July 24, 1928. 1,678,481

J. D. ROBERTS

ELECTRIC FUSE

Filed Dec. 20, 1926 2 Sheets-Sheet 1

FIG. 1

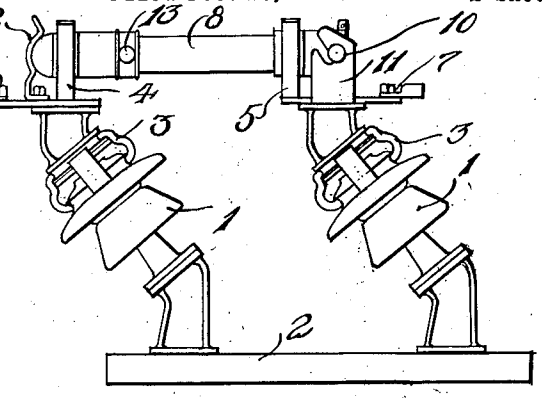


FIG. 2

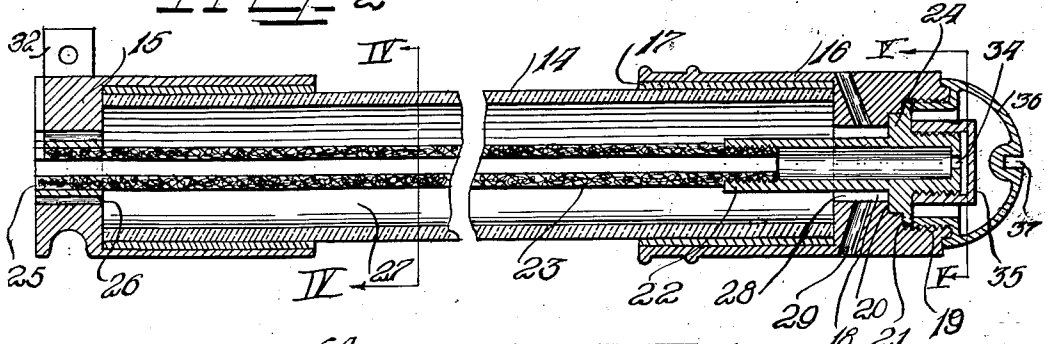


FIG. 3

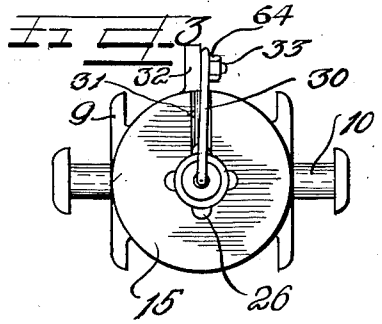


FIG. 4

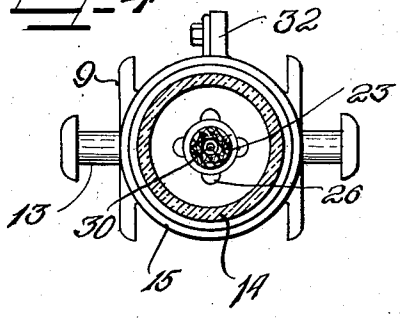
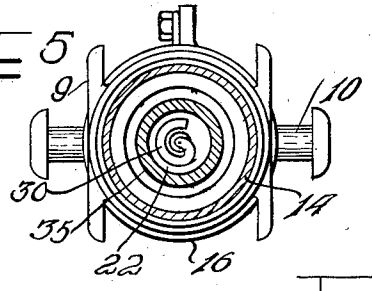


FIG. 5



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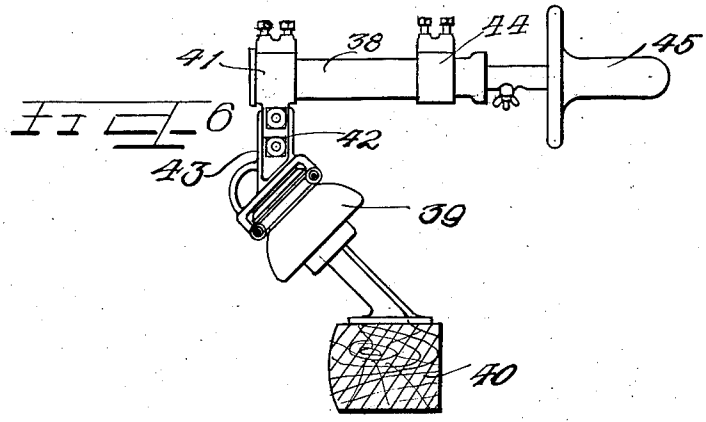


FIG. 6

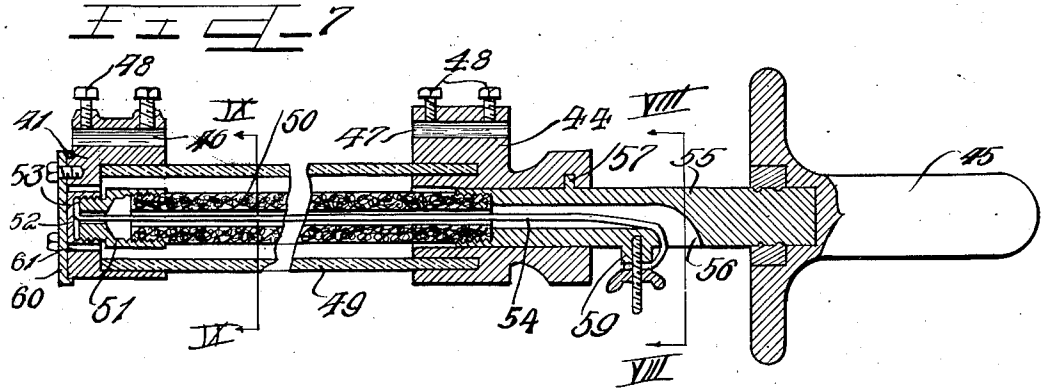


FIG. 7

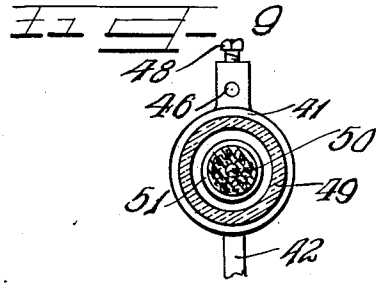


FIG. 9

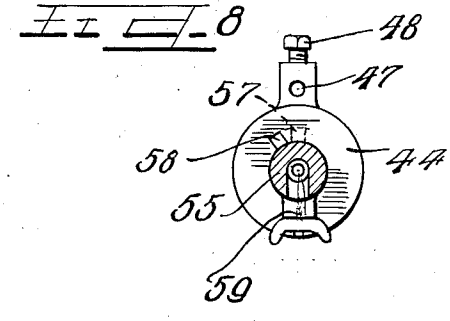


FIG. 8

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Patented July 24, 1928. 1,678,481

UNITED STATES PATENT OFFICE.

JOSEPH D. ROBERTS, OF SPRINGFIELD, ILLINOIS.

ELECTRIC FUSE.

Application filed December 20, 1926. Serial No. 155,792.

This invention relates to an electric fuse, and more especially to a fuse of the expulsion type adapted for use with high tension circuits.

It is an object of this invention to provide an electric fuse having high rupturing capacities and positive in operation and capable of promptly extinguishing the electric arc formed by the fusion of the fuse element.

It is a further object of this invention to provide an electric fuse, wherein the fuse element is enclosed in a specially designed high strength insulating tube provided with a non-combustible inner liner.

It is a further object of this invention to provide an electric fuse so constructed as to maintain a high efficiency of di-electric between the main contacts of the fuse.

It is a further object of this invention to provide an electric fuse wherein the fuse element may be readily installed without special tools or appliances.

It is a further important object of this invention to provide an electric fuse, the design of which is adaptable for use with disconnecting switches, transformer cutouts, replacement fuses and for the protection of various types of electrical apparatus.

Other and further important objects of this invention will be apparent from the disclosures in the specification and the accompanying drawings.

This invention (in a preferred form) is illustrated in the drawings and hereinafter more fully described.

On the drawings:

Figure 1 is an elevational view of a fuse embodying the principles of my invention and a suitable support therefor.

Figure 2 is an enlarged longitudinal section of the fuse.

Figure 3 is an end view of the same.

Figure 4 is a sectional view taken on line IV—IV of Figure 2.

Figure 5 is a sectional view taken on line V—V of Figure 2.

Figure 6 is an elevational view of a modified form of my device.

Figure 7 is a broken enlarged longitudinal section of the same.

Figure 8 is a sectional view taken on line VIII—VIII of Figure 7.

Figure 9 is a sectional view taken on line IX—IX of Figure 7.

As shown on the drawings:

In Figure 1 the reference numeral 1 indicates a pair of insulators of the pin type mounted upon a suitable supporting structure 2. A bracket 3 is clampingly mounted on each of said insulators 1 for supporting a pair of fuse clips 4 and 5 provided with terminal posts 6 and 7 for connection with an electrical circuit. A fuse, denoted as a whole by the numeral 8 and embodying the principles of this invention, is adapted to be slidingly received in said clips 4 and 5. For this purpose smooth metal contact faces 9 are formed on opposite sides of said fuse 8 for contact with the clips 4 and 5. Said fuse is further provided with oppositely extending pins 10 positioned near one end thereof and adapted to be received in a slotted support 11 secured to one of the brackets 3. A single resilient clip 12 mounted upon the other bracket 3 is adapted to engage the other end of said fuse to hold the same in the slotted support 11. Said fused body 8 is further provided with a pair of laterally extending pins 13 to permit the fuse to be readily disengaged from the resilient clip 12 by means of an operating pole. The fuse may thus serve as a manually operated disconnecting switch as well as for the purpose of automatically interrupting the electric current when the circuit becomes overloaded.

The details of the fuse 8 are more clearly shown in Figures 2 to 5, inclusive. Such fuse comprises an outer tube 14 formed of borosilicon glass or other relatively non-fusible transparent material, secured at its ends to metallic ferrules 15 and 16, respectively. A metallic cement or solder 17 serves both to secure the glass tube to said ferrules 15 and 16 and also to form gas tight joints therewith. Said ferrules, which are preferably formed of brass, serve as above indicated as the terminals for contact through the faces 9 with the fuse clips 4 and 5. The ferrule 16, which will hereinafter be called the top ferrule, is provided with a central aperture 18, enlarged to form a threaded bore 19 and a series of shoulders 20 and 21. A sleeve 22 supporting an inner tube 23 is adapted to be inserted through said aperture 18 and is provided with an enlarged portion 24 for engagement with the shoulders 20 and 21. Said tube 23 is preferably of small bore and formed of suitable fabric, such as linen, coated and lined with bakelite to provide a non-carbonizing inner surface. When in place, said tube 23 extends through an aperture 25 formed in the end ferrule 15. Said end fer-

rule 15 is also provided with small apertures 26 positioned parallel to and circumferentially with respect to the aperture 25 for ventilating the interior chamber 27 formed between the outer tube 14 and the inner insulating tube 23. Similar apertures 28 are formed in the top ferrule 16 for communication with radial passages 29 to permit thorough circulation of air through the chamber 27. In this way the tendency of moisture to form on the inside of the outer tube 14 and on the outside of the inner tube 23 is prevented, thereby maintaining a higher efficiency of the di-electric.

A fuse element 30, preferably comprising an aluminum wire or ribbon, is adapted to be inserted through the aperture 25 into the open end of the inner insulating tube 23. One end of said fuse element 30 extends through a groove 31 in the end of the ferrule 15 and is secured to a binding post 32 formed on said ferrule 15 and provided with a screw 33 and nut 64. The other end of said fuse element 30 extends through an aperture 34 in the end of said sleeve 22 and is there held by means of a cap 35 threaded over the end of said sleeve 22. A spherical headed cap 36 having a slot 37 is adapted to be threaded into the threaded bore 19 to enclose the cap 35 and hold the sleeve 22 in place. It will thus be apparent that the cap 36 may be readily removed by means of a screwdriver inserted within the slot 37, and the inner tube 23 and sleeve 22 removed as a unit should it become necessary to insert a new inner tube. On the other hand if a new fuse element is to be replaced, it is only necessary to remove the cap 35, insert the new fuse element through the hole 34 and screw the cap 35 back into place.

If during the operation of one of the fuses such as above described, the circuit becomes overloaded and the fuse is blown, the unfused portion of the fuse element will be expelled from the inner tube 23 due to the rapid expansion of the gases within said tube and to the fact that one end of the inner tube is closed by the cap 35. Consequently any arc formed by the rupture of the fuse element will be immediately extinguished due to the violence of the expulsion of the gases and of the unfused portion of the fuse element. The fact that the inner surface of the insulating tube 23 is non-combustible prevents any deterioration of said tube. The insulating characteristics of the bakelite linen tube are further enhanced and preserved by its enclosure in the special glass outer tube 14 and by the ventilation provided between said inner and outer tubes by the ventilating ports 26, 28 and 29.

In Figures 6 to 9, inclusive, there is shown a form of fuse specially adapted for use with transformers. A fuse 38 of this type is shown as supported from an insulator 39 mounted upon a support 40. Said fuse 38 is provided at one end with an apertured ferrule 41 having an extension 42 formed thereon adapted to be slidably received in a clip 43 secured to said insulator 39. At the other end of said fuse 38 there is provided a passaged ferrule 44 into which a handle 45 is adapted to be inserted. Said ferrules 41 and 44 are provided with slots 46 and 47 for receiving the respective ends of a wire carrying electric current. Screws 48 are adapted to be threaded into said slots 46 and 47 to engage the ends of said wires.

Said fuse 38 comprises, as heretofore, a glass tube 49 secured at its ends in said ferrules 41 and 44 and enclosing an inner concentric insulating tube 50. Said tube 50 is supported from the ferrule 41 by means of a sleeve 51 having a central aperture 52 formed therein. A cap 53 is adapted to close said aperture 52 and to secure one end of a fuse element 54. An outside cap 60 is secured to the end of the ferrule 41 to close the aperture 61 therein. The other end of said tube 50 is adapted to be threadingly secured to a passaged cylinder 55, with the passage 56 of said cylinder 55 registering with the bore of the tube 50. Said cylinder 55, upon the outer end of which is mounted the handle 45, is provided with a lug 57 adapted to be inserted into a slot 58 in the end of said ferrule 44 and to be secured therein by a twist of the handle 45 (Figure 8). Said cylinder 55 is further provided with a binding post 59 to which the other end of the fuse element 54 may be secured. It will thus be apparent that the tube 50 and fuse element 54 may be removed together by a twist of the handle 45 to disengage the lug 57 from the slot 58 in the ferrule 44.

The principle of the two types of fuses described is the same, since in both instances the insulating tube enclosing the fuse element is closed at one end and open at the other, whereby the fuse element may be expelled upon its fusion. Both types of fuses provide for ready removal of the fuse element and replacement with a new element without requiring the use of special tools or specal types of element.

I am aware that many changes may be made, and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I therefore do not purpose limiting the patent granted hereon, otherwise than necessitated by the prior art.

I claim as my invention:

1. An electric fuse, comprising a relatively non-fusible glass tube, apertured metallic ferrules secured to the ends thereof, an open ended tube of non-carbonizing insulating material supported from said ferrules within said glass tube, one end of said insulating

tube registering with one of said ferrule apertures, and a fuse element adapted to extend through said one aperture and insulating tube with its ends establishing electrical contact with said ferrules, whereby a rupture of said fuse element will result in the unfused portion of said element being blown out through said one aperture with sufficient force to extinguish the electric arc formed upon the rupture of the element.

2. An electric fuse, comprising metallic ferrules having longitudinal apertures extending therethrough, a transparent relatively infusible tube secured at its ends to said ferrules, an inner insulating tube having one end opening through one of said ferrule apertures, a closure member for the other end of said inner tube secured in the other apertured ferrule, and a fuse element clampingly held at one end by said closure member with its other end extending through said one ferrule aperture.

In testimony whereof I have hereunto subscribed my name.

JOSEPH D. ROBERTS.