E. O. SCHWEITZER & N. J. CONRAD.

FUSE DEVICE.

APPLICATION FILED DEC. 31, 1914.

Patented Apr. 1, 1919.

2 SHEETS—SHEET 1.

1,299,387.

Fig. 1.

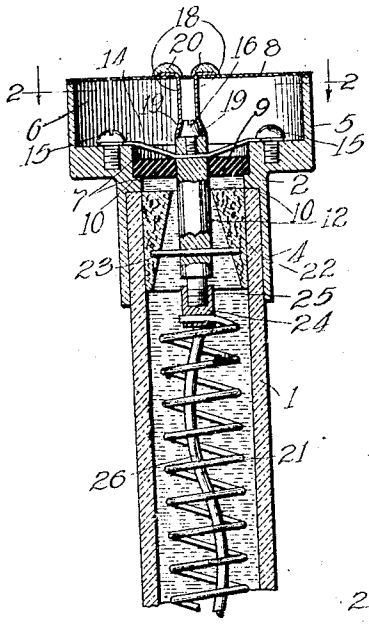


Fig. 3.

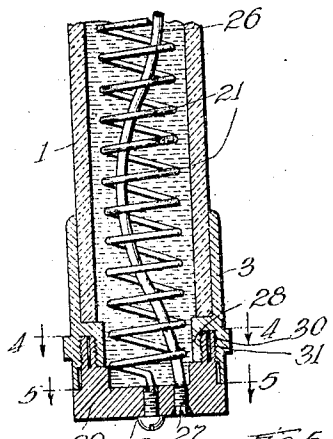


Fig. 4.

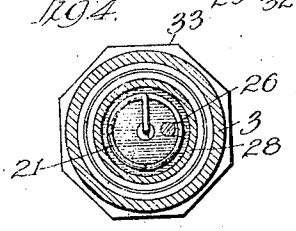


Fig. 5.

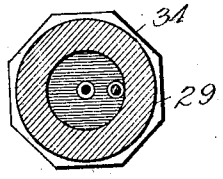
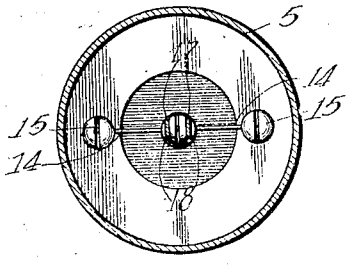


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 6.

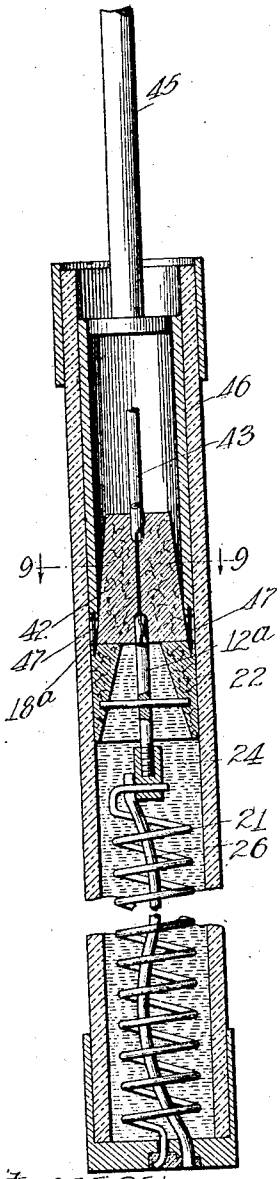


Fig. 7.

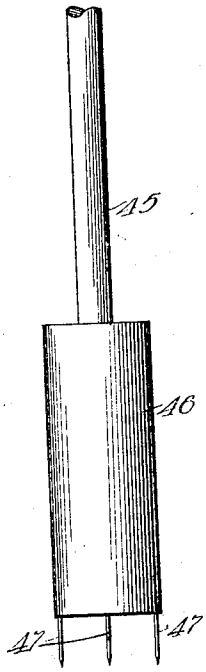
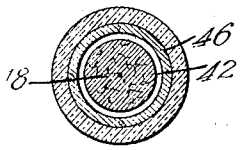


Fig. 8.



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EDMUND O. SCHWEITZER AND NICHOLAS J. CONRAD, OF CHICAGO, ILLINOIS.

FUSE DEVICE.

1,299,387. Specification of Letters Patent. Patented Apr. 1, 1919.

Application filed December 31, 1914. Serial No. 879,828.

To all whom it may concern:

Be it known that we, EDMUND O. SCHWEITZER and NICHOLAS J. CONRAD, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Fuse Devices, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

Our invention relates to fuse devices, and especially to a type of fuse device particularly adapted for extra high potentials.

Prominent objects of the invention are to provide a simple, practical, and efficient type or construction of fuse device of the kind specified; to arrange for the advantageous operation of the device either upon a long continued moderate overload or a sudden excessive overload; to arrange for the easy and quick refilling or reëquipping of the device after operation, and generally to arrange for the reassemblage and reconstruction of the device whenever necessary; to provide means which will aid and facilitate such operations; and to secure the foregoing and other desirable results in a simple and expeditious manner.

In the accompanying drawings Figure 1 is a longitudinal sectional view of the upper part of a fuse device embodying our invention;

Fig. 2 is a cross section of the same taken on line 2—2 in Fig. 1;

Fig. 3 is a longitudinal sectional view of the lower portion of the device shown in Figs. 1 and 2;

Figs. 4 and 5 are cross sections taken on lines 4—4 and 5—5 respectively in Fig. 3;

Fig. 6 is a longitudinal vertical section of a device similar to the device shown in Figs. 1 to 5 inclusive after operation, and being connected together in process of being refilled, together with a tool for use in the separation and connection of the parts for the refilling or reëquipping operation;

Fig. 7 is an elevation of said tool;

Fig. 8 is a cross-section of the same on line 9—9 in Fig. 6.

Referring first to Figs. 1 to 5 inclusive, we show a fuse device comprising a tube 1 which is preferably of transparent insulating material such for example as glass. At the upper end of this tube 1 which is desirably cylindrical in shape, is secured a head 2 which is preferably of metal, such for example as brass or copper. At the lower end of the tube 1 is a cap or fitting 3 also preferably made of metal such as brass or copper. The head 2 is constructed with a lower cylindrical portion 4 adapted to inclose the upper end portion of the tube 1 and is also constructed with an upper cylindrical portion 5 of greater diameter than the lower portion 4, which portion 5 provides a fuse space or chamber 6. The head 2 is provided with a central bore or aperture 7 establishing an opening between the chamber 6 and the interior of the tube 1. A disk 8 of sheet metal or other suitable material is mounted upon the head 2 and detachably secured thereto by means of solder. This disk 8 forms a lid or cover for the head 2 and serves as a vent member to permit the chamber 6 to be vented by the forcible removal of said disk or lid 8. A disk or member 9, preferably of insulating material is located between the chamber 6 and the interior of the tube 1, preferably resting upon shoulders 10—10 formed on the interior of the tubular portion 4 of the head 2, whereby said disk 9 is held against movement toward the tube 1, but fits loosely enough to permit its being moved away from the tube 1. A centrally arranged terminal post or member 12 is located at the upper end of the tube 1 and passes through the insulating disk 9, so that the upper end thereof enters the chamber 6. A fuse member 14, preferably in the form of a fine wire of steel or similar high resistance and strong material extends across the mouth or bore 7 and is secured at its opposite ends by screws 15—15 in contact with the head 2. This fuse member or wire 14 passes through a hole in the terminal post or member 12. A screw 16 is fitted into a screw threaded socket at the upper end of the terminal post 12 and has its head provided with two flat faces 17—17. Fuses 18—18 extend upwardly from the screw 16 to the vent member or lid 8, said fuses being preferably of flat form as shown in Fig. 2. The lower ends of said fuses are soldered to the head of the screw 16 by solder 19 which preferably softens at a comparatively low temperature. The upper

ends of the fuses 18 pass through the lid or vent member 8 and are soldered to the top of the same by solder 20 of the ordinary variety. These flat faces 17—17 provide a considerably greater area of contact between the screw 16 and the fuses 18 than the cross-sectional area of the fuses 18 themselves. The diagonal position of the soldered connection between the fuses 18 and the screw 16 permits the solder when melted to run out by gravity from between the parts thus tending to insure opening of the circuit upon slow rise of temperature. Within the tube 1 we provide suitable actuating mechanism, as for example a spring 21 having its lower end secured to the bottom cap 3 and having its upper end secured to the terminal 12, the latter being connected with a funnel shaped liquid director 22 by means of a cross piece 23. As a matter of further and specific improvement the connection between the terminal 12 and spring 21 comprises a socket member 24 having a threaded socket adapted to receive the threaded lower end 25 of the post or terminal 12, the spring 21 having its upper end conveniently passed through and secured to the lower portion of said threaded socket 24. These parts 24—25 form a rigid screw connection which is however easily separable when the terminal 12 has been drawn down into the sleeve 1. A flexible conductor 26 extends preferably from the threaded socket 24 to the bottom of the tube 1 and is secured to a screw 27 (Fig. 3) in the cap 3. The tube 1 is preferably filled with some suitable arc extinguishing liquid, such for example as carbon tetra chlorid.

In the operation of the device an ordinary continued overload will not overheat any of the fuses 14 or 18, but will soften the solder 19 securing the fuses 18 to the screw 16. This will release said fuses from their connection with the screw 16, and cause strong wire 14 to melt and permit the spring 21 to operate, drawing the terminal 12 through the disk 9 and so separating said terminal 12 quickly and substantially from the terminal formed by the annular portion of the head 2 to which the fuse 14 is secured. In case of a sudden overload, as for example, on short circuit, the instantaneous heat capacity at the head of the screw 16 is quite high because of its being connected directly to the moving terminal, as a result of which the main fuses 18 will blow and thus open the circuit and either release the spring 21 directly or shunt so much current through the fuse 14 that it will blow and thereby release the spring 21, causing the opening of the circuit by means of a wide gap as before.

The lower end of the device involving the member 3 shown in Fig. 3, is desirably so constructed as to permit ready assemblage and disassemblage of the device, but at the same time to make a perfectly tight closure for the volatile liquid inside of the device. As one construction we show in Fig. 3 the member 3 provided with an annular internally arranged flange 28 and an end member or plug 29 having an annular rim or portion 30 which fits within the flange 28. The rim 30 is preferably provided with an annular recess or slot 31 giving it more flexibility or compressibility so that when said end member 29 is screwed tightly into position, it will make a tight fit with the member 3. By screwing the end of the spring 21 and the end of the flexible conductor 26 to the member 29 by means of screws 32 and 27, respectively, the end member 29 may be easily detached and again attached and the spring and flexible conductor readily connected and disconnected. To permit turning of the member 29 relative to the member 3 so as to unscrew and screw up the same, the member 3 is conveniently provided with a hexagonal nut portion 33 and the member 29 with a hexagonal nut portion 34, which said portions may be grasped by an ordinary wrench or other tool.

Referring to Figs. 6, 7 and 8, we show a device somewhat similar to the one shown in Figs. 1 to 5, inclusive, the same having been operated, and also show a tool for refilling or reëquipping said device. This device of Figs. 6, 7 and 8 has a somewhat different fuse arrangement, a fuse 18^a being located within cork or other suitable holder or container 42 which is mounted above the liquid director 22, the fuse being soldered at its lower end to a terminal post or rod 12^a and at its upper end to another terminal post or rod 43 which latter is understood to be adapted to extend up to and be secured to the vent member 8 or other member at the upper end of the device suitable for attachment of said member 43. In application filed by us April 18, 1912, Serial No. 691,718, for fuse devices, which has since matured into Patent No. 1135548, dated April 13, 1915, we show this general type of structure. When the fuse operates the liquid director is drawn downwardly by a spring 21 and separated from the upper terminal thereby forming a wide gap, the liquid being directed against the lower terminal of the liquid director 22. In this construction of Fig. 6 there is, however, the novel feature referred to in the construction of Figs. 1 to 5, inclusive, namely the disconnectible joint between the liquid director and associated parts and the spring 21, said joint being shown in Fig. 6 as a coupling member 24 having the threaded socket adapted to receive the threaded end of the member 12^a.

This disconnectible socket is particularly valuable for purposes of refilling or renewing the fuse device after it has operated. It adds very materially to the economy of the

fuse device because the blown fuse may be replaced by a fresh fuse at a trifling cost. As explained, when the fuse device operates the spring 21 draws the terminal 12 with liquid director attached down into the sleeve 1. The parts then are in a peculiarly inaccessible position for renewal. We provide the screw joint so that the terminal 12 may be easily separated from the spring 21, so that a new fuse may be connected in place.

To disconnect and connect the terminal 12 from and to the socket 24, we provide a special tool which is illustrated in Figs. 6, 7 and 8. This tool comprises a handle or operating rod 45 which is fastened to a hollow shank 46. The shank 46 is of an outer diameter which will easily slide within the main sleeve 1 and has an inner diameter such that the stem 12 and connected parts may come within the shank. This shank is preferably made of a piece of tubing. It is provided with a plurality of prongs or pins 47 at the lower edge. These prongs 47 are adapted to be forced into the upper surface of the liquid director 22, which, as previously explained, is firmly connected to the terminal 12 by the cross bar or pin 23.

Thus, in order to disconnect the terminal 12 after the device has operated, the tool is inserted into the sleeve 1, the prongs 47 are thrust into the liquid director and the tool is then turned in the proper direction to unscrew the terminal 12 from the socket 24. After the parts are unscrewed, the terminal and liquid director are withdrawn from the sleeve 1. If the parts have been damaged by the operation of the fuse, a new terminal and director unit is provided with fuse attached. The prongs 47 are stuck into the top of the liquid director 22 and the new unit is introduced into the sleeve 1 and screwed in place on the socket 24 by turning the handle 45.

The tool is shown in Fig. 6 as being used with a modified form of fuse device in which a cork 42 surrounds the fuse 18^a, between the top of the terminal 12^a and the upper rod or terminal 43. The tubular shank 46 encircles the cork 42 and connected parts, and the prongs 47 engage the liquid director. In each case the tool is used the same way for unscrewing the used terminal and for connecting it after a new fuse is provided or for attaching a new unit to the socket 24.

Thus in these various arrangements the fuse device may be refilled or reëquipped at low cost and without removing the lower cap from the tubular member 1.

It will be understood that changes and modifications may be made without departing from the spirit of the invention.

What we claim is:

1. The combination of a metallic terminal having an opening, a supporting fuse of relatively low capacity extending across said opening, a second terminal located in said opening and being secured to said fuse, other fuses of relatively greater capacity secured to said second terminal, and means independent of first said terminal for connecting said other fuses in circuit.

2. The combination of a metallic head having a fuse chamber, said head also having an opening across which a fuse is extended, a terminal located in said opening secured to and supported by said fuse, a removable venting member normally closing said fuse chamber, and fuses extended from said terminal to said venting member, said venting member being electrically connected to said metallic head.

3. The combination of a metallic head having a fuse chamber, said head also having an opening across which a fuse is extended, a terminal located in said opening and secured to said fuse, a removable venting member normally closing said fuse chamber, and fuses extended from said terminal to said venting member, said latter fuses being secured to said terminal by low melting point solder, said venting member being electrically connected to said metallic head.

4. The combination of a metallic head having a fuse chamber, said head also having an opening across which a fuse is extended, a terminal located in said opening and secured to said fuse, a removable venting member normally closing said fuse chamber, fuses extended from said terminal to said venting member, and a spring acting upon said terminal, said venting member being electrically connected to said metallic head.

5. The combination of a metallic head having a fuse chamber, said head also having an opening across which a fuse is extended, a terminal located in said opening and secured to said fuse, a removable venting member normally closing said fuse chamber, fuses extended from said terminal to said venting member, a spring acting upon said terminal, and an insulating member through which said terminal extends, said spring being on one side and said fuses on the other, said venting member being electrically connected to said metallic head.

6. The combination of a tubular member provided at one end with a fuse chamber, said chamber being external to said tubular member, fuse terminals in said fuse chamber, one of said terminals being movable down into the tubular member and normally extending partially into said tubular member, a fuse between said terminals, a spring in said tubular member, a detachable connection between said movable terminal and spring, said detachable connection comprising a threaded socket and a threaded member adapted to fit therein, said socket and

member being readily detachable when the movable terminal has been moved out of the chamber down into the tubular member.

7. The combination of a tubular member provided at one end with a fuse chamber, fuse terminals in said fuse chamber, one of said terminals being movable down into the tubular member and normally extending partially into said tubular member, a fuse between said terminals, a spring in said tubular member and a detachable connection between said terminal and spring and a liquid director in said tubular member secured to said terminal and serving to guide the same in a tubular member, said connection being readily detachable when the movable terminal has been moved out of the chamber and down into the tubular member.

8. The combination of a tubular member provided with external circuit terminals, a pair of internal fuse terminals, one of said internal terminals comprising a movable stud extending into said tubular member, a fuse connected between said stud and the other internal terminal, a spring in said tubular member normally under tension and connected to said stud and a detachable connection between said movable stud and said spring, said detachable connection comprising axially placed engaging parts on the stud and on the end of the spring.

9. A tubular casing having one end provided with a closure made in two parts, one of which has a threaded annular recess and the other of which has a threaded rim adapted to fit into said recess, said rim being provided with an annular recess substantially concentric with and back of the threaded part of the rim.

10. The combination of a tubular sleeve of insulating material, fuse terminals at one end of said sleeve, one of said terminals lying within the upper end of said sleeve, a fuse between said terminals, a spring in said tubular member adapted to draw said terminal down into the sleeve and a rigid screw connection between said terminal and spring, said connection being readily detachable when said terminal has been drawn down into the sleeve.

11. In combination, a liquid director comprising a short cylindrical block of insulating material having a central aperture therethrough, a short rod or stud passing through said director and connected thereto, the lower end of the rod or stud being threaded, a spring below said liquid director, a connecting member having a threaded socket therein for receiving the end of the rod or stud, said member being mounted on the end of the spring substantially axially of said spring, and a flexible conductor connected to said member.

12. In a fuse device, a terminal member comprising a short rod or stud of metal having screw threads at its lower ends, a liquid director comprising a short cylindrical block of non-conducting material having a jet opening for causing liquid to flow against the other end of the rod or stud and a cross-bar passing through the rod or stud and supporting the liquid director.

13. In combination, a cylindrical sleeve, a cap at each end of said sleeve, a coil spring secured at one end to the lower cap, a terminal comprising a metallic stud adapted to be connected by a fuse to the upper cap, said stud having its lower end threaded, a liquid director mounted on said stud, and a threaded socket secured to the upper end of said spring, said stud being adapted to have its threaded part removably engaged in said socket and to be readily removable when the stud and liquid director have been drawn down into the sleeve by said spring.

14. In combination a sleeve of insulating material, a metallic cap permanently secured about the lower end of said sleeve, said cap closing off the end of the sleeve to form a liquid tight vessel, a metallic band surrounding the upper end of the sleeve, a terminal in the upper end of said sleeve, said terminal being adapted to be connected electrically through a fuse to said metallic band, a spring having its lower end permanently secured to the cap and a connecting member at the upper end of said spring, said terminal and said connecting member having coöperating parts forming a readily separable connection to permit renewal of the fuse after the same has blown and after the terminal has been drawn down into the sleeve.

15. A fuse device provided with a metallic fuse soldered to a metallic terminal by low melting point solder, said fuse and terminal being connected to metallic parts of good heat conductivity, said device being so organized that on moderate overload said solder will soften and cause operation of the device, and on excessive overload, said fuse will melt.

16. In a fuse device, a metallic terminal of high conductivity, a metallic fuse, said terminal and fuse being joined by solder which melts at a substantially lower temperature than the body of the fuse, and means tending to separate the terminal and the fuse.

17. In a fuse device, a metallic terminal of high conductivity, a metallic fuse, said terminal and fuse being joined by solder which melts at a substantially lower temperature than the body of the fuse, and means tending to separate the terminal and the fuse, the soldered joint between the fuse and the terminal being of greater area than the area of cross section of the fuse.

18. A fuse device provided with a metallic fuse soldered directly to a metallic terminal of relatively large carrying capacity by solder of lower melting point than that of

the body of the fuse or of the terminal, said junction between said fuse and said terminal being adapted to be heated solely by the passage of current through said parts, said device being so organized that on moderate overload said solder will soften and cause operation of the device and upon excessive overload, said fuse will melt to cause operation of the device.

In witness whereof, we hereunto subscribe our names this 22nd day of December, A. D. 1914.

EDMUND O. SCHWEITZER.
NICHOLAS J. CONRAD.

Witnesses:
A. LYDA JONES,
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