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H. BITTER

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FUSE

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Fig. 1.

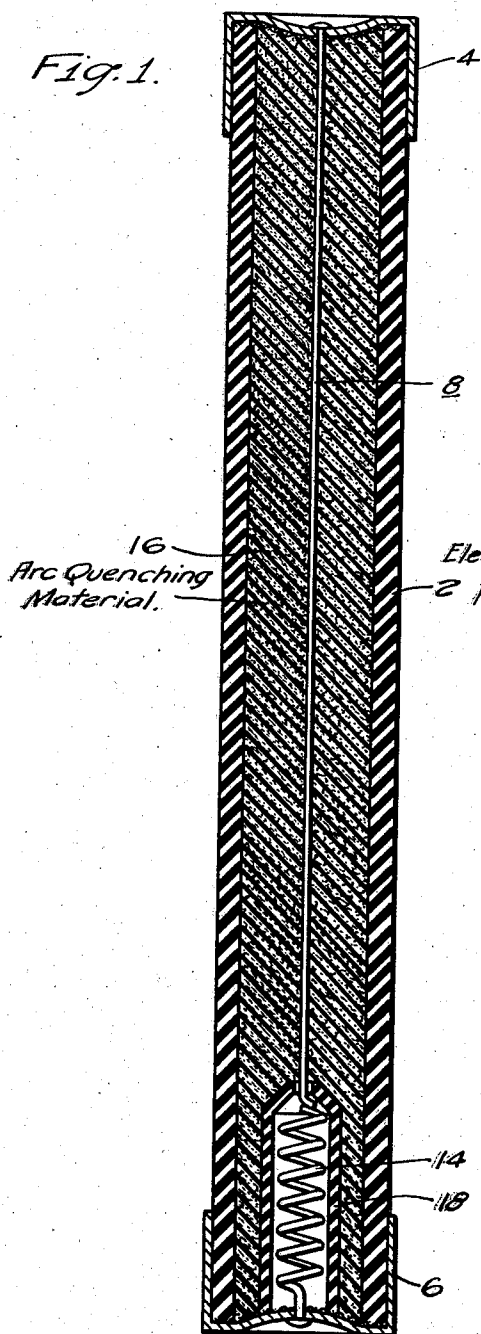
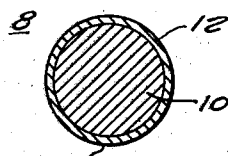
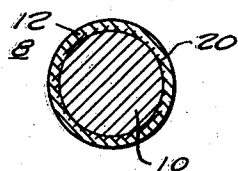


Fig. 2.



Electrolytically deposited low-melting
2 point alloying material

Fig. 3.



WITNESSES:

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FUSE

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7 Claims. (Cl. 200—135)

This invention relates, generally, to high voltage fuses, and more particularly to the fusible elements thereof.

The desirability of obtaining in a fuse protection against relatively light continuing overloads while at the same time providing a fuse which will not blow on sudden high current surges which only last a short period of time, such, for example, as may occur when heavy apparatus is initially thrown on the circuit, has long been recognized. One method which has been proposed for accomplishing this purpose is to provide fuse wire or strip of a low resistance with a coating of a material having a lower melting point than the core material, so that the composite fusible element will have sufficient heat conducting capacity to withstand overloads which are applied for a short period of time, but on light continuing overloads, the fusible member will be heated up and the outer coating will be either melted off or will form an alloy with the core material. Of course, when the outer coating melts off the core member, the cross sectional area of the fuse member is correspondingly reduced, thereby increasing the current density and causing correspondingly greater heating of the core member and fusion thereof. Similarly when an alloy formation occurs between the coating and core material, the alloy will have a higher resistance than the core material, thereby causing a greater heating effect and fusion of the fuse member. In a fuse member of this type, there may be both an alloying formation upon heating of the conductor, and depending upon the amount of heat developed, and the melting point of the coating material, there may also be melting of the coating material off of the core member.

Heretofore composite fuse members of the above type have been formed by depositing the coating layer on the fuse conductor by bringing the core conductor into contact with the coating metal in the molten form. Such a process may be carried out, for example, by drawing the core wire or ribbon through a bath containing the molten coating metal. One disadvantage of fusible members produced by this method is that the composite members produced in this fashion will generally have a higher resistance than the core conductor would have without the coating, and as a result, such a composite fuse conductor will be heated to a greater extent for a corresponding current rating. The reason for this is that the molten material is at a relatively high temperature, and the process of applying this

metal to the core member will initiate some alloy formation between the two, which, as previously stated, has a much higher resistance than the core metal. Another disadvantage of composite fuse conductors of this type is that the quantity of alloy produced when the core wire is passed through a bath of molten metal depends on the temperature of the liquid metal, and this may result in different quantities of alloy formed so that different portions of the conductor will have different current ratings, and when cut into individual fuse strips, the strips may vary considerably in rating, unless the temperature of the molten metal is carefully controlled in the course of the process of depositing the coating.

In accordance with this invention, the foregoing disadvantages of a composite fuse conductor formed by passing a core conductor through a bath of molten coating metal are entirely overcome by producing the coating of the core member by an electrolytic method. By electrolytically depositing a coating metal on a core member, there will be no alloy formation because such a process is essentially a cold process. It can, therefore, be readily appreciated that a fuse conductor constructed by an electrolytic process will not only retain the conductivity of the core member, but it will even be somewhat increased by an amount corresponding to the conductivity of the coating deposited thereon. Furthermore, when the coating is deposited on the conductor by an electrolytic method, the quantity of metal can be more readily and more accurately controlled than when it is deposited on the core conductor from the molten state by the customary method. This method, therefore, will obviously provide a composite fuse conductor having a greater conductivity than was heretofore possible for fuse conductors of like dimensions and materials, and it is also possible to more easily obtain a uniform product because of the ease of control of the amount of metal deposited when using an electrolytic action. The present invention is especially important in connection with high voltage fuses, because in these fuses the ratio of the length of the fuse conductor to the cross sectional area of this conductor is so large that the problem of heat removal, for example, at rated load currents becomes very important.

There is illustrated in the drawing one type of fuse-holder for utilizing a fuse member constructed in accordance with this invention.

Fig. 1 is a longitudinal cross-sectional view of the fuse;

Fig. 2 is an enlarged transverse sectional view through the fusible wire shown in Fig. 1; and

Fig. 3 is a view similar to Fig. 2, but showing an alloy formation between the core fusible conductor and its coating material.

Although the fuse shown on the drawing utilizes a fusible element in the form of a fuse wire, it should be understood that this invention is also adaptable to fuses having other than circular shaped fuse conductors, such, for example, as flat strips or the like. Referring to the drawing, there is illustrated a fuse having a tubular fuse-holder 2 of insulating material, such, for example, as fiber or the like, with end terminal caps 4 and 6 of a conducting material, such as brass, secured over each end of the insulating tube 2. Interiorly of the fuse tube 2 there is provided a fuse wire 8 constructed in accordance with this invention of a core member 10 preferably of some good conducting material, such for example, as silver or copper, having electrolytically deposited thereon a coating material 12, such, for example, as tin or the like, which has a lower melting point than the core conductor 10 and is capable of alloying with core 10 upon the application of heat thereto. Fuse wire 8 is secured to end cap 4, for example, as by soldering or the like, and extends towards end cap 6 to be secured to a coil tension spring 14, which has the other end thereof soldered or otherwise suitably secured to end cap 6. Preferably the interior of fuse tube 2 is filled with an inert arc quenching material 16, such, for example, as sand or the like, and in order to prevent this material from filling the spaces between the coils of spring 14, a small insulating tube 18 is provided about spring 14 so that when fuse wire 8 melts, spring 14 will be free to elongate the gap to draw out the arc formed and permit the same to be quenched by movement of the arc quenching material 16 into the gap.

As shown in Fig. 1, fuse wire 8 extends substantially throughout the length of fuse tube 2. However, it is obvious that only a portion of fuse wire 8, as shown in Fig. 1, need be of the composite construction shown in Fig. 2, if desired. In the operation of a fuse such as that shown on the drawing, core wire 10 of the fusible element will have a definite fusion point which will be raised by application of coating material 12 thereto, and the increased thermal capacity provided by this coating will enable fuse wire 8 to withstand sudden short high current surges, but where light overloads are prolonged for a predetermined period of time, the conductor will gradually heat up to cause coating material 12 to alloy with core wire 10, as shown at 20 (Fig. 3), thereby increasing the resistance of fuse wire 8 and cause fusion thereof. As previously stated, the resistance of wire 8 may be also, in effect, increased by melting of coating 12 from core wire 10.

It will be observed from Fig. 2 that there is no initial alloy formation produced in a fuse wire

of composite construction formed by an electrolytic method in accordance with this invention. Accordingly, the greater part of the current flow through the fuse wire will take place through core wire 10, and only when this is overloaded will any alloy formation take place between the metals 10 and 12. It can be seen, therefore, that by producing a composite fuse conductor by an electrolytic method that not only is the conductivity of the composite structure increased over that of the core member, as distinguished from a decreased conductivity when produced by other methods, but also inasmuch as there is no alloy formation between the core and coating and because of the ease of control of electrode position methods, a uniform coating on a core member may be readily obtained so that the fuse wire will be of a uniform rating throughout.

Having described a preferred embodiment of the invention in accordance with the patent statutes, it is desired that the invention be interpreted as broadly as possible, and that it be not limited to this particular embodiment, inasmuch as it will be obvious, particularly to persons skilled in the art, that many changes, especially of form, of this embodiment may be made without departing from the broad spirit and scope of this invention. Therefore, it is desired that the invention be interpreted as broadly as possible and that it be limited only by the prior art and by what is specifically set forth in the following claims.

I claim as my invention:

1. In a fuse, a fusible member having a relatively high melting point, and a fusible coating electrolytically deposited on said member and having a lower melting point.

2. In a fuse, a fusible member having a relatively high melting point, and a fusible coating electrolytically deposited on said member and having a lower melting point and being of a material capable of combining with said member upon a rise in temperature to form a relatively high resistance alloy.

3. In a fuse, a fusible member, and a coating of a material capable of combining with the material of said member in response to heating thereof, electrolytically deposited on said member.

4. In a fuse, a fusible member having a relatively high melting point, and a fusible coating deposited on said member without the application of heat, and having a lower melting point.

5. In a fuse, a fusible member having a relatively high melting point, and a fusible coating deposited on said member by a cold process and having a lower melting point.

6. A fusible member of copper having a coating electrolytically applied thereto of a fusible alloying material having a lower melting point.

7. A fusible member of silver having a coating electrolytically applied thereto of a fusible alloying material having a lower melting point.

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