June 13, 1939. H. A. TRIPLETT 2,162,540

FUSE

Filed March 24, 1937

Fig. 1.

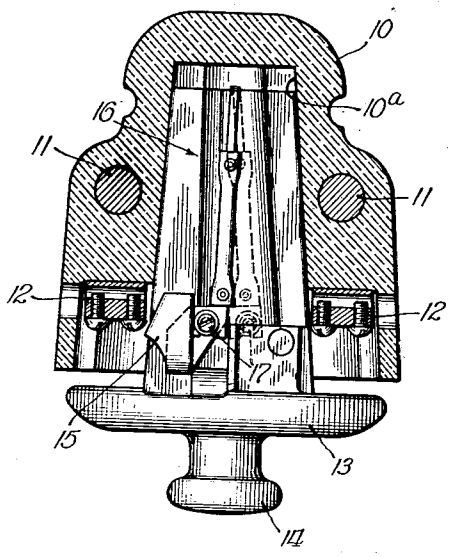


Fig. 2.

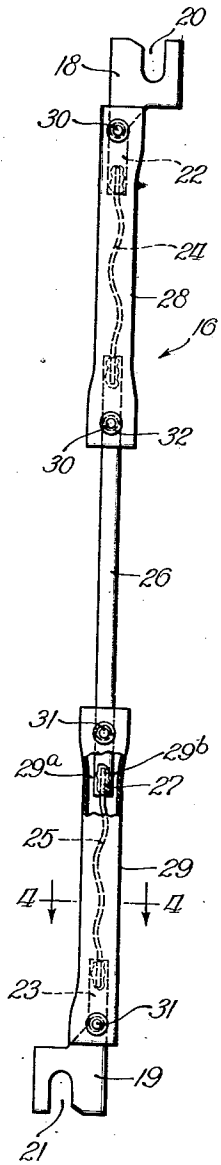


Fig. 3.

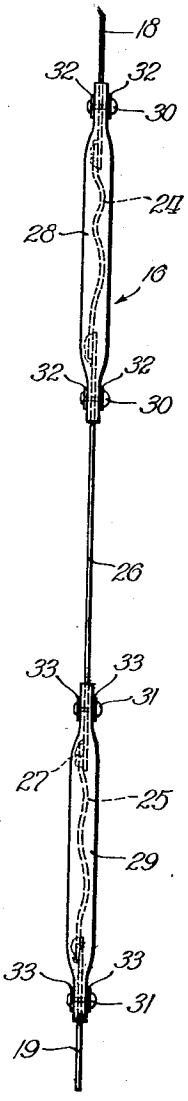


Fig. 4.

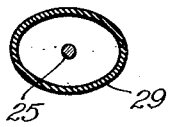
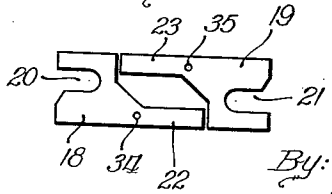


Fig. 5.



Inventor:
Hugh A. Triplett

By: Brown, Jackson & Boettcher
Dennis
Attys.

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UNITED STATES PATENT OFFICE

2,162,540

FUSE

Hugh A. Triplett, Wilmette, Ill., assignor to Schweitzer & Conrad, Inc., Chicago, Ill., a corporation of Delaware

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13 Claims. (Cl. 200—135)

My invention relates, generally, to fuses and it has particular relation to fuse links for installation in plug type cutouts, such as shown in Patent 1,419,114, to P. J. Smith.

In the patent to Smith a plug type cutout is disclosed that comprises a housing having a downwardly opening socket into which a plug is inserted from the under side. The housing is provided with terminals for connection to the line conductors while the plug is provided with terminals for connection to the terminals on the housing. These terminals are formed of copper and are arranged to be interconnected by a fuse link that is composed of aluminum.

Difficulty has been encountered in the use of a plug cutout of this type because of the galvanic action that takes place between the fuse link and the terminals of the plug. In the Smith patent the section of the fuse link adjacent the terminals of the plug was increased to prolong the life of the link but the decrease in section due to galvanic action still takes place. In other types of fuse link formed of zinc and provided with zinc terminals, this galvanic action also takes place between these terminals and the terminals of the plug cutout. Such action is undesirable in these links since it may, in time, reduce the current carrying section of the fuse link adjacent the terminals to such a point that the fuse will blow under normal operating conditions and at a time when no occasion for such action is present.

According to prior art practice, fuse links for a plug cutout of the type shown in the patent to Smith are intended to blow at some point intermediate their terminals. The location of the arc is uncertain and the direction of flow of the resulting gases is indeterminate. Moreover, the adjacent surfaces of the housing and the plug may be rendered conducting by the arc. Since the gases are conducting, they may form a conducting path between the terminals of the plug and increase the likelihood of a flashover therebetween if they flow downwardly.

The object of my invention, generally stated, is to provide an improved fuse link for use in plug type cutouts which may be readily and economically manufactured and installed.

An important object of my invention is to construct a fuse link for plug type cutouts and the like in which the materials employed for the terminals do not cause a reduction in fuse link life because of galvanic action therebetween resulting from the corrosive effects of the surrounding atmosphere.

Another important object of my invention is to provide two gaps in series at definite locations when the fuse link of a plug type cutout blows.

Still another important object of my invention is to provide for the upward flow of arc gases on the blowing of the fuse link of a plug type cutout.

A further object of my invention is to prevent the application of tension stress to the fusible element or elements of a fuse link adapetd for use in a plug type cutout and to avoid damage thereto during handling.

Another object of my invention is to prevent injury to the adjacent surfaces of the housing and plug by the arc or arcs formed on operation of the fuse link which may cause these surfaces to be rendered conducting.

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

My invention, accordingly, is disclosed in the embodiment hereof shown in the accompanying drawing, and it comprises the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the application of which will be indicated in the appended claims.

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

Figure 1 is a sectional view of the housing of a plug type cutout, the plug and a portion of the fuse link being shown in elevation;

Figure 2 is a view, in top plan, of the fuse link shown in Figure 1, certain parts being broken away to more clearly illustrate certain features of construction;

Figure 3 is a view, in side elevation, of the fuse link shown in Figure 2;

Figure 4 is a detail sectional view at an enlarged scale taken along the line 4—4 of Figure 2; and

Figure 5 is a top plan view of the fuse link terminals, showing how they may be punched out with a minimum of waste of material.

Referring now particularly to Figure 1 of the drawing, it will be observed that the reference character 10 designates a housing of a plug type cutout that may be mounted on a cross-arm or the like by bolts 11 extending transversely therethrough. A cutout of this type is ordinarily intended for use in connection with transformers that are mounted on power line poles. The housing 10 is provided with terminals 12 to which the

line conductors may be connected. The housing 10 is provided with a downwardly opening socket 10a into which a plug 13 may be inserted from the lower end. A handle 14 may be formed integrally with the plug 13 to permit insertion and removal thereof. Terminals 15, only one of which is shown, are provided near the base of the plug 13 for connection to the terminals 12 in the housing 10. These terminals are ordinarily formed of copper. The foregoing described plug type cutout shown in Figure 1 is identical with that shown in the patent to Smith, referred to hereinbefore.

My invention is related to the construction of the fuse link that is shown generally at 16 and which may be connected to the copper terminals 15 by screws 17. As shown, the fuse link 16 extends from opposite sides of the base of the plug 13 and over its upper end.

The details of construction of the fuse link 16 are more clearly illustrated in Figures 2, 3 and 4, to which reference will now be had. As there shown, the fuse link 16 comprises terminals 18 and 19 having slots 20 and 21 therein for receiving the screws 17. The terminals 18 and 19 are provided with shanks 22 and 23 to which fusible elements 24 and 25 may be connected. The ends of the fusible elements 24 and 25 are interconnected by a conductor 26 in the form of a strap that may be readily bent over the upper end of the plug 13.

Since the terminals 15 on the plug 13 are formed of copper, I also construct the terminals 18 and 19 of copper. The conductor 26 is also formed of copper. The terminals 18 and 19 and the conductor 26 are preferably tinned and the ends 22 and 23 of the terminals 18 and 19 and the ends of the conductor 26 are pinched to form trough-like portions for receiving the ends of the fusible elements 24 and 25. These elements are soldered, as indicated at 27, in these trough-like portions. The fusible elements 24 and 25 are formed preferably of tin wires. The diameter of these tin wires will vary, depending upon the rating of the fuse link, as will be readily understood.

Since the terminals 18 and 19 are formed of copper and the terminals 15 to which they are attached are likewise formed of copper, no galvanic action resulting from the corrosive effects of the surrounding atmosphere can take place therebetween because they are formed of like metals. There is then little likelihood of any reduction in section of the fuse link taking place and its current carrying capacity remains substantially the same throughout its life.

With a view to protecting the fusible elements 24 and 25 from any tension stress that might otherwise be applied thereto by pulling apart of the terminals 18 and 19, and to protect them during handling, strain members 28 and 29 in the form of insulating tubes or sleeves composed of rolled paper or fiber are provided surrounding them, and they are mechanically connected to the terminals 18 and 19 and the adjacent ends of the conductor 26 by rivets 30 and 31, as illustrated. The rivets 30 and 31 are formed preferably of copper and washers 32 and 33 are provided underneath the headed ends thereof to secure the sleeves 28 and 29 in position. The diameter of the sleeves 28 and 29 and the width of the terminals 18 and 19 are so chosen that, when the ends of the former are flattened onto the latter, these ends are substantially closed. The other ends of the sleeves 28 and 29, when flattened onto the ends of the conductor 26, form vents 29a and 29b, as shown in Figure 2 to readily permit the escape of gases therethrough, which gases may be generated on blowing of the fusible elements 24 and 25. In assembling the fuse link 16 the fusible elements 24 and 25 are provided of such length that a slight amount of slack is present, as indicated. When the sleeves 28 and 29 are secured in position by the rivets 30 and 31, no tension stress will be applied to the fusible elements 24 and 25 when the terminals 18 and 19 are pulled apart.

As illustrated in Figure 5 of the drawing, the terminals 18 and 19 may be formed from a single blank with the necessary portions being punched out or otherwise removed to provide the desired shape. Holes 34 and 35 may be formed during this operation for receiving the rivets 30 and 31. In this manner a minimum of scrap loss results in the manufacture of the terminals 18 and 19.

When the fuse link 16 is in position on the plug 13, it will be observed that the fusible elements 24 and 25 are positioned below the upper end of the plug 13. Because of the fact that two fusible elements are provided, two gaps are provided in the circuit on blowing of the fuse link 16. This is in contradistinction to the provision of only a single gap when the fuse links of the prior art are used. The two gaps make it possible for the cutout to more readily extinguish the arcs incident to the blowing of the fuse link 16 and, consequently, increased its interrupting capacity.

Another important result that is obtained when the two fusible elements are employed and located as illustrated, is that the gases formed by the blowing of the fusible elements 24 and 25 are directed upwardly in the socket 10a by the sleeves 28 and 29. As a result all of the products of the arcs are not directed downwardly to form a conducting path between the terminals 15 of the plug 13.

In the prior art constructions, as indicated hereinbefore, only a single arc is formed and its location is indeterminate. In such case the gases formed by the arc may flow directly downwardly and the undesired conducting path between the terminals 15 of the plug 13 may be formed. It will be obvious that this disadvantage has been overcome in the construction and arrangement of the fuse link 16.

There are, generally, three conditions under which the fuse device disclosed herein may be called upon to operate. These are: a slight overload condition; a heavy overload condition; and a short circuit condition.

When the fusible elements 24 and 25 are composed of tin, as herein disclosed, under slight overloads, they are melted slowly and a chemical reaction takes place as a result of which they are converted to a tin oxide. This change takes place quitely and with substantially no generation of gases, and the sleeves 28 and 29 are not ruptured.

Under heavy overload conditions, such as current flows of 50 to 100 amperes, appreciable quantities of gas are evolved inside the sleeves 28 and 29 and the air inside of them is also heated, thereby creating pressure. Because of the vents, such as the vents 29a and 29b, in the upper ends of the sleeves 28 and 29, when the link 16 is disposed in operative position as shown in Figure 1, and the closed lower ends, a blast action takes place which assists in extinguishing the arcs. The hot gases thus evolved are released

into the upper end of the socket **10***a* into which the plug **13** extends and, by the time they have reached the lower end of the socket, where the terminals **12** and **15** are located, they are sufficiently cooled and deionized to prevent a flashover between these terminals. Under such operating conditions there may be appreciable generation of gases but the sleeves **28** and **29** may remain intact.

Because of the connection of fuse devices of the type disclosed herein near the ends of feeder circuits, with considerable impedance between them and the power source, the chances of flow of extremely high short circuit currents are slight. However, these devices may be called upon to interrupt short circuit currents of the order of 800 amperes. In such case the sleeves **28** and **29** are ruptured and the fusible elements **24** and **25** are immediately disintegrated.

It will be observed that the insulating sleeves **28** and **29** perform several useful functions. They not only provide a mechanical support for the fusible elements **24** and **25** but they also prevent damage thereto while the links are being carried about in the lineman's truck or repair kit. Arcs formed therein are prevented from contacting the adjacent surfaces of the housing **10** and the plug **13** which are ordinarily formed of porcelain and which may become conducting when subjected to the action of the arc. Because of the vents at the upper ends and the closed lower ends, the sleeves **28** and **29** direct the products of the arcs upwardly, thereby giving them a chance to cool before they are vented out of the lower end of the housing **10**.

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

I claim as my invention:

1. A fuse link for mounting on the plug of a plug type cutout comprising, in combination, a pair of terminals disposed to be secured to the base of said plug, a relatively infusible conductor disposed over the upper end of said plug intermediate said terminals, a pair of fusible elements electrically interconnecting each of said terminals with the adjacent ends of said conductor, and a tubular insulating sleeve surrounding each of said fusible elements and mechanically interconnecting each of said terminals with the adjacent ends of said conductor.

2. A fuse link for mounting on the plug of a plug type cutout comprising, in combination, a pair of terminals disposed to be secured to the base of said plug, a relatively infusible conductor disposed to be positioned over the upper end of said plug and to extend downwardly along the sides thereof, and a pair of fusible elements interconnecting said terminals and the adjacent ends of said conductor a substantial distance below the upper end of said plug whereby two gaps are formed in series on blowing of said fuse wires.

3. A fuse link for mounting on the plug of a plug type cutout comprising, in combination, a pair of terminals disposed to be secured to the base of said plug, a relatively infusible conductor disposed to be positioned over the upper end of said plug and to extend downwardly along the sides thereof, a pair of fusible elements interconnecting said terminals and the adjacent ends of said conductor below the upper end of said plug whereby two gaps are formed in series on blowing of said fusible elements, and a pair of strain members in the form of sleeves of insulation surrounding said fusible elements and attached to said terminals and said ends of said conductor in such manner as to prevent the application of tension stress to said fusible elements.

4. A fuse link for mounting on the plug of a plug type cutout comprising, in combination, a pair of tinned copper terminals disposed to be secured to the base of said plug, a relatively infusible tinned copper strap disposed to be positioned over the upper end of said plug intermediate said terminals, and a pair of tin fuse wires interconnecting said terminals and the adjacent ends of said strap a substantial distance below the upper end of said plug whereby two gaps are formed in series on blowing of said fuse wires.

5. A fuse link for mounting on the plug of a plug type cutout comprising, in combination, a pair of tinned copper terminals disposed to be secured to the base of said plug, a relatively infusible tinned copper strap disposed over the upper end of said plug intermediate said terminals, a pair of tin fuse wires soldered to said terminals and to the adjacent ends of said strap for interconnecting them below the upper end of said plug whereby two gaps are formed in series on blowing of said fuse wires, and a fiber sleeve surrounding each of said fuse wires and riveted to said terminals and said ends of said strap.

6. A fuse link comprising, in combination, a pair of terminals, a pair of fusible elements each connected to a terminal, a conducting element connecting said fusible elements in series circuit relation, and an insulating sleeve surrounding each of said fusible elements and arranged and adapted to direct the gases generated therein on occurrence of an arc away from the terminal individual thereto.

7. In a fuse link, in combination, a fusible element, a substantially rigid terminal connected to one end of said fusible element, a flexible lead connected to the other end of said fusible element, and an insulating sleeve surrounding said fusible element and fastened to said terminal and to said flexible conductor in such manner as to prevent the application of tension stress to said fusible element.

8. In a fuse link, in combination, a fusible element, a terminal connected to one end of said fusible element, a flexible lead connected to the other end of said fusible element, and an insulating sleeve surrounding said fusible element and fastened to said terminal and to said flexible conductor in such manner as to prevent the application of tension stress to said fusible element, one end of said sleeve being substantially closed and the other end being open to permit free flow of gases therethrough.

9. In a fuse link, in combination, a fusible element, a terminal connected to one end of said fusible element, a flexible lead connected to the other end of said fusible element, and an insulating sleeve surrounding said fusible element and fastened to said terminal and to said flexible conductor in such manner as to prevent the application of tension stress to said fusible element, said sleeve having a length several times its cross-sectional dimension for causing the longitudinal flow of gases to assist in extinguishing the arc formed on blowing of said fusible element.

10. A fuse device comprising, in combination, a housing closed at the top and opening downwardly, a pair of terminals at the open end of said housing mounted in insulated spaced relation, fusible means interconnecting said terminals and extending upwardly in said housing, and insulating means surrounding said fusible means for preventing injury to the adjacent surface of said housing by the arc formed on blowing of said fusible means.

11. A fuse device comprising, in combination, a housing closed at the top and opening downwardly, a pair of terminals at the open end of said housing mounted in insulated spaced relation, a fusible element connected to each of said terminals and extending upwardly in said housing, a conductor interconnecting the upper ends of said fusible elements, and an insulating sleeve surrounding each of said fusible elements having a length several times its cross-sectional dimension, the lower end of each sleeve being substantially closed and the upper end being vented, whereby gases generated in each sleeve on blowing of the fusible element therein flow upwardly into the top of said housing and are cooled before passing downwardly over said terminals.

12. A fuse link for mounting in substantially a U-shape comprising, in combination, a terminal member at each end of the link, a fusible element connected to each terminal member and extending substantially parallel to each other, a flexible conductor interconnecting said fusible elements and adapted to form the central portion of the U-shape, and means for directing the products of the arcs formed on blowing of said fusible elements away from said terminal members.

13. A fuse link for mounting in substantially a U-shape comprising, in combination, a terminal member at each end of the link, a fusible element connected to each terminal member and extending substantially parallel to each other, a flexible conductor interconnecting said fusible elements and adapted to form the central portion of the U-shape, and tubular insulating means secured to each of said terminal members and surrounding said fusible elements for directing the products of the arcs formed on blowing of the latter away from the former.

HUGH A. TRIPLETT.