Sept. 11, 1951 A. J. BOWIE 2,567,420

ELECTRIC FUSE

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Fig. 1.

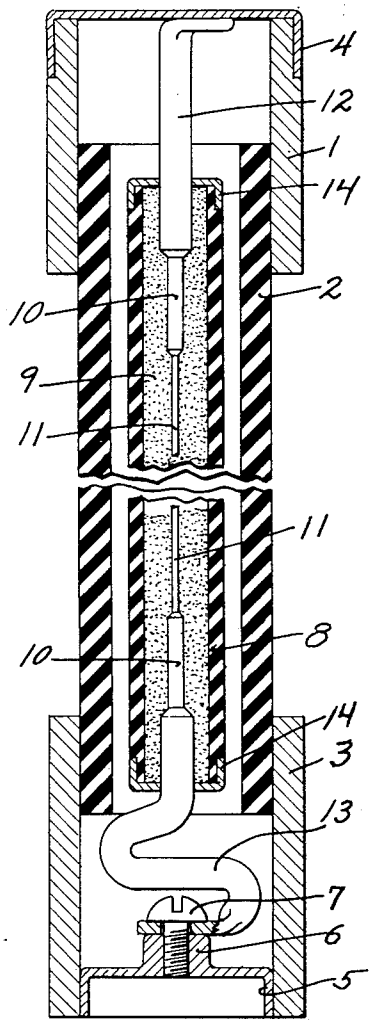


Fig. 2.

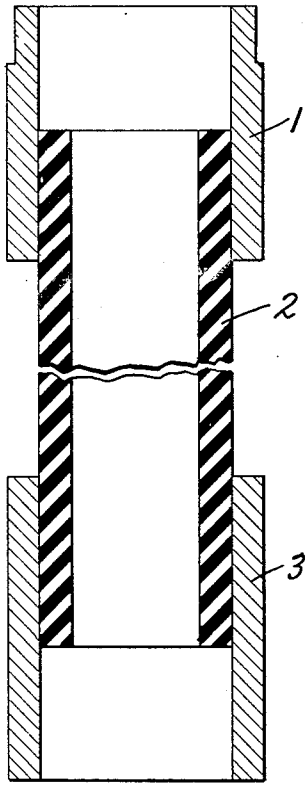


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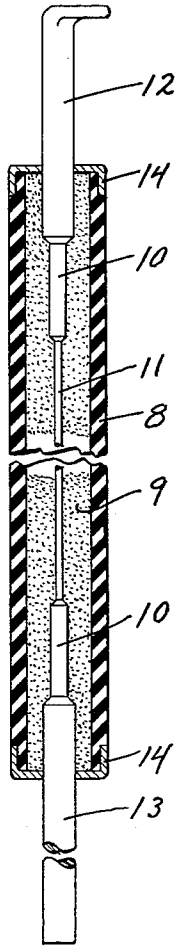


Fig. 6.

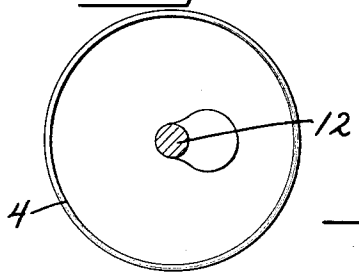


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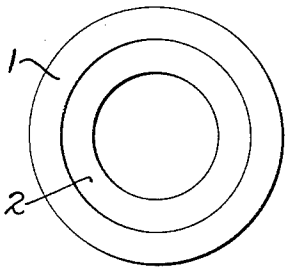


Fig. 7.

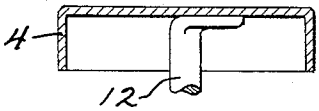
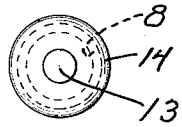


Fig. 5.



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Fig. 8.

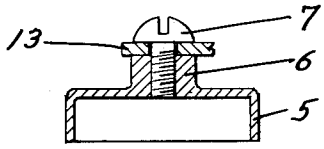


Fig. 10.

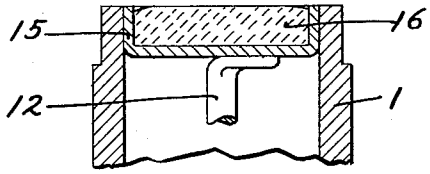


Fig. 9.

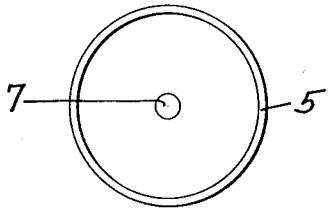
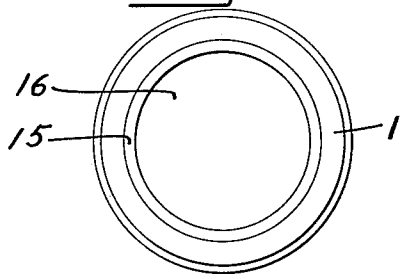


Fig. 11.



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ELECTRIC FUSE

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Application February 4, 1947, Serial No. 726,377

3 Claims. (Cl. 200—131)

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Fuses, as usually made, consist of an insulating tube with external ferrules at or near each end for conducting current through the fuse element which is within the tube. Two types of construction are generally employed—the unfilled fuse where the fuse element is within the tube, generally near one end of the tube, and is provided with a metallic lead to carry current to the other end, this lead being expelled when the fuse blows; and a second type of filled tube, where the fuse element is surrounded by an insulating powder within the fuse tube, the fuse element which blows first being usually located centrally in the tube. When this type blows, usually the powder around the fuse element blows out of the tube and tends to extinguish the arc.

In general, the interrupting capacity of a fuse is increased by allowing it to blow out of both ends with a differential blow-out pressure, so that a weaker expulsion blows from one end, but if the pressure is sufficiently great, the other end will blow out too. In the past, filled fuses can be readily refilled in the factory, but are not practicable for field refill, owing to the difficulty in keeping the powder dry, and in using the correct amount of powder not to pack and yet sufficient to fill the tube.

In any event, with the filled fuse there is some danger of moisture within and also of packing of the filler.

It is the object of my invention to overcome both of these shortcomings, and at the same time to provide a fuse capable of ready field refill.

I accomplish this by the use of a refill cartridge inserted in the main fuse tube with caps for contacting the fuse ferrules. This cartridge I make preferably of fiber, and provide with closures which may be light metal caps pressed on each end. The fuse element metal within the cartridge is weakened at a position predetermined, preferably in the central part where the fuse will blow. Insulating arc extinguishing powder fills the cartridge and surrounds the fuse element. When this blows, the end closures are expelled.

The refill cartridge is preferably made slightly smaller than the inside of the main fuse tube. If the pressure is sufficiently high, this causes its refill tube to expand until it touches the outer tube. This action relieves powder packing and facilitates expulsion. Also it increases the strength of the tube against rupture.

Horn fiber is an ideal material to use, as it allows necessary expansion without rupture.

The main fuse tube is provided with contact caps, which carry current from the refill to the

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ferrules. These are preferably arranged to blow out of the ferrules at different pressures. I prefer to make these caps of brass, contacting the ferrules by friction.

Although these caps fit the ferrules very closely, it is difficult, even with factory refill, to make the top cap moisture tight when the fuse is vertically mounted or in an inclined position. On this account the top cap, which in my previous designs I made to insert in the ferrule, I now make to fit the ferrule externally, thus shielding it against direct falling moisture.

This is a distinct improvement, and is generally applicable to previous makes of fuses as a basic idea.

Fig. 1 is a sectional elevation of a fuse and refill.

Fig. 2 is a sectional elevation of the main fuse tube only.

Fig. 3 is an end view thereof.

Fig. 4 is a sectional elevation of a refill.

Fig. 5 is an end view thereof.

Fig. 6 is an end view of a top cap.

Fig. 7 is an elevation in section thereof.

Fig. 8 is an elevation in section of a bottom cap.

Fig. 9 is an end view thereof.

Fig. 10 is an older type in section of a top closure for inserting within the top ferrule.

Fig. 11 is an end view thereof.

1 is a top ferrule; 2 is a main fuse tube; 3 is a bottom ferrule; 4 is a sealing cap to which the fuse refill is soldered; 5 is a bottom sealing cap with terminal 6 soldered thereto; and 7 is a screw by which lower end of the fuse refill is connected to the cap 5; 8 is a refill cartridge tube with insulating powder 9; 10 is fuse element with reduced area at center 11, to blow first; 12, 13 are preferably copper fuse ends; 14, 14 are end caps of metal, preferably which are pressed on the cartridge 8; 15 is an insert type of cap of older design for pressing in and contacting to the top ferrule; 16 is a wax fill for same to avoid a sump for water collection.

The refill consists of items 8 to 14, inclusive, and of 4 soldered to fuse end 12, and also of pieces 5, 6 and 7.

The fuse refill is replaced by dropping the cartridge within tube 2 and pressing cap 4 on ferrule 1.

The other end of cartridge 13 is then connected to caps 5 and 6 by screw 7, and cap 5 is then pressed into ferrule 3. When the fuse blows, internal pressure at 11 expands tube 8 to contact tube 2. Then pressure blows out end caps

14, 14 and either or both caps 4 and 5, opening the fuse tube for expulsion of the filler 9. The internal pressure in the refill, in turn, expels caps 4 and 5, opening the refill to discharge to the atmosphere. The novel elements are:

1. Refill cartridge powder filled.

2. Spaced relation of this to the fuse tube 2, allowing expansion of this cartridge and overcoming powder packing.

3. Horn fiber cartridge to aid in arc extinguishing and also to allow some expansion without breaking tube 8.

4. External top ferrule cap protection against direct moisture.

When the fuse 11 belows, it generates a pressure within tube 8, and tends to expel caps 14. If the powder 9 is too tightly packed, the pressure within expands tube 8 till it touches fuse tube 2. This expansion overcomes any tendency of powder 9 to pack and allows ready expulsion thereof from the ends of tube 8. When caps 14, 14 are expelled from tube 8, pressure is exerted on caps 4 and 5, tending to expel them from tube 2. The refill tube 8 is of such size that it slidably fits within the main tube 2, and a slight expansion of the said refill tube when the fuse blows will allow it to expand without bursting, due to the reinforcing thereof by the main tube. The caps 4 and 5 will be successively expelled from their associated ferrules 1 and 3 respectively, but before the pressure gets high enough to burst the main tube 2 under heavy loads, both caps will be expelled to effect the opening of both ends of the said main tube. The strength of tube 8 will allow it to expand and touch tube 2 before breaking, and the use of a yieldable fiber refill tube is of important advantage to secure full bursting strength of both tubes 8 and 2.

If cap 15 is used as formerly on upper ferrule 1, moisture is liable to enter from direct rain, which is prevented with outside cap 4 of later design.

What I claim is:

1. In an electric fuse, a main insulating tube having electrical contacts on its opposite ends, a tubular refill fuse member fitting inside the main tube and having its interior filled with an insulating powder, the said tubular refill fuse member being adapted to expand radially upon the fuse blowing, and the said tubular fuse member being normally positioned in sufficiently close relation to the main tube to permit the tubular fuse member to contact the main tube without bursting upon the fuse blowing, a fuse element positioned within the insulating powder, closures at the ends of the tubular fuse member adapted to be opened when the fuse blows, and means electrically connecting the end contacts of the main tube with the fuse element.

2. In an electric fuse, a main insulating tube having electrical contact members normally closing its opposite ends, the said contact members being adapted to be discharged from the tube upon a predetermined pressure being generated inside the tube when the fuse blows, a tubular refill fuse member fitting inside the main tube and having its interior filled with an insulating powder, the said tubular fuse member being adapted to expand radially upon the fuse blowing, and the said tubular fuse member being normally positioned in sufficiently close relation to the main tube to permit the tubular fuse member to contact the main tube without bursting upon the fuse blowing, a fuse element positioned within the powder, closures at the ends of the tubular fuse member adapted to be opened when the fuse blows, and means electrically connecting the contact members of the main tube and the fuse element.

3. In an electrical fuse, a main insulating tube having ring shaped ferrules secured on its ends, electrical contact members closing the openings through the ferrules, at least one of the said contact members being adapted to be discharged from its associated ferrule upon a predetermined pressure being generated inside the tube when the fuse blows, an insulating refill cartridge fitting inside the main tube and having an insulating powder therein, the said cartridge being adapted to expand radially upon the fuse blowing, and the said cartridge being normally positioned in sufficiently close relation to side walls of the main tube to permit the cartridge to contact the main tube without bursting upon the fuse blowing, an elongated fuse element positioned within the powder, closures at the ends of the cartridge adapted to be opened when the fuse blows, and means electrically connecting the contact members of the main tube and the fuse element.

AUGUSTUS JESSE BOWIE.

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