June 29, 1943. S. I. LINDELL 2,323,229

FUSE CONSTRUCTION

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Fig. 3

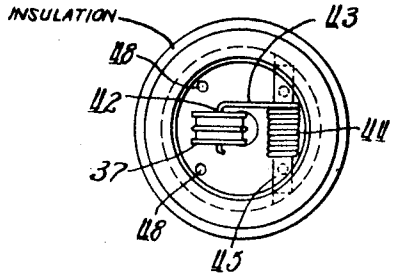
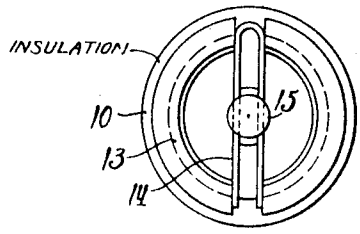


Fig. 2



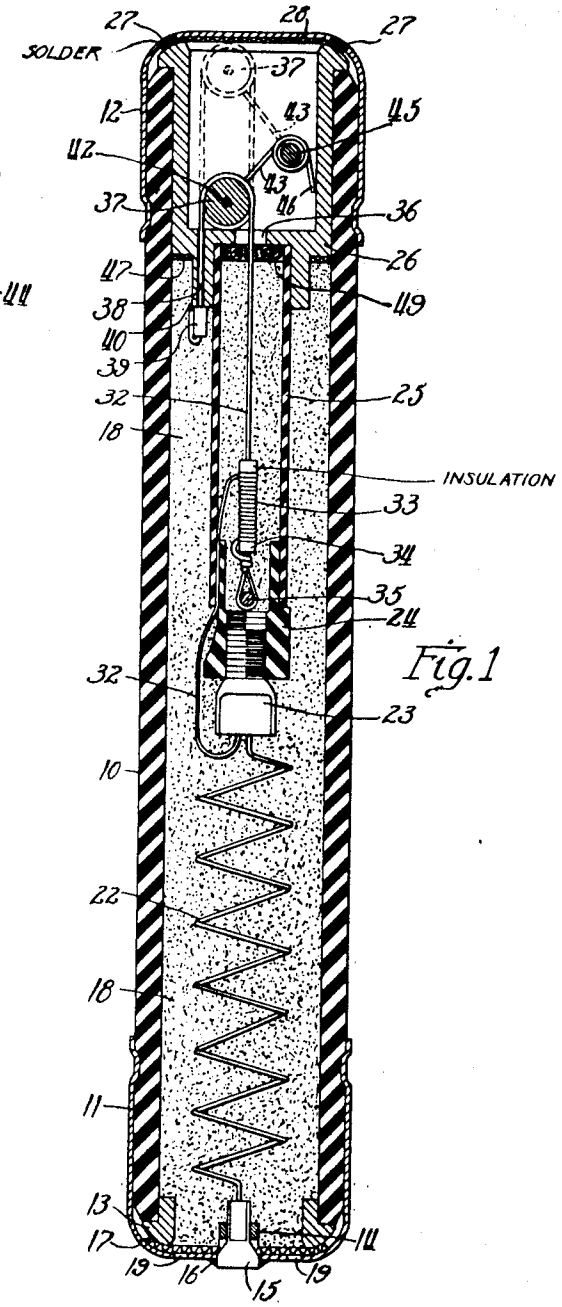


Fig. 1

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Fig. 5.

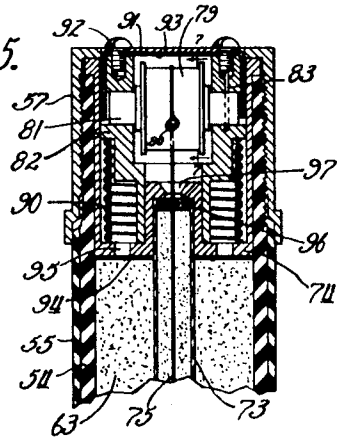


Fig. 6.

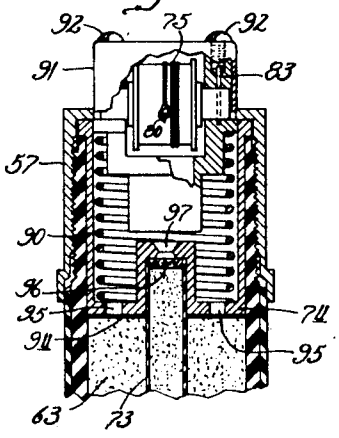


Fig. 7.

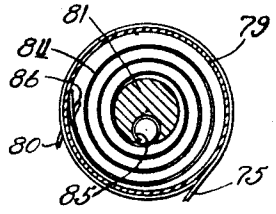
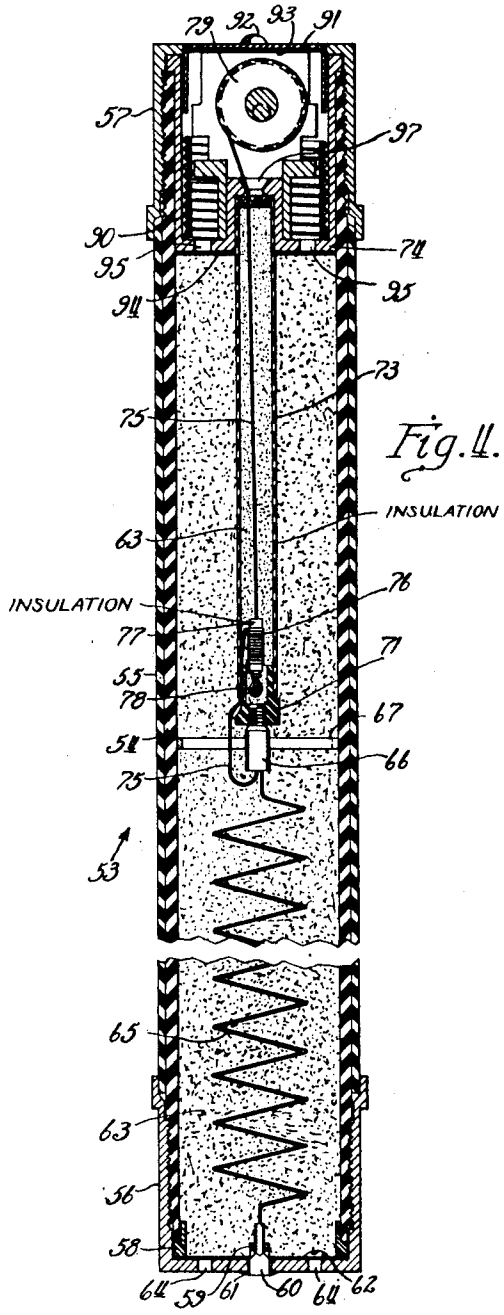


Fig. 4.



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UNITED STATES PATENT OFFICE

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FUSE CONSTRUCTION

Sigurd I. Lindell, Chicago, Ill., assignor to Schweitzer & Conrad, Inc., Chicago, Ill., a corporation of Delaware

Application August 2, 1940, Serial No. 349,899

3 Claims. (Cl. 200—117)

This invention relates, generally, to circuit interrupting apparatus, and it has particular relation to this type of apparatus in which the circuit is opened on the blowing of a fusible section of a conductor.

An object of this invention is to provide for lengthening the arc in a fuse device in a new and improved manner.

Another object of this invention is to provide for elongating the arc in a fuse device by moving a roller in a new and improved manner.

It is also an object of this invention to provide for elongating the arc by moving a roller and also to provide an indication that the fuse has operated in a new and improved manner.

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

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

Figure 1 is a longitudinal cross-sectional view of one embodiment of the present invention;

Figure 2 is a bottom plan view of the fuse construction shown in Figure 1 with the lower ferrule removed;

Figure 3 is a top plan view of the fuse construction shown in Figure 1 with the top ferrule removed;

Figure 4 is a longitudinal sectional view of another embodiment of the invention;

Figure 5 is a detail sectional view of the upper end construction of the fuse shown in Figure 4, the view being taken at right angles to that of Figure 4;

Figure 6 is a view similar to that shown in Figure 5 and illustrating the relationship of the parts after the fusible section has blown; and

Figure 7 is a detail sectional view taken along the line 7—7 of Figure 5.

Referring now particularly to Figure 1 of the drawings, it will be observed that the reference character 10 designates an insulating housing which is tubular in form. The housing 10 is preferably formed of fiber. At its ends are metallic ferrules or caps 11 and 12 which are secured in place by having portions deformed into suitable recessed portions on the housing 10, as shown.

The housing 10 is provided at its lower end with a metallic ring 13 which interfits with the same and carries a terminal retainer 14 in the form of a hairpin shaped metallic member, Figure 2, that supports a metallic terminal 15. The terminal 15 projects through a suitable aperture in the lower end of the ferrule 11 and is secured thereto by soldering as indicated at 16. A cloth washer 17 is provided for preventing the escape of marble dust 18 with which the housing 10 is filled, through apertures 19 in the ferrule 11.

The marble dust 18 embeds a coil 22 of tungsten wire which ordinarily has a relatively low resistance. However, when the coil 22 of wire is heated above a predetermined temperature, it reacts with the marble dust 18 and increases its resistance substantially to an infinite value. The functioning of this so-called chemical fuse is described in detail in Triplett Patent 2,200,608.

One end of the coil 22 of tungsten is connected, as shown, to the terminal 15, while the other end is connected to a terminal 23 which is threaded into an adapter 24 that is formed of suitable insulating material such as fiber. The adapter 24 interfits with a sleeve 25 of suitable insulation such as "Bakelite" or glass. The upper end of the sleeve 25 interfits with a brass retainer 26 that is inserted through the upper end of the housing 10 and substantially fills the same. A good electrical connection between the retainer 26 and the upper ferrule 12 is provided by solder 27 which fills apertures provided therefor in the ferrule 12 and which is bonded to the upper portion of the retainer 26 as will be readily understood. A fine mesh wire screen 28 is provided between the ferrule 12 and the upper end of the retainer 26.

The terminal 23 is connected to the ferrule 12 by a conductor 32. In one embodiment of the invention that has been made the conductor 32 is formed of "Chromel A" wire having a diameter of 0.0113 inch. The conductor 32 extends from the terminal 23 through a suitable groove in the adapter 24 to the inside of the sleeve 25 where it is formed into a coiled portion 33 about a spacer 34 that is formed of suitable heat resisting material such as lava. The conductor extends from the coiled portion 33 and is looped over a pin 35 which extends transversely of the adapter 24, and then it extends through the spacer 34 and out of the sleeve 25 through an aperture 36 in the retainer 26. The conductor extends over a roller 37 and through an opening 38 in the retainer 26 where it passes through a metallic sleeve 39 that is deformed onto the same and has a portion that is soldered as indicated at 40 to the retainer 26. The coil portion 33 of the conductor 32 is provided in order to concentrate heat on the portion which extends through the spacer 34 and to cause fusion of the same

on flow of relatively low overcurrent. The construction shown is intended for use in installations where the normal load current is relatively small. For example, it can be employed in connection with potential transformers in which the normal current flow is ordinarily below one ampere through the high voltage winding. In the event that an overload of two or three amperes should occur, the section of the conductor 32 within the spacer 34 will be fused and the circuit will be opened thereat. However, if a relatively heavy flow of current takes place, such as a current flow of the order of hundreds, or even thousands of amperes, then the entire conductor 32 will usually be completely fused and sufficient current will flow through the coil 22 of tungsten wire as to heat it to the point where it reacts with the marble dust 18 and increases its resistance to such an extent that the current flow never reaches the extent that it might have reached had not the resistance of the circuit been thus increased. The functioning of the particular arrangement of the conductor 32 in combination with the coil 22 of tungsten wire is described in further detail in the copending application of Lindell, Serial No. 285,661, filed July 21, 1939.

On flow of low fault current it is desirable that the ends of the conductor 32 within the lava spacer 34 be promptly separated as soon as a portion has been fused in order to lengthen the arc for facilitating its extinction. In order to effect this, the roller 37 is mounted on an extension 42 of an arm 43 which forms a part of a coil spring 44 that is carried by a pin 45. The pin 45 is mounted on the retainer 26. An extension 46 of the spring 44 bears against a side wall of the retainer 26 and permits tensioning of the spring.

When the conductor 32 is installed in place it is pulled through the opening 38 in the retainer 26 to such an extent that the roller 37 occupies the position shown by full lines in Figure 1. When the portion of the conductor 32 within the lava spacer 34 is fused on the occurrence of an overload, the roller 37 is no longer restrained and it is quickly urged to the position shown by the broken lines under the influence of the coil spring 44. It will be observed that the speed of elongation of the arc that is formed on fusion of the portion within the lava spacer 34 is twice that of the speed of the roller 37 as it is moved by the spring 44. This is due to the fact that the conductor 32, instead of being attached to the roller 37, is fastened to the retainer 26.

A cloth washer 47 is provided at the lower end of the retainer 26 for preventing the marble dust 18 in the housing 10 from escaping through apertures 48, Figure 3, in the retainer. For the same purpose, asbestos string packing 49 is provided around the conductor 32 where it passes out of the sleeve 25 through the aperture 36 in the retainer 26 for retaining the marble dust 18 in the sleeve 25 in place.

In Figure 4 of the drawings, another embodiment of the invention is disclosed. As there shown, a tubular housing, illustrated generally at 53, is provided having an inner lining 54 of fiber and an outer lining 55 of "Bakelite." Ferrules 56 and 57 are provided at the ends of the housing 53. The ferrule 56 has associated therewith a metallic ring 58 for supporting a terminal retainer 59 which is similar to the terminal retainer 14 shown in Figure 1. The terminal retainer 59 carries a terminal 60 which projects through a suitable aperture in the ferrule 56 and is soldered thereto as indicated at 61. A cloth washer 62 is provided for preventing the escape of marble dust 63 through vent openings 64 in the ferrule 56.

As described hereinbefore, the marble dust 63 is provided to embed a coil 65 of tungsten wire whose resistance increases when it is heated to a predetermined temperature. The coil 65 of tungsten wire is secured at one end to the terminal 60 and at the other end to a terminal 66 which is partly supported in position by a generally S-shaped terminal support member 67. The terminal 66 is threaded into an adapter 71 of insulating material, such as fiber, which interfits with a sleeve 73 of insulation such as "Bakelite" or glass that in turn interfits with a cup-shaped metallic retaining member 74 in the upper end of the housing 53.

The terminal 66 is connected to the upper ferrule 57 by a conductor 75 which, for a one ampere fuse, may be formed of "Chromel A" wire having a diameter of 0.0113 inch. The conductor 75 extends through a suitable groove in the adapted 71 and is coiled as indicated at 76 about a lava spacer 77 for the purpose previously described. The conductor 75 is looped about a pin 78 that is carried by the adapter 71 and extends through the spacer 77 and through the sleeve 73. After the conductor 75 leaves the sleeve 73, it is wound about a roller 79 and fastened to an integrally formed tab 80 thereof as shown more clearly in Figures 5 and 7 of the drawings.

The roller 79 is mounted for rotation with respect to a pin or shaft 81 that is carried by a roller support member 82 and is prevented from rotating with respect thereto by a pin 83. Within the roller 79 there is provided a coil spring 84, one end 85 of which, as shown in Figure 7, interfits with a correspondingly shaped groove in the shaft 81, and the other end is hooked over a tab 86 that is integrally formed with the roller 79.

The roller support member 82 can be stationarily mounted within the cup-shaped retainer 74. In such case, when the section of the conductor 75 within the lava spacer 77 fuses, the roller 79 would merely revolve under the influence of the coil spring 84 and withdraw the portion of the conductor 75 attached thereto from the sleeve 73 and would wind it upon itself as shown in Figure 6 of the drawings.

In some instances it is desirable to provide an indication that the fuse has operated. For this purpose the roller support member 82 is movably mounted within the cup-shaped member 74 and is arranged to be moved outwardly thereof by means of a coil compression spring 90. The roller support member 82 is provided with a cap 91 which is secured thereto by screws 92. The cap 91 projects out of the ferrule 57, as shown in Figure 6 of the drawings, when the fuse has operated to indicate that the fuse should be replaced. A cloth washer 93 is provided between the cap 91 and the upper end of the roller support 82 to prevent the escape of the powder 63 through apertures, not shown, in the cap 91.

A washer 94 is provided at the lower end of the cup-shaped member 74 in order to prevent the marble dust 63 from escaping through the apertures 95. For the same purpose, asbestos string packing 96 is provided for preventing the escape of the marble dust 63 through the aper-

ture 97 through which the conductor 75 extends for connection to the roller 79.

When the conductor 75 is installed in operative position, it not only tensions the coil spring 84 within the roller 79 but also it tensions the coil compression spring 90. The spring 90 is somewhat weaker than the spring 84 in order to facilitate this. When this construction is employed, it will be obvious that the spring 84 within the roller 79 provides a shock absorber action between the conductor 75 and the remaining parts of the fuse. In handling the fuse it is likely that the roller support member 82 and parts associated therewith which are movable relative to the cup-shaped retainer 74 may tend to move out of the housing 53. This movement is resisted, of course, by the conductor 75. In a low amperage fuse, the diameter of the conductor 75 is necessarily small, and, if this shock absorber action as provided by the spring 84 were not present, it is entirely possible that the conductor 75 might be mechanically broken during handling or installation. The spring 84 permits some relative movement of the roller support member 82 and parts attached thereto relative to the cup-shaped retainer 74, and thus eases the strain applied to the conductor 75.

The roller 79 has such a diameter and the spring 84 is arranged to revolve it a sufficient number of times so that the air gap which is introduced in the circuit between the ferrules 56 and 57 after the conductor 75 parts within the spacer 77 and the conductor 75 is wound upon the roller 79 is relatively great and sufficient to prevent restriking at the voltage for which the fuse is designed to operate. The length of this air gap is relatively great as compared to the gap which would be obtained if its length were dependent entirely upon the movement of the indicator cap 91. It will be noted that the air gap is produced by a compact operating mechanism which is combined with an indicator that has a relatively short stroke. This is important since fuses of this type are used in cubicles and like installations where space is at a premium and an indicator having sufficient range of movement to provide by itself the necessary air gap would be objectionable if not entirely impracticable.

The springs 84 and 90 are so arranged and constructed that they are not additative with respect to the application of tension to the conductor 75. Therefore, since the spring 84 is the stronger of the two springs, the tension imposed on the conductor 75 is independent of the spring 90. Therefore, the time-current characteristic of the conductor 75, which is dependent upon the stress imposed on it, is not impaired by friction which may develop in the sliding indicator mechanism as would otherwise be the case if its time-current characteristic were dependent alone upon the force exerted by the spring 90 which moves the indicator cap 91.

Since certain further changes can be made in the foregoing constructions and different embodiments of the invention can be made without departing from the scope thereof, it is intended that all matter shown in the accompanying drawings and described heerinbefore shall be interpreted as illustrative and not in a limiting sense.

What is claimed as new is:

1. In a fuse device, in combination, an insulating casing, terminals at the ends of said casing, a conductor within said casing interconnecting said terminals and having one portion that always operates first to open the circuit between said terminals on overload and another portion which operates following the operation of said one portion, a roller at one end of said casing over which said one portion of said conductor is positioned, means rotatably mounting said roller about an axis spaced from its axis of rotation, and means for effecting rotation of said roller about the first mentioned axis to withdraw said one portion of said conductor on operation thereof.

2. In a fuse device, in combination, an insulating casing, terminals at the ends of said casing, a conductor within said casing interconnecting said terminals including an elongated portion that always operates first by fusing resulting in the formation of an arc to open the circuit between said terminals on overload and another portion which operates subsequently by increasing its resistance, a roller at one end of said casing over which one end of said elongated portion extends, means fastening said one end of said elongated portion to the adjacent terminal, a support pin extending transversely of said casing at said one end, a spring wound on said support pin, and means holding one end of said spring stationary, the other end of said spring extending as an arm and providing a support for said roller, said spring being held tensioned by said elongated portion as long as the same remains intact.

3. In a fuse device, in combination, an insulating casing, terminals at the ends of said casing, a conductor within said casing interconnecting said terminals and including a fusible section, a roller at one end of said casing over which one end of said conductor extends, means fastening said one end of said conductor to the adjacent terminal, a support pin extending transversely of said casing at said one end, a spring wound on said support pin, and means holding one end of said spring stationary, the other end of said spring providing an arm for supporting said roller, said spring being held tensioned by said conductor as long as said fusible section remains intact.

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