Aug. 11, 1931. N. J. CONRAD 1,818,382

PRIMARY CUT-OUT

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Fig. 1.

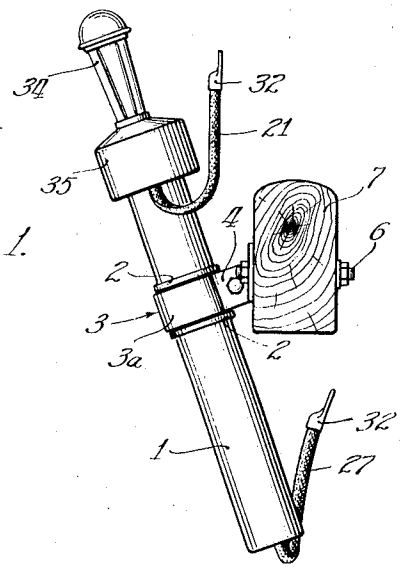


Fig. 2.

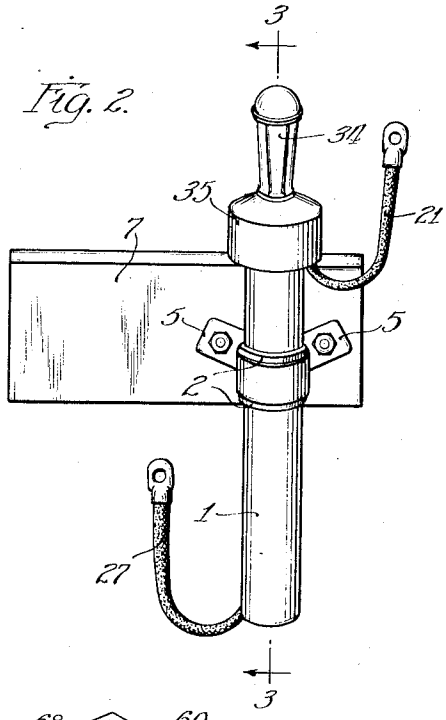


Fig. 9.

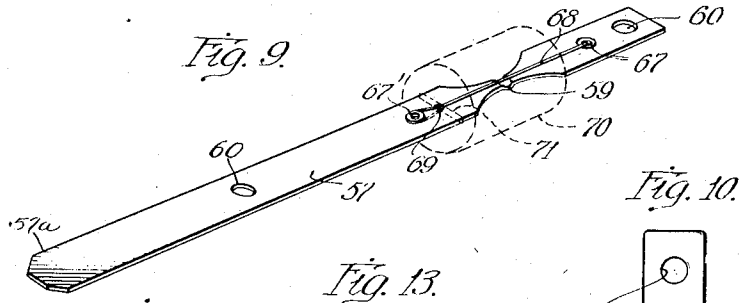


Fig. 10.

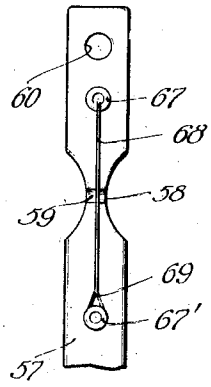


Fig. 11.

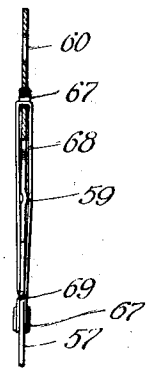


Fig. 13.

Fig. 12.

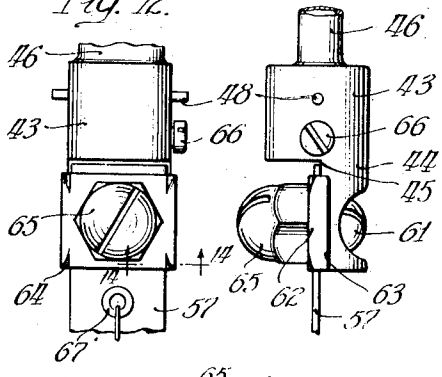
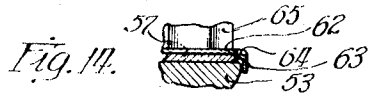


Fig. 14.



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PRIMARY CUT-OUT

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Fig. 3.

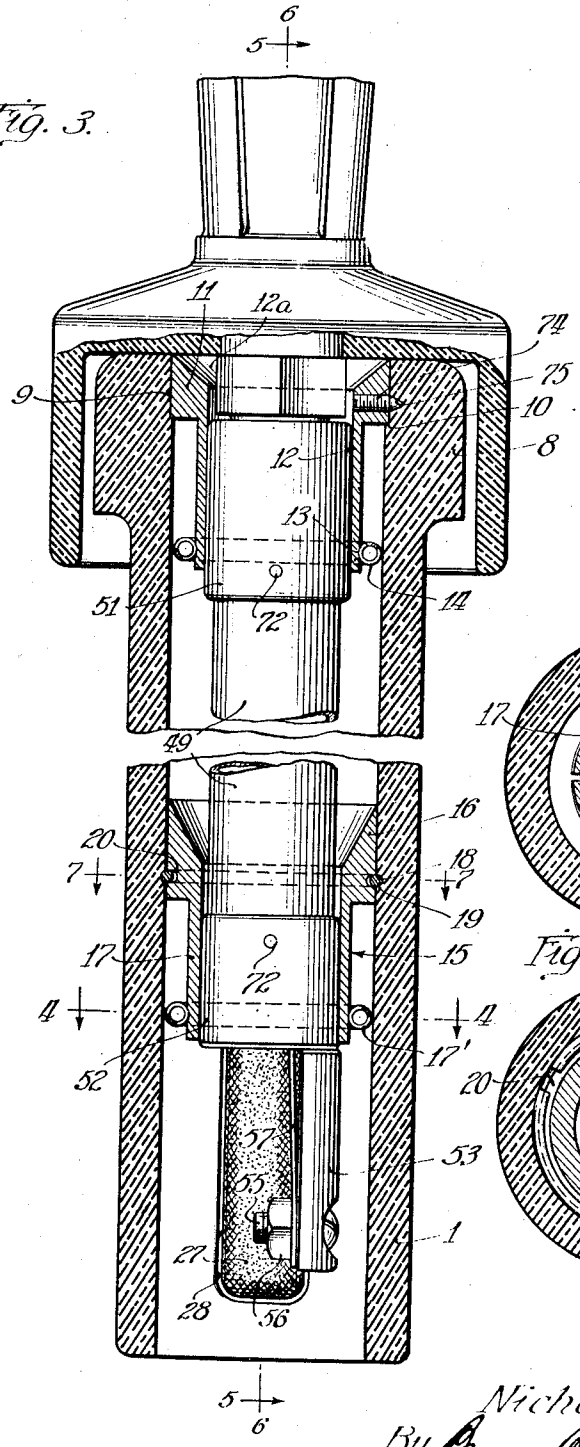


Fig. 8.



Fig. 4.

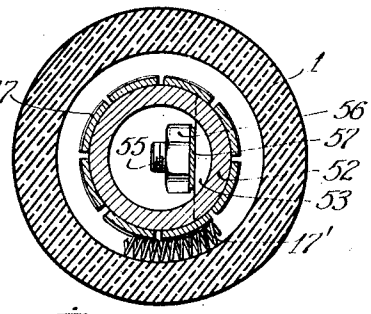
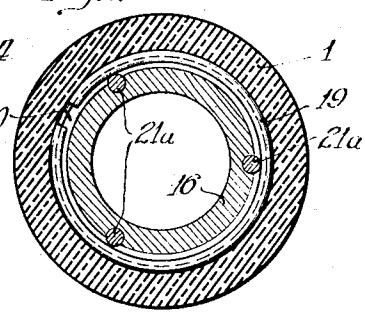


Fig. 7.



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PRIMARY CUT-OUT

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Fig. 5.

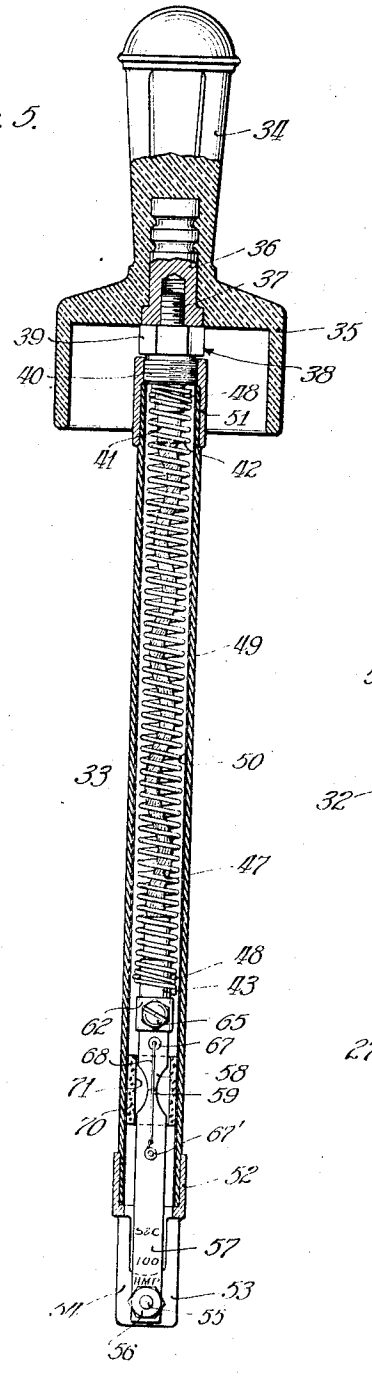
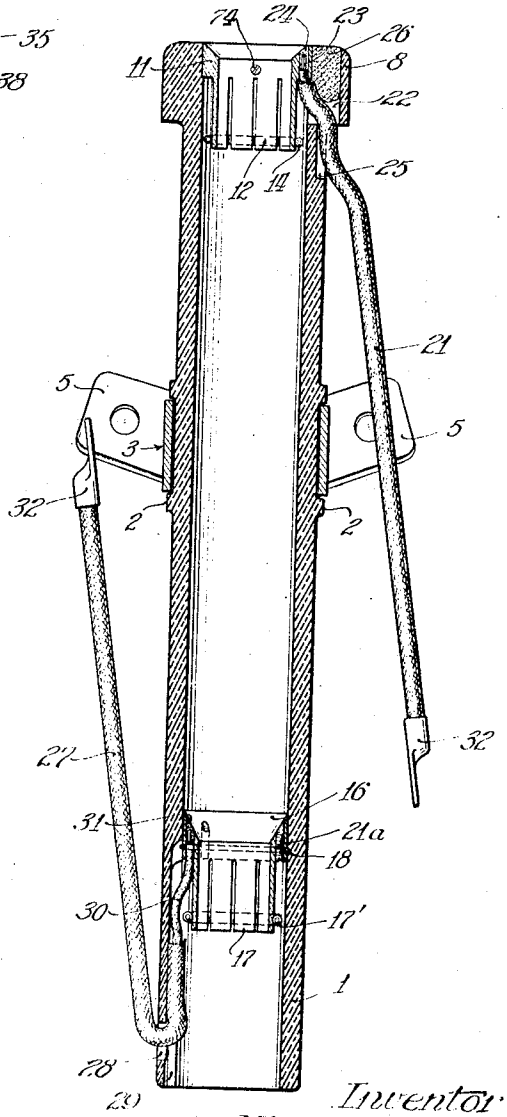


Fig. 6.



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Patented Aug. 11, 1931 1,818,382

UNITED STATES PATENT OFFICE

NICHOLAS J. CONRAD, OF WILMETTE, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO SCHWEITZER & CONRAD, INC., OF CHICAGO, ILLINOIS, A CORPORATION OF DELAWARE

PRIMARY CUT-OUT

Application filed August 1, 1927. Serial No. 209,662.

This invention relates to cut-outs, and more particularly cut-outs adapted for use in the primary circuits of electrical distribution systems.

In distributing systems the current supplied to the primary circuit from the substation or transformer station, as the case may be, may have a potential of from one thousand to sixty-six hundred volts, under present practice. The value of this current may vary from one to two hundred amperes. This current of the primary circuit is stepped down to a suitable voltage by a step-down transformer by means of which current is supplied to the secondary circuit for use as power or for lighting purposes. There are necessarily a comparatively great number of primary transformers in a distributing system which necessitates the use of a large number of cut-outs, each transformer being provided with its individual cut-outs. These cut-outs are commonly mounted upon the cross arms so that the size of the cut-out and its disposition, as well as its cost are all important considerations. It is also very desirable that the cut-out itself be of simple construction and so assembled as to permit ready replacement of parts.

This cut-out is intended more particularly as an improvement over the cut-out disclosed in my patent for primary cut-out, Patent No. 1,466,423 issued August 28, 1923. While the cut-out of my patent is highly satisfactory in many respects, I have found that it is possible to simplify the construction of this cut-out and to increase its efficiency from a practical standpoint. It is, of course, very desirable that proper contact be assured at all times between the clips in the cut-out and the contact members or ferrules, and that excessive spreading of the contact elements of the clips be prevented. With this object I have provided means whereby the contact elements of the clips are urged inwardly into contact with the contact ferrule, this means also serving to limit outward movement of the clip elements beyond normal operative position. I have also provided a simplified and less expensive form of fuse structure, as well as improved means for relieving the fuse element of strain and for securing it to the terminal member which is operated by the tension spring. Further objects and advantages of the improved form of my cut-out will appear from the detailed description.

In the drawings:

Fig. 1 is a side view of the cut-out mounted on a cross arm in position for use;

Fig. 2 is a front view of the cut-out in operative position;

Fig. 3 is a section taken substantially on line 3—3 of Fig. 2, the handle being broken off;

Fig. 4 is a section taken substantially on line 4—4 of Fig. 3;

Fig. 5 is a section through the handle structure and the fuse tube and associated parts taken substantially on line 5—5 of Fig. 3;

Fig. 6 is a section through the housing taken substantially on line 6—6 of Fig. 3;

Fig. 7 is a section taken substantially on line 7—7 of Fig. 3;

Fig. 8 is a detail of the connection between the ends of one of the contact clip springs;

Fig. 9 is a detail perspective view of the fuse strip;

Fig. 10 is a detail face view of the upper portion of the fuse strip;

Fig. 11 is an edge view of the upper portion of the fuse strip partly in section;

Fig. 12 is a detail front view of the lower terminal member and associated parts;

Fig. 13 is a detail side view of the lower terminal member and associated parts;

Fig. 14 is section taken substantially on line 14—14 of Fig. 12 on an enlarged scale.

The cut-out includes a housing 1 in the form of an elongated cylindrical sleeve open at its lower end. This sleeve is provided intermediate its ends, with spaced circumferential flanges 2 which define a recess for the strap portion 3—A of a hanger clamp 3 formed of galvanized steel. Arms 4 extend from the ends of band 3—A and are bent at an inclination to provide fingers 5 which are disposed substantially at right angles to arms 4 laterally thereof and are disposed at an obtuse angle upwardly away from the arms 4. The fingers 5 are provided

with openings for reception of bolts 6 by means of which the hanger is secured to a cross arm 7 so as to support the sleeve housing 1 at an acute angle downwardly toward the cross arm. As will be noted more clearly from Fig. 3, the lower end of housing 1 is open so that, by supporting this housing at the inclination illustrated, any gases evolved in the cut-out due to arcing or blowing of the fuse element will be discharged from the lower end of the housing in a direction away from the lineman. This serves to fully protect the lineman against discomfort and possible injury in inserting or removing the fuse structure of the cut-out.

The upper end of the sleeve housing 1 is thickened to provide a reinforcing flange 8 and the bore of the housing is increased slightly in diameter from the upper end thereof to form a recess 9 having an angular shoulder 10 at its lower end. This recess receives a base ring 11 of a contact clip 12, the ring seating upon shoulder 10. The upper face 12—A of this ring is of frusto-conical shape to facilitate insertion of the fuse member into the clip. The clip further includes a plurality of resilient contact fingers 12 formed integrally with the base ring 11. This ring and the fingers are preferably formed of brass of proper temper to give to the fingers appreciable resiliency.

The fingers 12 are provided in their outer faces with tranverse shallow recesses or grooves 13 of arcuate shape, these grooves being aligned to form, in effect, a continuous annular channel about the fingers of the contact clip. The grooves 13 receive the inner portion of an elastic member, such as a coil tension spring 14 which acts by contractile force to urge the fingers 12 inwardly of the clip. This spring is preferably formed of bronze, or any other suitable or preferred material may be used, or the spring may be replaced by a suitable elastic member which will function in the same manner as the spring. In forming the spring a straight coil, of suitable length is first wound, the last few turns of this coil at one end, being of reduced diameter so as to thread into the turns at the other end of the coil. The coil is then set into circular shape and the reduced turns threaded into the larger end of the coil and secured in position by soldering or in any other suitable manner. This construction is clearly illustrated in Fig. 8. This provides an annular spring of uniform exterior diameter the ends of which are permanently secured together in such manner as to not interfere with the proper operation of the spring as a contractile member for contracting the contact fingers 12 of the clip.

A second contact clip 15 is mounted in housing 1 remote from clip 12. The clip 15 is similar in construction to clip 12 and includes a base ring 16 and resilient contact fingers 17 projecting therefrom and provided in their outer faces with aligned grooves receiving a tension spring 17′ similar to spring 14. The clip 15 is secured in position within the housing by means of a split ring 18 formed of spring wire of suitable gauge. This ring is forced into the sleeve housing 1, as at 19, and engages into a groove 20 formed in the outer face of ring 16. The groove 20 is of greater depth than a semi-circle and receives the ring 18 when this ring is completely closed or contracted so that the ring can lie within groove 20 with its outer face flush with outer face of ring 16. The clip 15 is then inserted into the barrel and properly positioned therein, and the ring 18 is then expanded, thus locking the clip 15 in the housing 1. To expand the ring and prevent displacement of the clip 15, I provide the clip ring 16 with a plurality of locking screws 21*a* which thread through the ring from the lower end thereof, these screws being disposed to intersect the groove 20 and contact with the inner face of locking ring 18 so as to expand the same into locking engagement with the housing sleeve 1. These screws co-act with the ring 19 to positively lock clip 15 in housing sleeve 1 in such manner as to effectually prevent displacement thereof. This construction will be clear from Figures 6 and 7.

A lead 21, preferably of the twin or two wire type, is inserted through an opening 22 in flange 8 of housing 1 and the wires 23 of this lead are inserted in a suitable opening in ring 11 and secured therein in any suitable manner, as by solder 24. To better accommodate the lead 21 housing 1 is provided, in its outer face, with a groove 25 forming, in effect, a continuation of the opening 22. The upper portion of opening 22 is closed by a suitable cement or compound 26 so as to effectually cover the wires 23 and exclude moisture. This method of connecting the lead is clearly illustrated in Fig. 6. A second lead 27, similar to lead 21, extends through an opening 28 provided in housing 1 adjacent the lower end thereof. This lead is then bent into parallelism with the inner face of the housing, the bent over portion of the lead being disposed in a groove 29 extending from the lower end of the housing. The wires 30 of this lead extend into an opening or bore in ring 16 in which these wires are secured in any suitable manner, as by solder 31. Each of these leads is provided at its outer end with a terminal lug 32 by means of which the leads can be readily attached to the circuit wire so as to connect the cut-out in series therewith.

The housing structure and associated parts so far described are adapted for cooperation with a plug structure indicated in its entirety by the reference number 33 (Fig. 5). This plug structure includes the

handle 34 provided at its lower portion with an integral base 35 of cup shape which fits over the upper end of housing 1 and extends downwardly about flange 8, as illustrated in Fig. 3. This member thus serves to effectually prevent the entry of moisture and foreign materials into the housing from the upper end thereof. The handle 34 and base 35, as well as the sleeve housing 1 are molded from an insulation of very high dielectric strength, as well as mechanical strength, which is not affected by the weather. I preferably use for this purpose a product commercially known as "Electrose", though there are several other materials, such as hard porcelain, bakelite or rubber, which would be suitable.

A metallic insert 36, preferably formed of steel or iron, plated or galvanized, is secured in the handle 34 by being molded therein. This insert is suitably bored and threaded for reception of a threaded stud 37 of an upper terminal member 38. This member is formed of a single piece of brass and includes a hexagonal body 39 from the lower end of which extends a reduced threaded neck 40. A reduced tubular element 41 extends from neck 40 and receives the upper end of a tension coil spring 42, the lower end of which fits about a lower terminal member 43. This lower member has its lower portion cut away to provide a semi-cylindrical extension 44 having a flat base 45 (Figs. 12 and 13). A tubular element 46 projects upwardly from the terminal member 44 and receives one end of a stranded copper conductor 47, the other end of which extends into element 41 of the upper terminal member 38. The end portions of the conductor 47 are secured in the elements 41 and 43 by placing such elements in a press and flattening them on the ends of the conductor 47. This conductor is confined within the tension spring 42 and is readily flexible so as to accommodate extension and retraction of the spring. To prevent the ends of the spring from pulling off of the terminal members, stop pins 48 are secured in such members, these pins passing through the end turns of the spring. The conductor 47 serves to carry the current flowing through the cut-out and relieves the spring 42 of any injurious heating effects which might result from omitting the conductor 47 and permitting the current to flow through the spring.

The spring 42 and associated parts are housed in a tube 49. The tube is preferably constructed of layers of different types. Fiber stock paper is wound on a mandrel to a required thickness, then paper impregnated or coated with raw bakelite or similar material is wound upon the first layers to a required thickness. The bakelite or other material is then treated as by baking or hot moulding under pressure, the outer layers becoming a substantially homogenous impregnated mass or layer and the inner layers remaining in their original condition as what is known commercially as fiber. The lining 50 imparts mechanical strength to the tube and enables it to better withstand the arc as it does not so readily carbonize, as well as the strains incidental to withdrawal and insertion of the plug structure into the housing. The outer impregnated layers render the tube weather and moisture proof and prevents warping and swelling.

A brass ferrule 51 is secured on the upper end of tube 49 and projects beyond the same, the upper end portion of this ferrule being interiorly threaded for co-operation with neck 40 of member 38. This provides simple and efficient means for establishing both mechanical and electrical connection between the ferrule and the terminal member 38, and for securing the tube to the handle structure. The ferrule 51 also forms a contact member which co-operates with the upper contact clip 12.

A lower contact ferrule 52 is secured on the lower end of tube 49. This ferrule is formed from a suitable length of brass rod bored out from one end to receive the end portion of tube 49, this rod being cut away for the greater portion of its diameter beyond the ferrule to provide an extension 53 integral with the ferrule and having a flat face 54. This extension 53 is provided with a threaded hole disposed at right angles to face 54, which hole receives a securing screw 55 on which is threaded a nut 56, the screw and nut co-acting to clamp the lower end of the fuse strip 57 to the lower end of extension 53.

The fuse strip 57 is relatively thin and flat and is cut away from either side adjacent its upper end to provide a link element 58 which is quickly fusible relative to the body of the strip and is provided, at its central point, with a slight bend or kink 59. The other end of the fuse strip 57 is secured to portion 44 of terminal member 43 (Figs. 12 and 13). The upper end of strip 57 fits flat against the flat face 45 and is provided with a hole 60 which receives a securing screw 61 threaded through the element 44. A clamping member or washer 62 bears upon the other face of strip 57 and also has an opening receiving the shank of screw 61, this clamping member being provided with lateral flanges 63 which project across the edges of strip 57 and extend about the lateral portions of member 44. Preferably the strip 57 is of less width than face 45 of member 44 (Fig. 12) and the bight portion of member 62 is provided, adjacent to each corner thereof, with a depression forming an inwardly projecting element 64. These elements are disposed to contact with the edges of strip 57 and to align this strip with member 44. A cap or acorn nut 65 is threaded upon screw 61 and bears against the

outer face of clamp member 62, the screw and the nut co-acting to effectually clamp the upper end of the fuse strip and secure it to the lower terminal member 43. Having the strip 57 of somewhat less width than the face 45 of member 44 facilitates assembly though, if desired, the strip 57 can be made of the same width as face 45, in which case the elements 64 will be omitted and the flanges 63 will serve to hold the strip in alignment with member 44. To avoid possibility of turning of member 43, I provide a stop screw 66 therein which is disposed to contact with the adjacent end of spring 42.

The fuse strip 57 connects the lower terminal member 43 and the extension 53 of the lower contact ferrule 52, as clearly illustrated in Figure 5. When this fuse strip is in operative position the spring 42 is under tension and, unless proper provision were made, this strip would be under constant tension throughout its whole length including the link element 58. This would be very objectionable as it would subject the link element to mechanical strain resulting in variation of the rating of the fuse element. Also, it would be impractical to construct a fuse strip having a fuse element of sufficient mechanical strength to withstand the constant strain of the tension spring as the fuse strip is formed of a relatively soft metal or alloy which does not possess great mechanical strength. While the portion of the strip which is of normal or full width is amply able to withstand the mechanical strain to which it is subjected by the tension spring, the link element 58, which is greatly reduced in width, does not possess the desired strength. I have, therefore, provided a strain member which spans the link element 58 and serves to provide a mechanical connection between the upper portion of the strip and the lower portion thereof beyond the ends of link element 58.

Referring more particularly to Figures 10 and 11, I secure two eyes 67 and 67′ through the strip 57 beyond the ends of link element 58. These eyes are of great diameter relative to the thickness of strip 57 and are formed of brass or other suitable material which is appreciably harder than the material of the strip. A strain member in the form of a wire 68 is passed through eye 67, the end portions of this wire being passed through an opening 69 in the strip and wrapped about the projecting end portions of eye 67′, after which this eye is beaded and clinched so as to effectually secure the ends of the wire. The eye 67 is also clinched so as to avoid any sharp edges against the wire and to effectually secure the eye in the strip. The wire 68 is of such length as to take up all mechanical strain between the eyes 67 and 67′ effectually avoiding any strain being transmitted to the link element 58. Wire 68 possesses high mechanical strength and high electrical resistance, this strain member being preferably formed from a suitable length of nickel-chromium wire of small gauge. A closure plug 70, preferably formed of cork or other suitable heat insulating material is provided with a longitudinally extending slit 71 which snugly receives strip 57, this plug being thus slidably mounted on the strip. The plug 70 is somewhat greater in length than the fuse element 58 so that, when this plug is in position, it completely encloses the fuse element so as to form an envelop about the same. The plug thus serves to exclude air from the fuse element and is of very material assistance in choking the arc and serves as a barrier when the fuse blows. This plug also serves to protect the fuse element from the atmosphere so as to prevent oxidation and also acts as an insulator to prevent variations in temperature such as would interfere with the rating of the fuse element, to a large extent. The plug also serves as a reinforcement for the fuse portion to resist bending and twisting. The plug member 70 fits loosely the interior of sleeve 49. In the event the socket member is inserted into the housing when the line is short circuited the gases evolved due to the blowing of the fuse will expel the plug member or cork 70 blowing it out of the lower end of the tube and the housing sweeping the arc out of the tube and quickly killing it and also serving during this operation as an arc barrier between the terminals.

The ferrules 51 and 52 may be secured to the ends of the tube 49 in any suitable or preferred manner. For this purpose I have shown in Fig. 3, screws 72 which pass through the ferrules and are threaded into the sleeve, these screws being ground off flush with the outer faces of the ferrules. For securing the ring 11 of contact clip 12 in the upper end of the sleeve housing 1, I also provide screws 74 which thread through the collar 11 radially thereof, each of these screws being provided with a point 75 which engages into the flange 8 of the housing, these screws co-acting with shoulder 10 to lock the contact clip 11 against movement in either direction.

The contact clips 12 and 15 may be of the same or different sizes. Preferably the clip 12 is of slightly greater interior diameter than the clip 15, the ferrule 52 being of slightly less exterior diameter than ferrule 51. This permits insertion of the plug structure without any binding action between clip 12 and ferrule 52, facilitating insertion and withdrawal of the plug. The springs 14 and 17 act to contract the resilient contact fingers of the clips so as to insure close contact thereof with the contact ferrules. The exterior diameter of these contractile springs is such that, if the lower end of the plug struc-

ture is inserted into the top contact clip and accidentally swung sidewise or at an angle with the housing, the clip fingers are spread by the contact ferrule so that the spring will contact with the inner wall of the housing and will co-act therein as a stop member to limit spreading apart of the fingers of the clip beyond full operative position. This is advantageous in preventing undue spreading of the fingers accidentally as would eventually render close contact thereof with the ferrules impossible. The springs thus act to hold the fingers of the clips in close contact with the ferrules and prevent excessive spreading. While I have shown the contact fingers as provided with grooves or recesses for reception of the inner portions of the spring, these fingers may be otherwise shaped to receive and retain the spring.

As will be noted more clearly from Fig. 9, the opening 60 for reception of screw 55 is remote from the lower end of fuse strip 57. This provides a lower portion 57*a* which projects slightly beyond the lower end of sleeve 49, when this sleeve is screwed onto neck 40 of terminal member 38 with the spring 42 retracted, in assembling. The lower end portion of the strip is then grasped by a pair of pliers and the strip is pulled through the tube to bring opening 60 into alignment with screw 55, and is then moved toward extension 53 to cause the screw to pass through the opening, the strip being then secured in the manner previously described. The projecting portion 57*a* of strip 57 is then trimmed off, as in Fig. 5. The rating of the fuse is preferably impressed in the strip above screw 55, as illustrated. This greatly facilitates assembly of the device and the proper tensioning of the spring 42.

What I claim is:—

1. In a primary cut-out, a housing, contact clips mounted within the housing in spaced relation, a fused plug member insertible into the housing and having spaced contact members co-operating with the clips, and resilient means normally free of the housing for urging the clips closed and co-acting with the housing upon expansion of said resilient means to limit opening of the clips.

2. In a primary cut-out, a housing, contact clips mounted within the housing in spaced relation, a fused plug member insertible into the housing and having spaced contact members co-operating with the clips, and coiled spring means carried by the clips and urging them closed, said means being normally free of the housing and co-acting with the housing upon expansion of said means to limit opening of the clips.

3. In a primary cut-out, a cylindrical housing, contact clips mounted within the housing in spaced relation and each including a plurality of contact fingers disposed in circular arrangement concentric with the housing, said fingers being movable toward and away from one another radially of the clips, a tension coil spring mounted upon the fingers of each clip and urging them toward each other, said spring being of a size to contact with the surrounding wall of the housing and limit spreading apart of the fingers, and a fused plug member insertible into the clips and having contact members co-operating with said clips.

4. In a primary cut-out, a housing, contact clips mounted within the housing in spaced relation and each including a base ring and a plurality of resilient contact fingers secured to the ring concentric therewith and forming cylindrical contact clips, the fingers being provided in their outer faces with aligned grooves, a tension coil spring mounted in the groove of the fingers of each clip, and a plug member insertible into the clips, and having spaced contact members co-operating with said clips.

5. In a primary cut-out, a housing, contact clips mounted within the housing in spaced relation and each including a base ring and a plurality of resilient contact fingers secured to the ring concentric therewith and forming cylindrical contact clips, the fingers being provided in their outer faces with aligned grooves, a tension coil spring mounted in the groove of the fingers of each clip, and a plug member insertible into the clips, and having spaced contact members co-operating with said clips, the convolutions at one end of the spring being reduced in diameter and threaded into and permanently secured to the other end of the spring, the annular spring resulting being of uniform exterior diameter and co-operating with the surrounding wall of the housing to limit spreading apart of the fingers.

6. In a primary cut-out, a housing open at its lower end, spaced contact clips within the housing, a handle structure including a member for enclosing the upper end of the housing, an upper terminal member secured to said handle structure, a lower terminal member, a tension spring connecting the terminal members, an insulating tube having end contact ferrules for cooperation with said clips, the ferrule at the upper end of the tube having electrical and mechanical connection with the upper terminal member, said tube being inserted through the clips and open at its lower end to permit the free passage of gases therethrough, a fuse strip connecting the lower terminal member and the lower contact ferrule, and a closure plug surrounding the fuse strip and fitting loosely the interior of the tube, said plug being free from the tube to be expelled from the lower open end thereof.

7. In a cut-out, a contact member, a terminal member, a fuse strip connecting said members, means urging the terminal mem-

bers, away from the contact members, said strip being provided with a relatively quickly fusible portion forming a fuse link, anchor members of harder material than the strip secured in said strip beyond the ends of the link portion, and a strain member of relatively great strength and high resistance spanning said link portion and secured at its ends to said anchor members.

8. In a cut-out, a contact member, a terminal member, a fuse strip connecting said members, means urging the terminal members away from the contact member, said strip being provided with a relatively quickly fusible portion forming a fuse link, eyelets of harder material than the strip secured through said strip beyond the ends of the link portion, and a strain member passed through one of the eyelets and having its ends secured about the ends of the other eyelet at opposite sides of the strip.

9. In a cut-out, a terminal member having a flat face, a fuse strip having a flat end portion seating flat against said flat face, a clamping member seating on the end portion of the strip and having lateral flanges extending across the lateral edges of the strip and about the lateral portions of the terminal member, and means for forcing said clamping member toward the flat face of the terminal member, the clamping member being further provided at each end and adjacent the flanges with projections contacting with the edges of the strip and holding it aligned with the terminal member.

10. A fuse comprising a strip of fusible material having a portion intermediate the ends thereof of an appreciably reduced cross sectional area, and a strain wire connected to the fuse on the opposite sides of said portion and intermediate the ends of the fuse to relieve that portion of tensile strain.

11. A fuse comprising a relatively thin and flat strip of fusible material having a portion intermediate the ends thereof of an appreciably reduced cross sectional area, said strip having a pair of openings on the opposite sides of said portion and intermediate the ends of the fuse, and a strain wire connected between the said openings to relieve that portion of the fuse of tensile strain.

In witness whereof, I hereunto subscribe my name this 27th day of July, 1927.

NICHOLAS J. CONRAD.