sides of the cap A are adapted to fit against the spring clips 12 when the fuse is in circuit. Similar surfaces 11, 11 on opposite sides of the terminal B perform a similar function with reference to the spring clips 13. The interior of the cap A is provided with an annular projection 14 which is threaded for the reception of a terminal member 15. The latter is provided with lugs 16 for the reception of one or more turns at one end of the coiled tension spring G. The other end of the coiled spring G is likewise connected to the skirt of the movable terminal D by means of similar lugs 16^a similarly engaging end turns of the spring G. The member 15, being electrically and mechanically connected to the terminal A, is in turn electrically connected to a terminal 17 at one end of a plurality of flexible insulated conductors 18. The terminal 17 closely fits within the bore of the member 15 and is firmly held in place by any suitable means, as a set screw 19. The other end of the conductors 18 is provided with a similar terminal 20 which likewise snugly fits within the bore of the plunger D and is held in place by any suitable means, such as a set screw 21. Thus the cap terminal A is electrically united through the member 15 and the conductors 18 to the movable fuse terminal D.

The fuse terminal D, besides having the inner skirt 22, has an outer flaring flange 23 which has a diameter approximately equal to the internal diameter of the tube C. The member D also has three arms 24 which are adapted to engage at their outer ends with the interior of the tube C. The flange 23 and the arms 24 thus serve as guides for the member D as it is moved in the tube C. Normally the plunger D is held in the position illustrated. This is accomplished by the support F. When so positioned and at rest, the contained fluid extends to a point in the neighborhood of, or slightly above the fuse link E. When the supporting members give way and the plunger D is drawn down by the spring G, then the flange 23, by closely engaging with the walls of the tube C, insures a flow of the liquid J through the openings 25, 26, and 27 formed in the inclined flange 23. By this means the liquid is projected in forceful streams against any arc which may be formed by reason of the rupture of the strip E. Normally the outer end of the terminal B is closed by an end plate 27^a which is flanged at its periphery so as to fit snugly within the bore of the terminal at its outer end. The plate is secured to the terminal at its periphery by jeweler's cement or the like. Besides being weakly secured in place it is itself quite thin. Consequently when the fuse blows, the plate 27^a may be readily dislodged, thereby leaving the top of the terminal open for the escape of gases and products of combustion under pressure.

The cross wire structure F constitutes the main support for the plunger D and it is by means of this structure that the plunger is held adjacent to the fuse terminal B against the tension exerted by the spring G which at this time is stretched and exerts a strong pull upon the member D. The cross wire structure includes a fine strain wire 28 which is secured at its opposite ends to the terminal B by any suitable means, such as screws 29 and 30, which, be it noted, also secure the knife edge members 31 and 32 respectively to the same terminal. A second strain wire 33 passes over the strain wire 28 and is secured at its lower ends to the plunger fuse terminal D. This wire may also be secured in various ways. It is shown as connected at one end to the terminal D by the screw 34 and at the other end by the screw 35 to the insulating block 36 mounted in an opening in the side of the terminal D. A short tube 37 of conducting material encloses the wire 28 and serves as a wearing saddle for the wire 33. It will be seen that the wire 28 is electrically in contact with the terminal B at all times. One end of the wire 33 is likewise electrically connected at all times to the terminal D, but the other end of the wire 33 is electrically connected to the screw 35 which is insulated from the member D by the block 36. The tube 37 is merely used for the purpose of protecting

the wires and preventing the one cutting too readily through the other. This tube also serves as a conductor of electricity between the two wires. The wires 28 and 33 are preferably fine steel wires having high tensile strength. Although this is preferable it will be understood that other like materials may be used in place of steel without departing from the spirit of my invention.

The main fuse E extends between the fuse terminals B and D in two branches. This construction is employed with the intent that when the link E is being cut by the knife edges 41 substantially equal forces are applied to the moving terminal D as a single unbalanced force would tend to cause the terminal D to assume a position not in alignment with the glass tube C with consequent reduction in the speed of operation. Although this is preferable it will be understood that a single fuse link equivalent to one-half of link E as shown may be employed without departing from the spirit of my invention. The two branch connection is brought about by connecting the center of the strip E mechanically and electrically to the top of the plunger D. This may be done by any suitable means, as a screw 39, the latter passing through an opening in the strip and being screwed into a threaded opening 40 in the top of the plunger D. The ends of the strip E are electrically and mechanically fastened to the protruding ends of the supporting members 31 and 32. As clearly shown, the free end of each of the members 31 and 32 is provided with an upturned knife edge 41 over which the strip E extends and adjacent to which it is electrically and mechanically connected by any suitable means, as a screw 42. Adjacent to the knife edges 41 the strip E is bent upward to provide loops on either side of the screw 39 and in this way slack is provided which allows the terminal D to have considerable freedom of movement, in case either of the wires 28 or 33 is broken, before pulling out the slack in the strip E and making the latter taut. When this taut condition is established, the knife edges 41 cut the strip and so break the circuit which would normally flow between the terminals B and D through the strip E.

The auxiliary circuit extends from the screw 35, mounted in the insulating block 36 in the terminal D, through an insulated wire 43 extending to the clip-engaging terminal H. The wire 43 is provided at the end adjacent to the plunger with the terminal 44 through which the screw 35 passes. The block 36 is preferably held firmly within the terminal D by a transverse screw 45 and the end of the wire 43 adjacent to the terminal H is connected to the inner end of a pin 46 which extends through an opening in the tube C and is secured at its outer end to the terminal H by any suitable means, such as solder. In order to properly seal the opening through which the pin 46 passes, a suitable sealing material, such as litharge or a metallic alloy, should be employed.

When the parts are put together in the manner described, the fuse is ready for insertion into the clips 12, 13 and 47 of the supporting structure, the terminal A being between clips 12, the terminal H between clips 47 and the terminal B between clips 13. The clips 12 and 13 constitute the terminals of the main circuit and the clip 47 is included in the auxiliary circuit. As clearly shown, the clip 12 is connected by wire 60 to one end of the primary winding 49 of the transformer T; the other end of the said winding being connected by conductor 50 with supply wire 51. The other supply wire 52 is connected by conductor 53 with clip contacts 13. The secondary winding 54 of the transformer is inductively related to the primary winding 49. Within the transformer is a thermostat 55. This is set to close the auxiliary circuit whenever the transformer overheats. One terminal of the thermostat is connected by conductor 56 to the clip 47 and the other terminal 57 is connected to the winding 49 at a point which will give the necessary potential for the auxiliary circuit. As shown in the diagram, Fig. 8, the fuse is withdrawn from the clips. This was done merely to make the diagram a little clearer.

With the circuit arrangement of Fig. 8 and the fuse in circuit, it will be seen that current will normally flow over a path between the supply wires which may be traced from supply wire 51 through conductor 50, primary transformer winding 49, clips 12, terminal A, strands 18, movable terminal D, fuse strip E, contact B, clips 13 and conductor 53 to the return wire 52 of the supply circuit. It will be noted that the current passing between terminals B and D will pass through the fuse strip E. It will also be seen that there is a path for current between these same two terminals B and D through wire 33, wear saddle 37 and wire 28. In case of a short circuit, there will be a flow of current through the circuit just traced. The fuse strip E, and immediately thereafter one or both of the wires 28 or 33, will be heated to a point of rupture. As a result, the terminal D will be jerked quickly toward the cap A by the spring G. Any arc that was formed between the terminals B and D, will be quenched by the flow of the liquid J through the openings 25, 26 and 27 in the flange 23 of the terminal D.

In case of a heavy overload upon the transformer, the circuit just described will be ruptured in the same way.

On the other hand, if there is a slight overload, but one which continues a long time, injury to the transformer winding might re-

sult if it were not for the presence of the auxiliary local circuit including the thermostat 55. The heating up of the transformer will cause the thermostat to close its circuit at contact 57 and permit current to circulate in the local auxiliary circuit. Such local circuit may be traced from the tapped point in the winding 49 of the transformer T, through thermostat contacts, 57, 55, wire 56, clips 47, contact ring H, post 46, conductor 43, terminal 44, wire 33, main terminal D, conductor strands 18, fuse cap A, clips 12, and wire 60 to the upper terminal of the transformer winding 49. The current circulating in this local circuit will immediately heat the included wire 33 to the point of rupture and terminal D will thereupon be released. It will then promptly respond to the pull of the spring G and draw the strip E sharply against the knife edges 41. The strip E will thus be severed and the circuit opened. In the meantime the liquid J rushing against the parts above the terminal D will promptly quench any arc that might be formed between the terminals.

Where no liquid J is used, the throw of the lower terminal D is relied upon to break the circuit by a separation sufficient to prevent undue arcing.

It will be understood that in carrying out my invention many alterations and changes may be made in the details of the structure illustrated and described without departing from the spirit and scope of my invention. I therefore do not wish to be limited to the exact details disclosed but aim to cover by the terms of the appended claims all those alterations and modifications which rightly come within the spirit and scope of my invention.

What I claim as new and desire to secure by a patent of the United States is:

1. A device of the class described comprising relatively movable electric terminals, a knife edge, a fuse strip electrically joining said terminals and passing with accumulated slack over said knife edge, and means for forcibly drawing upon said fuse strip to take up its slack and bring it sharply against said knife edge to sever said strip.

2. A device of the class described comprising a relatively fixed electric terminal, a relatively movable electric terminal, a knife edge carried by said fixed terminal, a fuse strip electrically uniting said terminals and passing with accumulated slack over said knife edge, and means for moving said movable terminal away from said fixed terminal to take up the slack in said fuse strip and draw it sharply against said knife edge to disrupt said strip.

3. A device of the class described comprising an annular terminal having a central opening therein, supports secured to said terminal and having at their inner ends knife edges spaced apart in said opening, a fuse strip secured to said supports and passing over said knife edges and the space between said knife edges in said opening, the bridging portion of said strip between said knife edges being slack so as to allow considerable movement at its center before becoming taut, a movable terminal secured to said strip in said opening, spring means for drawing said movable terminal away from said annular terminal in the direction of the axis of said opening to draw said strip taut against the knife edges of said supports to serve in disrupting said strip.

4. A device of the class described comprising relatively movable electric terminals, a knife edge, a fuse strip electrically connecting said terminals and movable into engagement with said knife edge to be severed thereby, means for separating said terminals with enough force to sever said strip on said knife edge, and means operative under normal electrical conditions to hold said terminals against separation and under other electrical conditions to free said terminals for separation.

5. A device of the class described comprising relatively movable electric terminals, a knife edge, a fuse strip electrically connecting said terminals and movable into engagement with said knife edge to be severed thereby, a tension spring for separating said terminals, said spring being normally under tension, mechanical means for holding said terminals in normal position with said spring under tension, and electrical connections with said mechanical means responsive to current therein to break the hold of said mechanical means to thereby free said terminals for separation.

6. A device of the class described comprising relatively movable electric terminals, a knife edge, a normally slack fuse strip electrically connecting said terminals and positioned to engage said edge and to be severed thereby when drawn taut, a tension spring normally under tension and operative to separate said terminals when freed, a metal link for mechanically holding said terminals with said fuse strip slack, and connections for said link to supply current thereto to disrupt said link to thereby free said tension spring to separate said terminals and sever said fuse strip.

7. A device of the class described comprising a fixed electrical terminal, a relatively movable electrical terminal, a tension spring to separate said terminals, looped wires mechanically connecting said terminals to hold them against the separating action of said tension spring, an electrical connection to said wires whereby excessive current will rupture at least one of them to free said tension spring to separate said terminals, and other electrical connections whereby current

may be introduced to said wires to rupture at least one of them to free said tension spring to separate said terminals.

8. A device of the class described comprising relatively movable terminals, a wire loop having its ends secured to one of said terminals, a second wire loop passing through said first loop and having its ends secured to the other of said terminals, said loops mechanically holding said terminals in normally spaced relation, means for forcibly separating said terminals when one of said loops is broken, a fusible element calibrated to rupture at a specified current and providing a preferred path for current between said terminals, and electrical connections to one of said loops whereby current may be supplied to produce a break therein by fusion which will free said separating means for action regardless of the condition of said fusible element.

9. A device of the class described comprising relatively movable main terminals, looped wires for mechanically holding said main terminals in spaced relation, means for forcibly separating said main terminals when one of said wires breaks, a third terminal, one of said wires being electrically connected only to one of said main terminals and the other of said wires being electrically connected at one point to the other of said main terminals and at another point to said third terminal, and external contacts for engaging terminal clips on a support, said external contacts being connected respectively to said other main terminal and to said third terminal thus providing a portion of a local protecting circuit through the fuse.

10. A device of the class described comprising a fixed terminal, a cooperating movable terminal, a third terminal mechanically fixed upon and electrically insulated from said movable terminal, a wire loop having its ends secured to said fixed terminal, a second wire loop passing through said first loop and having one end electrically and mechanically connected to said movable contact and its other end mechanically and electrically connected to said third terminal and thereby mechanically connected to said movable terminal, said loops holding said fixed and movable terminals in spaced relation, and means for forcibly separating said fixed and movable terminals when a break occurs in one of said loops.

11. A device of the class described comprising an annular terminal having a central opening therein, a movable terminal in line with the axis of said opening, a wire loop having its ends secured to said annular terminal and spanning said opening, a second wire loop passing through said first loop and having its ends secured to said movable terminal, said loops mechanically holding said terminals in normally spaced relation, a spring acting on said movable terminal and tending to draw it away from said annular terminal, and electrical connections to said loops whereby electric current may be passed through portions of said loops to produce a break therein by fusion which will allow said spring to separate said terminals.

12. A device of the class described comprising an annular terminal having a central opening therein, a second terminal movable in line with the axis of said opening, a third terminal mechanically secured to and electrically insulated from said movable terminal, a first wire loop having its ends secured mechanically and electrically to said annular terminal and spanning said opening, a second wire loop passing through said first loop and having its ends secured mechanically and electrically to said second and third terminals respectively, said loops holding said annular and second terminals in spaced relation, and means for forcibly drawing said movable terminal from said annular terminal when a break occurs in one of said loops.

13. A device of the class described comprising a fixed electrical terminal, a relatively movable electrical terminal, a tension spring to separate said terminals, looped wires mechanically connecting said terminals to hold them against the separating action of said tension spring, electrical connections to said wires whereby electric current may be utilized to rupture them by fusion to free said tension spring to separate said terminals, a normally slack fuse strip electrically connecting said fixed and movable terminals, and severing means for rupturing said strip when stretched tight by said tension spring.

14. A device of the class described comprising relatively movable terminals, a wire loop having its ends secured to one of said terminals, a second wire loop passing through said first loop and having its ends secured to the other of said terminals, said loops mechanically holding said terminals in normally spaced relation, means for forcibly separating said terminals when one of said loops breaks, electrical connections to said loops whereby current may be directed through portions of said loops to produce a break therein which will free said separating means for action, a normally slack fuse strip electrically connecting said terminals, and means for severing said strip when stretched by said separating means.

15. A device of the class described comprising relatively movable terminals, looped wires for mechanically holding said terminals in spaced relation, means for forcibly separating said terminals when one of said wires breaks, one of said wires being electrically connected only to one of said terminals and the other of said wires being electrically connected at one point to the other of said terminals, an electrical connection to

said latter wire at another point, a normally slack fuse strip electrically connecting said terminals, and means for severing said strip when stretched by said separating means.

16. A device of the class described comprising a fixed terminal, a cooperating movable terminal, a third terminal mechanically fixed upon electrically insulated from said movable terminal, a wire loop having its ends secured to said fixed terminal, a second wire loop passing through said first loop and having one end electrically and mechanically connected to said movable contact and its other end mechanically and electrically connected to said third terminal and thereby mechanically connected to said movable terminal, said loops holding said fixed and movable terminals in spaced relation, means for forcibly separating said fixed and movable terminals when a break occurs in one of said loops, a normally slack fuse strip electrically connecting said fixed and movable terminals, and means for severing said strip when stretched by said separating means.

17. A device of the class described comprising an annular terminal having a central opening therein, a second terminal movable in line with the axis of said opening, a wire loop having its ends secured to said annular terminal and spanning said opening, a second wire loop passing through said first loop and having its ends mechanically secured to said second terminal, said loops mechanically holding said terminals in normally spaced relation, a spring acting on said second terminal and tending to draw it away from said annular terminal, electrical connections to said loops whereby current may be directed through portions of said loops to produce a break therein which will allow said spring to separate said terminals, a normally slack fuse strip electrically connecting said annular and second terminals, and means for severing said strip when stretched by said spring.

18. A device of the class described comprising an annular terminal having a central opening therein, a second terminal movable in line with the axis of said opening, a third terminal mechanically secured to and electrically insulated from said second terminal, a first wire loop having its ends secured mechanically and electrically to said annular terminal and spanning said opening, a second wire loop passing through said first loop and having its ends secured mechanically and electrically to said second and third terminals respectively, said loops holding said annular and second terminals in spaced relation, means for forcibly drawing said second terminal from said annular terminal when a break occurs in one of said loops, a normally slack fuse strip electrically connecting said annular and movable terminals, and means for severing said strip when stretched by said drawing means.

19. A device of the class described comprising a fixed terminal, a relatively movable terminal, a spring to separate said terminals, a fuse strip electrically connecting said terminals, looped wires mechanically connecting said terminals to hold them against the separating action of said spring, and an auxiliary terminal mounted upon and insulated from said movable terminal, said looped wires providing a path for current between said fixed and movable terminals in parallel to that providing by said fuse strip, and said wires also providing a path for current between said movable and auxiliary terminals.

20. A device of the class described, an enclosing casing, a fixed fuse terminal, a cooperating movable fuse terminal in said casing, said fixed terminal being at one end of said casing, a cap at the other end of said casing, a terminal ring secured to said casing intermediate of its length, said fixed terminal, cap and ring being adapted for connection to spaced terminals on a support, a coiled spring in said casing connecting said cap to said movable terminal, a third terminal secured to and insulated from said movable terminal, a flexible conductor connecting said cap and movable terminal, an auxiliary flexible conductor connecting said ring and third terminal, both of said flexible conductors lying wholly within said casing, a fuse strip electrically connecting said fixed and movable terminals, and looped wires mechanically and electrically connecting said fixed, movable and third terminals, said wires providing one current path between said fixed and movable terminals in parallel with said fuse strip and another independent current path between said fixed and third terminals.

21. A device of the class described comprising a fixed electrical terminal, a relatively movable electric terminal, a tension spring to separate said terminals, means including a strain wire electrically in circuit between said terminals and mechanically operative to hold said terminals against the separating action of said spring, an electrical fuse connection in shunt to said strain wire path for current whereby excessive current will blow said fuse and then rupture said wire to free said tension spring to separate said terminals, and other electrical connections whereby current may be introduced to said wire to rupture the same to cause a separation of said terminals independently of the action of said fuse connection.

22. A device of the class described comprising relatively movable terminals, means including a strain wire electrically in circuit between said terminals and mechanically operative to hold said terminals in normally spaced relation, means for forcibly separating said terminals when said strain wire is

broken, a fusible element electrically interposed between said terminals and calibrated to rupture at a specified current, said fusible element providing a preferred path alternative to said strain wire path for current between said terminals, and electrical connections to introduce current to said strain wire to produce a break therein by fusion which will free said supporting means for action regardless of the condition of said fusible element.

23. A device of the class described comprising relatively movable electric terminals, means for forcibly separating said terminals, a fuse link and a strain wire providing parallel paths for current between said terminals, said fuse link being calibrated to rupture at a specified current and normally insufficient of itself to mechanically hold said terminals against separation by said separating means, said strain wire being sufficient to mechanically hold said terminals against separation by said separating means and being ruptureable by current therethrough, and a terminal and connections for supplying a rupturing current to said strain wire independently of the rupture of said fuse link.

JAMES H. STARR.

CERTIFICATE OF CORRECTION.

Patent No. 1,807,228. **Granted May 26, 1931, to**

JAMES H. STARR.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 6, line 8, claim 16, after the word "upon" insert the word and; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 14th day of July, A. D. 1931.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.