L. W. DOWNES & R. C. PATTON.

FUSE.

APPLICATION FILED OCT. 12, 1916.

1,270,272. Patented June 25, 1918.

Fig. 1

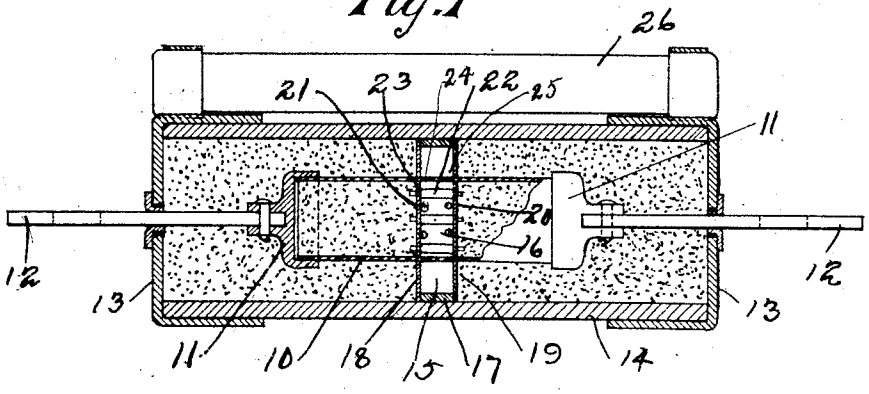


Fig. 2

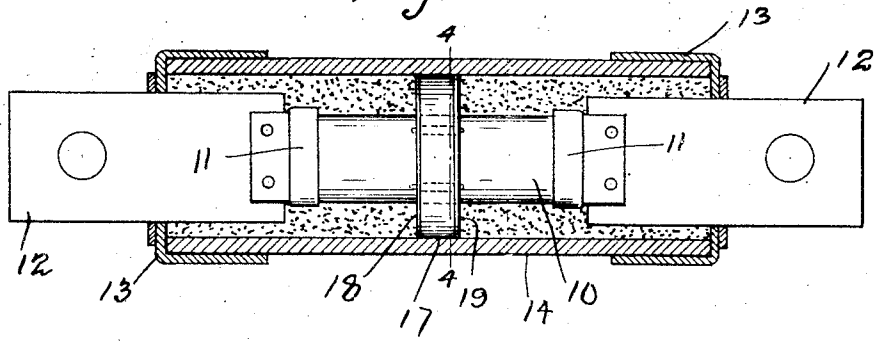


Fig. 3

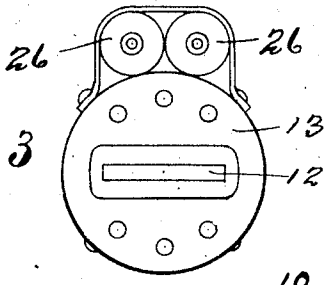


Fig. 4

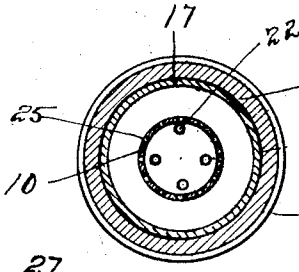
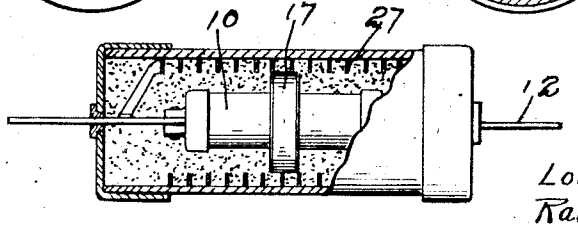


Fig. 5



Witnesses

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FUSE.

1,270,272. Specification of Letters Patent. Patented June 25, 1918.

Application filed October 12, 1916. Serial No. 125,167.

To all whom it may concern:

Be it known that we, LOUIS W. DOWNES and RALPH CLIFTON PATTON, citizens of the United States, and residents of the city of Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Fuses, of which the following is a specification.

This invention relates to electric fuses more particularly of the cartridge type, and the object of this invention is to provide a main fuse link connected electrically in parallel with an auxiliary fuse, said main fuse being provided with an air space or drum about its link for the purpose of completely extinguishing the arc at that point before the auxiliary link finally opens the circuit.

A further object of the invention is to provide an electric fuse having a fusible link of cylindrical shape and to provide an air chamber for said link formed both on the inside and on the outside of the cylinder for a portion of its length.

It is found in practice that when the current slowly creeps up beyond the maximum carrying capacity of the fuse, the link begins to oxidize on its surface, and if maintained at a critical temperature just below its melting point for any considerable time, this coating of oxid often becomes thick enough to support the metal within it even when the latter has become melted and when a filling of arc suppressing material lies against this oxid coated link it serves to support this skin and prevent the rupture which should otherwise occur.

In order to obviate this serious difficulty of preventing the rupture of the link at the proper time, we have provided an air space both on the inside and outside of the cylindrical link, which spaces are preferably arranged to register one with the other so that both the inside and outside walls of the link at the air space are entirely unsupported, whereby the weight of the metal will readily break the skin of oxid, fall away and disperse, because the skin has not sufficient strength in itself to support the weight of molten metal.

Then again another advantage secured by the use of the air space is, that the filling materials generally employed become electrical conductors to a certain extent, if heated to high temperatures. This has been termed the Nernst effect, an example of which may be seen in the well-known Nernst lamp.

The air chambers divide the filling material and so prevent highly heated layers of the same from serving as a conductor to re-establish the circuit after the link is blown.

The desirable effects secured by the air chambers aid in the quiet operation of any fuse, but are particularly valuable when used in a main fuse connected electrically in parallel with an auxiliary fuse.

With these and other objects in view, the invention consists of certain novel features of construction, as will be more fully described, and particularly pointed out in the appended claims.

In the accompanying drawings:

Figure 1— is a sectional side elevation of a main fuse showing an auxiliary fuse mounted thereon.

Fig. 2— is a side elevation partly in section showing a fuse with a tubular fuse link having an air chamber formed about it.

Fig. 3— is an end view of the construction shown in Fig. 1.

Fig. 4— is a sectional end view on line 4—4 of Fig. 2 through one row of metal reducing holes.

Fig. 5— is a sectional side elevation of a compound fuse the main link being provided with an inclosing air space and the auxiliary link being in the form of a helix mounted within the same casing.

Referring to the drawings, 10 designates a tubular fusible link supported at its opposite ends in the heads 11, which heads are in turn supported on the contact plates 12 extending out through the end caps 13 of the casing 14.

One of the features of our present invention is the forming of an air chamber 15 about the outside of this tubular link and also a chamber 16 on the inside of this tubular link, both of which chambers are arranged to register one with the other.

The outer chamber is formed by providing a ring 17 of fiber or other suitable material, which fits inside of the casing 14, and by providing two broad rings 18 and 19 of mica or other suitable heat resisting material to form the end walls of the chamber, the ring 17 serves as a separator to hold these walls of mica apart.

The inner chamber 16 is formed by providing a pair of disks 20 and 21 which are held in spaced apart relation by one or more spacing pins 22, each of which pins is shouldered as at 23, the reduced portion extending through openings in the mica disks.

The walls of the inner chamber are preferably arranged in line with those of the outer chamber so that the air chambers on both sides of the link will register.

In order to somewhat weaken that portion of the wall of the tubular link, which lies within the air chamber, we have formed a plurality of small holes 24 through the body of the link adjacent one of the chamber walls and a similar row of holes 25 adjacent the opposite wall of the chamber, thereby weakening the link between these holes so as to insure its rupturing within the chamber.

A filling of arc suppressing material is pressed both into the inside of the tubular link and also about the outside of the same, completely filling the casing except the sections between the walls of the inner and outer chambers.

By this construction, it will be observed that the walls of the tubular link are entirely unsupported within the chambers, whereby when fused, the metal will drop and disperse breaking the circuit at this point.

It is found in practice that the use of an air chamber in a compound fuse greatly increases the efficiency of such a fuse particularly in high current and high voltage circuits. Fig. 1 of the drawings illustrates a cartridge form of compound fuse in which one or more auxiliary fuses 26 of greater electrical resistance are connected electrically in parallel with the main fuse.

It has been found in large compound fuses, particularly those having a voltage of six hundred or more, that when an air space is not employed about the main link, the arc sometimes reëstablishes itself in the main fuse, after the auxiliary link is ruptured. This has been found to be due to the fact that either the skin of metallic oxid has not been entirely broken, or else the filling of arc suppressing material about the main link has become a conductor due to its high temperature.

When the air chamber is employed in a compound fuse, the main link ruptures within the chamber upon the passage of an excessive current without the formation of a violent arc because at the time this main link melts the potential across the gap formed in it is very low, due to the fact that the main link is then connected in parallel with a shunt circuit in the form of an auxiliary link. Therefore, the small arc formed at the break in the main link is entirely extinguished before the auxiliary link finally opens the circuit. It is then impossible for the circuit to reëstablish itself through the main fuse.

In some instances instead of mounting the auxiliary fuse in a separate casing and on the outside of the main casing, as illustrated in Figs. 1, 2 and 3, we construct the auxiliary element in a coil or helical form 27 and mount it in the same casing with the main fuse 10 as illustrated in Fig. 5 but any coöperating arrangement of main and auxiliary fuse links adapted to operate in connection with an air chamber is intended to fall within the scope of this invention.

Our present invention lies first, in the provision of a compound fuse having fuse links of any shape and providing an air chamber about the main fuse link for the purpose above described; second, to provide a fuse having a tubular fuse link with an air chamber, both on the outside and on the inside of the link; and third, the provision of a compound fuse having a main link in tubular form, said main link having an air chamber both on its inside and on its outside, said main fuse link being arranged to work in conjunction with an auxiliary fuse link of any shape or form and connected with it in parallel.

Having thus described one illustrative embodiment of our invention, we desire it to be understood that the details of construction may be varied without departing from the spirit of the invention, the scope of which is defined by the appended claims.

We claim:

1. In an electric fuse, the combination of a main fuse link and an auxiliary fuse link connected together electrically in parallel, an air chamber formed about said main link for a portion of its length, said auxiliary fuse being of a capacity sufficient to prevent the drawing out of an arc within the air chamber upon the melting of the main fuse link before the auxiliary link finally opens the circuit.

2. In an electric fuse, a cylindrical fuse link, a filling of arc suppressing material about said link and an air chamber formed both inside and outside of said cylinder for a portion of the length of the fuse.

3. In an electric fuse, a cylindrical fuse link, a filling of arc suppressing material in said fuse, and an air drum formed both on the outside and on the inside of said cylinder said drums registering with each other.

4. In an electric fuse, a cylindrical fuse link, an air drum formed on the outside of said link, an air drum formed on the inside of said link, said drums registering with each other, and a filling of arc suppressing material about said drums.

5. In an electric fuse, a casing, a cylindrical fuse link mounted in said casing, an air

chamber formed on the inside and about the outside of said link, the walls of said link being weakened between said chambers.

6. In an electric fuse, an outer casing, a cylindrical fuse link mounted in said casing, air drums having two side walls formed both on the outside and on the inside of said cylinder, spacers for separating and supporting said walls, and a filling of arc suppressing material packed against both of said walls.

7. In an electric fuse, a casing, a cylindrical fuse link in said casing, a filling of arc suppressing material about said link, an air chamber formed on both the inside and outside of said link for a portion of its length, and an auxiliary fuse connected electrically and in parallel with said main fuse, said auxiliary fuse being of a capacity sufficient to prevent the drawing out of an arc within the air chamber upon the melting of the main fuse link before the auxiliary link finally opens the circuit.

In testimony whereof we affix our signatures in presence of two witnesses.

LOUIS W. DOWNES.
RALPH CLIFTON PATTON.

Witnesses:
GEORGE W. STEERE,
P. O. BAKER.