May 3, 1932. H. GERDIEN 1,856,701

ELECTRICAL FUSE FOR HIGH OR LOW VOLTAGE

Filed Oct. 16, 1926

Fig. 1.

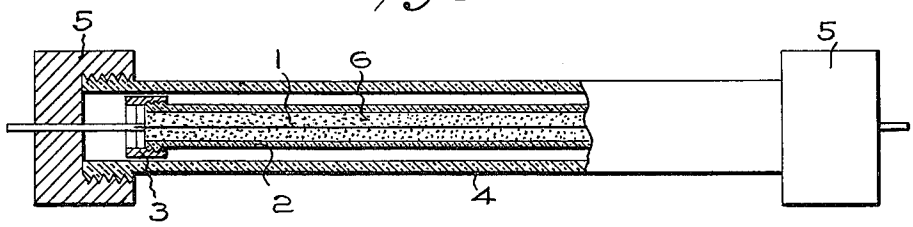
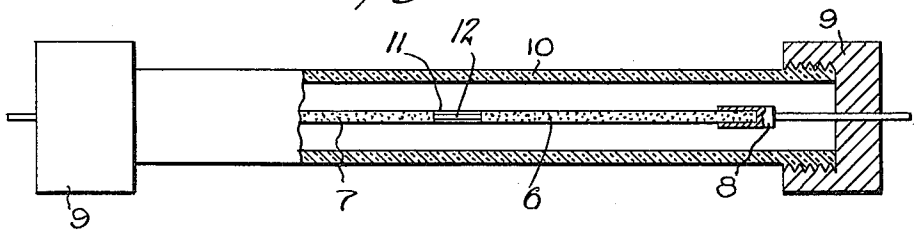


Fig. 2.



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Patented May 3, 1932 1,856,701

UNITED STATES PATENT OFFICE

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ELECTRICAL FUSE FOR HIGH OR LOW VOLTAGE

Application filed October 16, 1926, Serial No. 141,995, and in Germany October 16, 1925.

My invention relates to an electrical fuse and particularly to fuses of the high voltage type.

My improved fuse consists essentially of a fuse element, wire or strip, having a combustible material intimately associated therewith. The combustible material consists preferably of a mixture rich in oxygen, such as nitrate of barium, and an easily combustible material, such as aluminium or magnesium.

If the temperature of the fuse element exceeds a predetermined value due to an overload, the combustible material is ignited. The heat thus set free destroys the fuse element and the circuit is opened. It has, furthermore, been found that it is particularly advantageous to use a combustible mixture with an excess of oxygen so that the fuse element is completely oxidized.

In the drawings affixed hereto the structure of my invention is illustrated wherein:

Fig. 1 is a view, partly in section and partly in elevation, of a fuse embodying my invention.

Fig. 2 is a view, partly in section and partly in elevation, of a fuse embodying a particular form of my invention.

Referring to Fig. 1, a fuse wire or strip, preferably consisting of a metal which forms a non-conducting oxide, for instance, aluminium, is mounted in an insulating tube 2 and forms an electrical circuit with terminals 3 that are provided on the ends of the insulating tube 2. The terminals 3 are in the form of caps and are provided with apertures forming outlets from within the tube 2. The tube 2 is located within an insulating tube 4 of explosion-proof material. This tube has its ends completely enclosed by caps 5, through which sealed leading-in wires extend within the tube 4. The inner tube 2 is filled with a combustible mixture 6, such as nitrate of barium, magnesium and aluminium powder.

The device functions in the following manner: If the temperature of the fuse wire 1 exceeds a predetermined value due to an overload condition in the circuit the combustible mixture in the tube 2 is ignited, burns very quickly and thus fuses or melts the wire 1. The combustible mixture should therefore preferably possess a high heat of combustion. Due to the excess of oxygen in the combustible mixture the fuse wire is also burned and forms a non-conducting oxide. By the combustion of the mixture in the tube 2 a considerable pressure is set up within the tube 4 which suppresses or prevents the striking of an arc between the terminals of the circuit.

The length of the fuse element should be chosen in regard to the voltage of the circuit to be opened. To avoid a considerable loss of voltage in the fuse element, it should be made of comparatively large cross-section. Care must then be taken in selecting the combustible mixture to ascertain that it will be ignited readily at a low temperature. For this purpose an easily inflammable mixture may be interposed at a suitable place within the fuse element which transmits the ignition to the combustible material. For this purpose a mixture of potassium chlorate, sugar and magnesium powder may be employed. Such a mixture was found to ignite at about 200° C.

In order to oxidize the metallic vapors which are generated in the tube 2 during the combustion, substances with a high content of oxygen may be placed in the tube 2 or the tube 4. Particularly suitable for the purpose are substances which liberate oxygen with difficulty and which after the reduction form a non-conducting material, for instance sulphate of barium.

A construction which is particularly suitable for opening high-voltage circuits is shown in Fig. 2. It consists of a metal tube 7 of aluminium or magnesium which is slotted in its middle portion at 11 for the purpose of reducing the conducting cross-section. At this place the tube is filled with an easily inflammable mixture 12 such as potassium chlorate, magnesium and aluminium powder. At both sides of this filling there is provided in the tube the before mentioned combustible mixture 6 comprising nitrate of barium, magnesium and aluminium powder. The ends of the tube 7 are secured in the terminals 8 of the circuit which pass

through the caps 9 completely enclosing the ends of the insulating tube 10.

This fuse operates in the following manner: As soon as the temperature of the central portion of the fuse tube 7 exceeds the ignition temperature of the mixture contained in this portion, the mixture is ignited and initiates the combustion of the filling of the tube 7. The tube 7 is thereby fused or oxidized, the fuse blows and the circuit is opened. Here also the striking of an arc between the terminals of the circuit is prevented by the high pressure developed within the tube during the blowing of the fuse. Sulphate of barium may be provided in the tube 10 for fixing the metallic vapors.

The fuse according to my invention is particularly suitable for opening circuits carrying large currents at high voltages, because the striking of an arc is suppressed and the metallic vapors developed are burned into non-conducting oxides.

Various modifications and changes may be made without departing from the spirit and the scope of the invention, and I desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art.

I claim as my invention:—

1. In an electric fuse, a tubular metallic fusible element, and a combustible material containing oxygen in excess within the tubular element.

2. In an electric fuse, a tubular fusible current carrying element and a mixture of nitrate of barium, aluminium and magnesium powder within the element.

3. In an electric fuse, in combination, a tubular fusible current carrying element, a mixture of nitrate of barium, aluminium and magnesium powder within the element and a mixture of potassium chlorate, sugar and aluminium powder located at one place of said element.

4. In an electric fuse, in combination, a tubular fusible conducting element, a mixture of nitrate of barium, aluminium and magnesium powder within the element and a mixture of potassium chlorate, sugar and aluminium powder located at a place of said element of reduced cross-section.

5. In an electric fuse, a fusible current carrying tube consisting of metal the oxide of which is a non-conductor, and a combustible material within the tube.

6. In an electric fuse, a tubular fusible conducting element, a combustible material within the said tubular element, and a gas-tight explosion-proof tube enclosing said element.

7. In an electric fuse, in combination, a gas-tight, explosion-proof tubular case and a fusible current carrying aluminium tube filled with a combustible and easily inflammable material located in said case.

8. In an electric fuse, in combination, a gas-tight, explosion-proof tubular case and an aluminium tube filled with a combustible and easily inflammable material with slots at about the middle, located in said case.

9. In an electric fuse, in combination, a gas-tight explosion-proof tubular case and an aluminium tube filled with a combustible and easily inflammable material with slots at about the middle, located in said case containing a material rich in oxygen.

10. In an electric fuse, in combination, a metal tube containing a combustible mixture and slotted at about its middle where an easily inflammable material is located, terminals at both ends of said tube, and an outer gas-tight, explosion-proof tube enclosing said inner tube.

11. The combination in an electric fuse, of a fuse element having a reduced section, a combustible material associated with the fuse element along the greater part of its length and a combustible material of greater inflammability than the first said combustible material associated with the fuse element at its said reduced section.

In testimony whereof, I have hereunto subscribed my name this 28th day of Sept., 1926.

HANS GERDIEN