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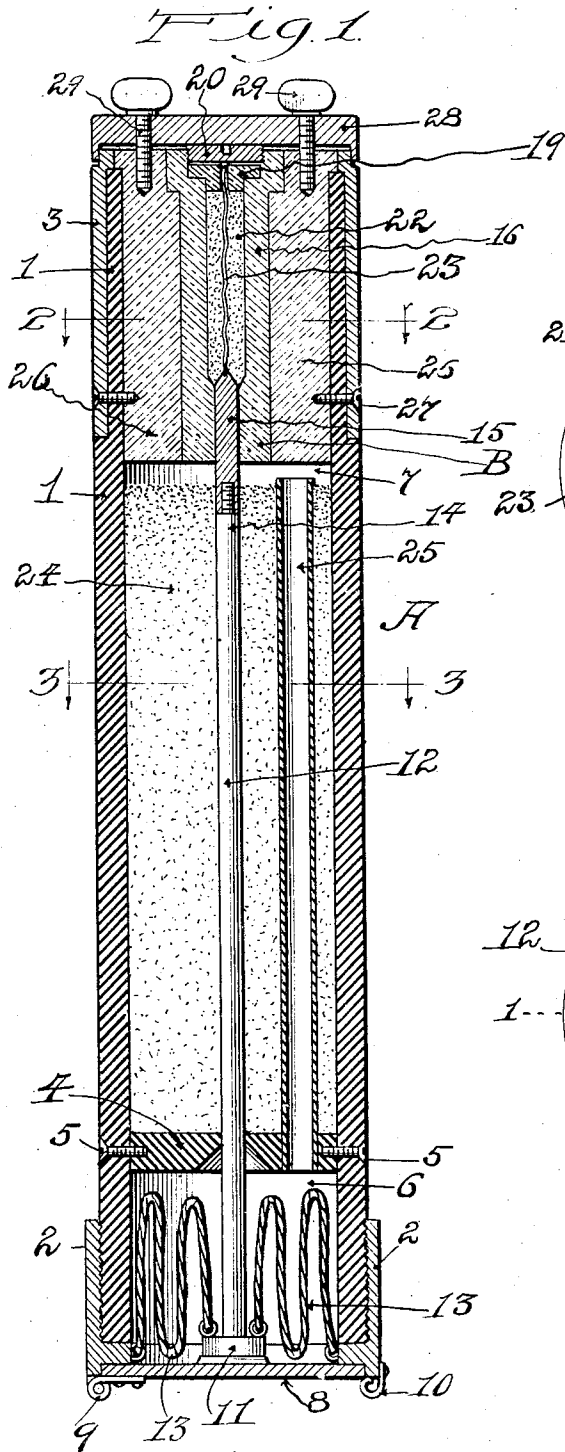
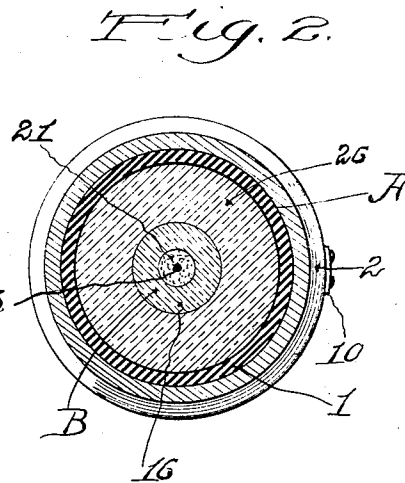
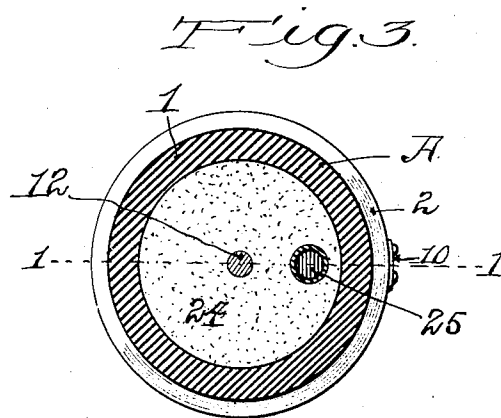
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1,782,089

PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS

Filed June 13, 1925

2 Sheets-Sheet 1



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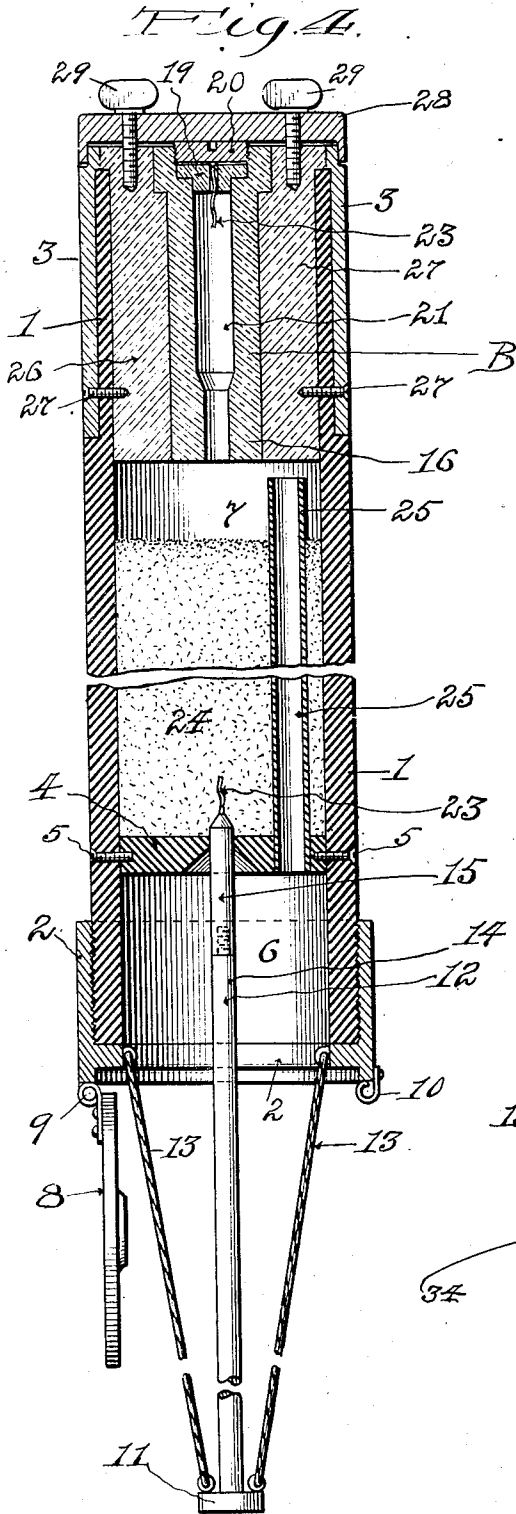
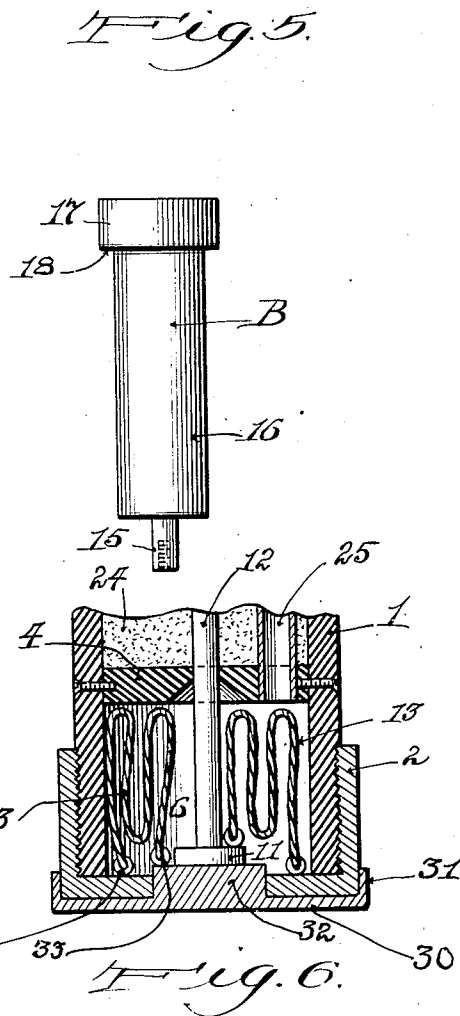
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PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS

Filed June 13, 1925

2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS

Application filed June 13, 1925. Serial No. 36,853.

This invention relates to improvements in protective devices for electric circuits, and more particularly to such devices wherein a fuse is used to rupture electric currents of high potentials.

The main object of the invention is to provide simple and positive means for opening the circuit by forming an air gap in high tension circuits with certainty and great rapidity.

Another object is to produce in such a device, means for holding the fuse in a removable cartridge which may be removed quickly, without the aid of special tools, and replaced by another cartridge having a new fuse and the circuit thus re-established.

Another object is to produce in such a structure, means for changing the relative positions of the parts to such an extent as to eliminate leakage of current back through the device after the fuse is blown.

These and other objects and advantages will be apparent to those skilled in the art to which my invention appertains, as I proceed with specification; the invention consisting in the devices and combinations of devices herein illustrated, is described and more particularly pointed out in the appended claims.

In that form in which I have chosen to herein illustrate my invention (it being manifest that other forms may be used), by means of the accompanying drawings:

Figure 1 is a central, longitudinal sectional view of a device embodying the invention, the section being taken in the plane indicated by dotted line 1—1 on Fig. 3.

Figures 2 and 3 are transverse, sectional views of the same, the sections being taken in the planes indicated by the dotted lines 2—2 and 3—3 respectively, on Fig. 1.

Figure 4 is a view similar to that of Figure 1, partly broken away, to illustrate the position of the parts when the fuse is blown.

Figure 5 is a side view of the fuse holding cartridge, detached; and

Figure 6 is a vertical, sectional view showing a modification.

The form illustrated in these drawings comprises a terminal element upon each end of an intermediate insulating housing mem-

ber, a conducting element extending longitudinally of and movable part way through the housing member, said movable member being electrically as well as mechanically connected at one end to one of the terminal elements, a cartridge element removably located in the other end of the housing and having a fusible element positioned therein and electrically connected to the longitudinally movable element and also to the other terminal element, and motor means within the removable element adapted, upon the blowing of the fuse, to operate the longitudinally movable element and force the latter into such a position as will not only give a visible indication to the repair man that the fuse has been blown, but also to cause the formation of an air gap sufficient to prevent current leakage or other injurious action in the circuit or to apparatus connected therewith.

More specifically now referring to Figures 1, 2 and 3, my device, indicated as a whole by the letter A, comprises a housing member 1 of any suitable shape, but preferably of the tubular form shown. The housing is provided upon its ends with tubular members or ferrules 2 and 3 secured thereto in any suitable manner. The housing 1 is made of insulating material, as for example, fibre or bakelite. Any other suitably insulating material may be used. The end members 2 and 3 are made of any suitable conductor metal through which current will flow. The device A will be installed in an electric circuit, in any suitable manner, as for example by the familiar spring clip in common use, and therefore not shown.

Within the housing 1, I secure a centrally apertured disc or partition 4 by screws 5 or any other suitable means, thus forming within the housing 1, lower and upper chambers 6 and 7, below and above, respectively, said partition disc 4. To the lower member 2 is applied a metallic closure or lid 8 movably secured in position in any convenient manner, as, for example, by a hinge 9 and spring retaining clip 10.

Resting upon this closure 8, when in the position shown in Fig. 1, is the base end 11 of a longitudinally movable conductor rod 100

12, electrically and mechanically connected to the conductor member 2 by a suitable conductor cable 13. This cable I prefer to make relatively strong and not easily breakable, for a purpose hereinafter stated.

5 This conductor rod 12 extends through the apertured partition 4 and lengthwise of the housing in the upper chamber 7. It is provided upon its upper end 14 with screw threads or other suitable means whereby it
10 may be quickly connected to and quickly disconnected from the lower movable member 15 of what I herein choose to designate as a cartridge, and which latter is indicated as a
15 whole by the letter B (see Fig. 5).

The cartridge B comprises a tubular portion 16 made of any suitable insulating material, such, for example, as lava, with its upper end 17 enlarged to form a supporting,
20 annular shoulder 18. The central bore or space 21 is contracted at its lower portion, but will be sufficiently large in cross sectional area to form a bearing for the member 15. At its upper end, the chamber is provided
25 with an interior, annular shoulder or bearing for an apertured insulating disc 19, and a metal conductor disc 20. The intermediate portion of the bore or chamber 21 is filled
30 with a quickly ignitable and explosive material, expansible gas or other motor element, such, for example, as gun powder, indicated at 22. A fuse wire 23 is passed through the motor member 22 and is soldered or other-
35 wise united at one end to the member 15 and at the other end to the disc 20.

Within the chamber 7 of the housing 1, and above the partition 4 is a suitable smothering or arc extinguishing material 24, as, for example, sand, through which the movable
40 conductor rod 12 extends. Extending upwardly through the material 24, with its lower end also passing through the partition 4, is a hollow tube 25. The tube 25 is in open communication at its upper end with the upper
45 portion of the chamber 7 and at its lower end with the chamber 6.

Within the upper part of the housing above the chamber 7 is a relatively thick, tubular reinforcing member 26, made of any suitable
50 insulating material, as for example lava, provided at its upper end with an interiorly arranged annular shoulder, upon which the shoulder 18 of the head 17 will rest, and whereby the cartridge B is supported.
55

The member 3 may be secured upon the housing A and to the reinforcing member 26 by screws 27 in any suitable manner. A
60 metallic conductor cap member 28 covers the end of the device A, being readily removable by means of thumb screws 29, or other suitable means. These screws 29 pass into the upper end of the reinforcing member 26 and serve not only to hold the parts together but
65 also to force the cap member 28 into firm

contact with the conductor disc 20 to which one end of the fuse 23 is attached. The member 28, while serving as a closure for one end of the device, also, by reason of its attachment to the member 26, will resist any
70 outward thrust of the motor element of the cartridge.

When the device A, as described, and as shown in Figure 1, is positioned for use in the line fuse clips (not shown) the normal
75 current will pass from one set of clips through member 3, cap 28, disc 20, fuse wire 23, end members 15 and 14, rod 12, conductor wires 13, lower contact 11, and lid 8 to member 2 and the other clips.
80

When the fuse wire 23 is blown by the presence of excess current, the arc produced will instantly operate the motor element 22, which surrounds the fuse wire in the chamber 21 and the motor element will exert a
85 downward thrust or pressure sufficient to quickly push the members 15 and 14 and the rod 12 downwardly. This pressure will be sufficient to at once overcome the holding tension of the spring 10 and release the closure 8. The parts will then assume the positions indicated in Fig. 4.
90

It will be observed that in this fuse-blown position, the end 15 will have passed into the body of sand or other smothering material in chamber 7, and any gases of explosion or expansion of the motor element will have passed through the airgap formed in the top of the chamber 7 above the sand, and will pass out through the tube 25 and chamber 6 into the atmosphere. Thus all danger
95 of a flow of current after the fuse is once blown or of trouble which might otherwise occur due to any excess of pressure by the motor element, will be prevented.
100

It will be understood that the wire 13 will straighten out when the lid 8 is pushed to the open position, as shown in Fig. 4, and by reason of the inherent strength of the cable or of the incorporation therewith of a metal chain or other suitable means (not shown), there will be a limit to the downward movement of the rod 12, and that it will be supported as shown, by the cable. It will also be understood that this position of the parts, as shown in Fig. 4, will afford a visible means
105 of enabling the repair man or other person to quickly determine the particular location where the device has interrupted the current by the blowing of the fuse.
110

To restore the current in the line, the device A is removed from the connector clips and the cap 28 removed, the old cartridge B is taken out and thrown away, the rod 12 pushed up until the end 15 is accessible for
115 disconnection from the end 14 of the rod, a new cartridge B inserted in the bore of the reinforcing member 26 and the end 15 of the new cartridge is united with the upper end 14 of the rod 12. The cap 28 may then be
120
125
130

replaced and the cable 13 folded in position in the chamber 6 and the lid 8 closed and locked by the spring 10. The device A is then again ready for positioning in the connector clips and put into service.

It will be understood that the reinforcing member 26 will be made of any insulating material sufficiently strong to withstand the stress due to the expansive pressure of the gun powder or other motor element used in the cartridge.

In Figure 6, I have shown the cover 8 in modified form, omitting the hinge and holding arrangement shown in the other views. In this form the closure is a slip-on plate 30 of conductor material with an annular up-turned circumferential flange 31 to fit, frictionally, over the member 2 and having on its inner face a raised boss 32 upon which the base end of the rod 12 will rest when the closure plate 30 is in operative position. The downward movement of the rod 12 due to the action of the motor element will quickly push the plate 30 from the member 2, thus uncovering the lower chamber 6. The plate 30 may be held from dropping away too far by using one of the cable members 13 which, as shown, is connected at one end 33 to the plate 30 and at its other end 34 to the member 2.

With the renewable cartridge containing the fusible element and explosive compound positioned within the metal sleeve or ferrule 3, this sleeve serves as an effective shield to prevent corona from forming along the fusible element and otherwise affect the explosive compound.

It will be apparent that with the plunger 15 embodied as a part of the renewable cartridge element B and arranged to be detachably secured to the end 14 of the rod 12, the cartridge is self-contained and may be readily replaced for the purpose of renewing the fuse. By providing the washer 19 with a small aperture in which the fuse element 23 fits, the fuse element on blowing cannot fire up through the aperture and oxidize the end disk 20. In operation, upon a blowing of the fuse element, a small ball of metal usually forms at the lower end of the aperture to prevent such oxidation. This is advantageous in keeping the permanent parts of the fuse clean.

It is also a distinct advantage to have the vent opening from the chamber 7 normally closed to the atmosphere so as to prevent the admittance of moisture. This is obtained in the preferred form of the invention by venting the chamber 7 through the tube 25 and also through the lower chamber 6 when the end closure 8 is open.

It will be readily understood that while I have described in detail my invention in the form which I have herein illustrated, my invention is not limited to the details of construction so described, since, manifestly,

other changes may be made in structural details without departing from the spirit of the invention, as set forth in the appended claims.

I claim as my invention:

1. A protective device for electric circuits, comprising a non-conductor housing having a removable conductor member on one end and a hinged conductor member on the other end, a movable conductor member slidably mounted within the housing and electrically connected at one end with the hinged conductor member, a removable extension on the other end of the movable conductor, a non-conductor, removable cartridge member interiorly provided with a motor element, and a fuse connected at one end with said extension member and electrically connected at its other end with the housing conductor member, so located in the cartridge that upon being blown its arc will actuate the motor element.

2. A protective device for electric circuits, embracing a housing provided with conductor means adapted for operative connection in circuit, a fuse, a movable conductor member, means for actuating the movable member when the fuse is blown by abnormal current conditions in circuit, and means permitting the end of the movable member to project beyond the housing when the fuse is blown, said means including a removable closure lid on which the end of the movable member is supported within the housing when the lid is closed.

3. A protective device for electric circuits, embracing a housing provided with conductor means adapted for operative connection in circuit, a fuse, a movable conductor member, means for actuating the movable member when the fuse is blown by abnormal current conditions in circuit, and means permitting the end of the movable member to project beyond the housing when the fuse is blown, said means including a removable closure lid on which the end of the movable member is supported within the housing when the lid is closed, and means for retaining the closure lid secured to the housing when in its removed position.

4. A protective device for electric circuits, embracing a housing provided with conductor means adapted for operative connection in circuit, a fuse, a movable conductor member, means for actuating the movable member when the fuse is blown by abnormal current conditions in circuit, a chamber in the housing containing a smothering material, the conductor member extending through and its ends projecting normally above and below said material, the end of said member connected with the fuse being completely surrounded by said material when the fuse is blown and said conductor is actuated, and means for establishing atmospheric com-

munication with the chamber above the said material when the fuse is blown, including a conduit passing through said material with its open ends located above and below the normal levels of the said material.

5. A protective device for electric circuits, embracing a housing provided with conductor means adapted for operative connection in circuit, a fuse, a movable conductor member, means for actuating the movable member when the fuse is blown by abnormal current conditions in circuit, a chamber in the housing containing a smothering material, the conductor member extending through and its ends projecting normally above and below said material, the end of said member connected with the fuse being completely surrounded by said material when the fuse is blown and said conductor is actuated, and means for establishing atmospheric communication with the chamber above the said material when the fuse is blown, including a wall in the housing upon which said material is supported, a chamber in the housing below the wall, a hinged lid adapted to be opened by the movement of the movable conductor, and a tubular member supported by the wall and extending through the material, its ends being constantly in open communication with the upper and lower chambers.

6. A protective device for electric circuits comprising a tubular housing of non-conducting material, a wall therein forming an upper and a lower chamber in said housing, a conductor member on one end of the housing a lid on the housing for closing the lower chamber, a conductor, closure member removably mounted on the other end of the housing, a non-conductor cartridge member removably mounted in the upper part of the upper chamber in the housing, a chamber for a motor element within said cartridge, a conductor member slidably mounted in the wall with its lower end extending into the lower chamber and resting upon the closure lid, a conductor cable connecting the lower end of said slidable conductor with the housing conductor member with which the lid is in electrical contact, a removable extension on the upper end of the slidable conductor, slidably supported by the cartridge and projecting into the explosive chamber therein, a fuse secured at one end to said extension member, passing through the motor chamber and connected at its other end to a conductor disc, means for forming contact between said disc and the housing removable conductor closure, a smothering material in the upper housing chamber supported by said wall and surrounding said slidable conductor, and a tube in the wall, its upper and lower ends being in constant communication with the upper and lower chambers of the housing.

7. A protective device for electric circuits comprising a fixed, non-conductor housing,

conductor members on each end of the housing adapted for operative connection in an electric circuit, a movable conductor operatively connected within the housing with one of the end conductors, a fusible member stationarily mounted within the housing and connected with the other end conductor and with the movable conductor, and means surrounding the fusible member ignited by the abnormal current changes which blow the fuse and which means actuate the movable conductor.

8. A protective device for electric circuits having a housing provided with conductor means adapted for operative connection in circuit, a removable cartridge member normally within the housing and which embraces a fuse and an explosive element adapted to be ignited when the fuse is blown by abnormal current conditions, a movable conductor member adapted to be actuated upon the ignition of the explosive element, and means for exposing to view the end of the movable member when the fuse is blown.

9. A protective device for electric circuits having a housing provided with conductor means adapted for operative connection in circuit, a fuse stationarily mounted within the housing adapted to be ruptured by abnormal current changes, a movable conductor forming a piston, means forming a cylinder for said piston and enclosing said fuse so that the piston will be actuated upon the blowing of the fuse, and means for relieving the pressure of the motor means.

10. A protective device for electric circuits having a housing provided with conductor means adapted for operative connection in circuit, a fuse within the housing, a movable conductor normally attached to the fuse, motor means operable by the arc of the blown fuse for actuating the movable conductor when the fuse is blown by abnormal current conditions in circuit, and a housing chamber containing a smothering material, the movable conductor being within said chamber and having its ends extending above and below said smothering material and adapted to move so that its fuse connected end will be completely surrounded by the material upon the blowing of the fuse.

11. A protective device for electric circuits having a housing provided with conductor means adapted for operative connection in circuit, a fuse within the housing, a movable conductor member normally attached to the fuse, motor means for actuating the movable conductor when the fuse is blown by abnormal current conditions in circuit, a housing chamber, smothering material in said chamber, a movable conductor extending through, and its ends projecting normally above and below, said material, and means for establishing atmospheric communication

with the chamber above said material when the fuse is blown.

12. A renewable fuse comprising, in combination, an insulating tube having metallic ferrules secured to and surrounding said tube adjacent its ends, a reinforcing sleeve of insulating material within one ferrule, and a renewable cartridge element positioned in said sleeve, said element containing a fuse connected at one end to said ferrule.

13. A renewable fuse comprising, in combination, an insulating tube having a metallic sleeve secured to and surrounding a portion of said tube and a renewable cartridge element positioned in said casing within said sleeve, said element containing a fuse, one end of which is connected to the sleeve, and an explosive element surrounding a portion of said fuse.

14. A fuse comprising, in combination, a tubular casing, end-closures for the opposite ends of said casing, a sand compartment disposed intermediate the ends of said casing, and means arranged to vent said compartment through the lower end of the fuse when that end closure is removed.

15. A renewable cartridge for fuses of the character described comprising, in combination, a tubular casing of insulating material, a plunger slidably mounted in one end of said casing, a closure for the opposite end of the casing, a fusible element secured at one end to said plunger, means to secure the other end of said element to said closure and a washer adjacent said closure and having an aperture through which said element passes.

16. A fuse comprising, in combination, a tubular casing, metallic ferrules secured to the opposite ends thereof, a compartment intermediate the ends of said fuse arranged to receive arc extinguishing material, a rod normally extending into said compartment and connected permanently to one ferrule, and a renewable cartridge element positioned within the other ferrule containing a fuse strip and a slidable plunger attached to one end of said fuse strip and adapted to be detachably secured to one end of said rod.

17. In a fuse of the character described, the combination of a tubular casing, a removable closure for the lower end of the casing, a member slidably positioned within the casing and arranged upon the disruption of a fuse to be projected downwardly therefrom, and means secured to said member and to said casing to limit the outward movement of said member.

18. A fuse adapted normally to be mounted in an upright position comprising a tubular casing of insulating material, ferrules at the opposite ends thereof, means to close the upper end arranged to prevent the entrance of foreign matter into the casing, a chamber within the casing intermediate its ends for receiving an arc extinguishing sub-

stance, a vent passage for said chamber including a vent tube extending upwardly therein, and means arranged normally to close the vent passage adapted upon a blowing of the fuse to open said passage.

19. A fuse adapted normally to be mounted in an upright position comprising a tubular casing of insulating material, ferrules at the opposite ends thereof, means to close the upper end arranged to prevent the entrance of foreign matter into the casing, a renewable cartridge element positioned in the upper end of said casing adjacent said closure, a chamber within the casing intermediate its ends, a vent tube extending upwardly in said chamber, and means arranged normally to close the vent passage adapted upon a blowing of the fuse to open said passage.

20. In a renewable high tension cartridge fuse, the combination of an insulating tube, a fusible element positioned centrally of said tube, an ionizable substance surrounding said element, and a metallic member spaced outwardly from and completely encircling said substance.

In testimony that I claim the foregoing as my invention I affix my signature this 11th day of June, 1925.

HARRY W. BAUMER.