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ELECTRIC FUSE HAVING BALANCED LOW CURRENT INTERRUPTING PERFORMANCE AND HIGH CURRENT INTERRUPTING PERFORMANCE

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Fig. 1

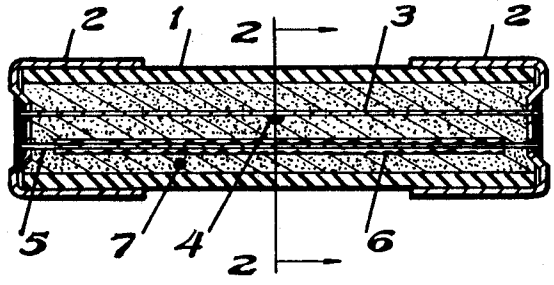
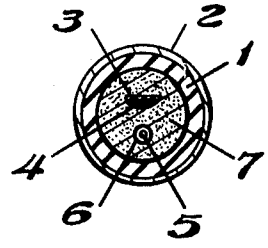


Fig. 2



Inventor:
FREDERICK J. KOZACKA

by Irwin Kalpin Attorney

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ELECTRIC FUSE HAVING BALANCED LOW CURRENT INTERRUPTING PERFORMANCE AND HIGH CURRENT INTERRUPTING PERFORMANCE

Frederick J. Kozacka, South Hampton, N.H., assignor to The Chase-Shawmut Company, Newburyport, Mass.

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3 Claims. (Cl. 200—120)

This is a continuation-in-part of my copending patent application Ser. No. 474,778 filed July 26, 1965, for Electric Fuse With Separate Quartz Sand Fillers Having Different Grain Sizes.

I have shown in the above patent application that in electric fuses relatively coarse quartz sand lends itself better to interruption of relatively small currents than relatively fine quartz sand, and that relatively fine quartz sand lends itself better to interruption of relatively large currents, or short-circuit currents, than relatively coarse quartz sand.

I have further shown in the above patent application that by providing a fuse with two separate bodies of quartz sand, one being relatively coarse and particularly adapted to interrupting relatively small protracted overload currents and the other being relatively fine and particularly adapted to interrupting relatively large currents, or short-circuit currents, an excellent interrupting performance at low currents as well as at high currents may be achieved.

While it is thus possible to provide electric quartz-sand-filled fuses having a balanced low current interrupting performance and high current interrupting performance, the manufacturing cost of such fuses are relatively high on account of the provision of two separate bodies of quartz sand having different grain sizes and different arc-quenching properties under different arcing conditions.

It is, therefore, one object of this invention to provide electric fuses having performance characteristics similar to those of the fuses disclosed in my above patent application, i.e. fuses having a balanced low current interrupting performance and high current interrupting performance, but not requiring two separate bodies of different quartz sand to achieve this end.

Another object of this invention is to provide quartz-sand-filled fuses having but one body of quartz sand, and yet having a balanced low current interrupting performance and high current interrupting performance.

Further objects and advantages of the invention will become apparent as the following description of the invention proceeds, and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to, and forming part of, this specification.

For a better understanding of the invention reference may be had to the accompanying drawings illustrating the invention wherein:

FIG. 1 is a longitudinal section of a fuse embodying the present invention; and

FIG. 2 is a section along 2—2 of FIG. 1.

The structure shown in the drawings is similar to that disclosed and claimed in the copending patent application of Philip C. Jacobs, Jr., filed October 21, 1965; Ser. No. 502,782, for Electric Quartz-Sand-Filled Fuse Adapted to Interrupt Effectively Protracted Small Overload Currents. The above application of Jacobs discloses that a fuse having a quartz sand filler can be adapted to interrupt effectively protracted small overload currents by shunting the main current carrying fusible element thereof by means of an additional fusible element having a considerably smaller current carrying capacity and a considerably higher resistance than the main fusible element, the additional fusible element being surrounded by a a woven sleeve of glass fibers.

I have discovered that the performance of a fuse of the kind disclosed in the above patent application of Jacobs depends critically upon the grain size of the quartz filler thereof, and that by providing the fuse with a filler having a relatively fine grain size the fuse can be caused to have a balanced interrupting performance, i.e. performance characteristics similar to those of the dual quartz-filler-fuse disclosed and claimed in my above referred-to patent application Ser. No. 474,778.

Referring now to the drawings, numeral 1 has been applied to indicate a substantially tubular casing of insulating material closed on the ends thereof by a pair of terminal elements 2 formed by caps or ferrules. Ferrules 2 are conductively interconnected by a first fusible element 3 in form of a ribbon having a relatively large current-carrying capacity. Fusible element 3 has preferably a plurality of serially related points of reduced cross-section and made of a metal having a relatively high conductivity and a relatively high fusing point such as silver, or copper, which metals will hereinafter be referred-to by the generic term high conductivity high fusing point metals. It supports in the center region thereof an overlay 5 of tin or another metal having a relatively low fusing point and capable in melted or liquid state of severing the base metal by which it is supported by a process of metal interdiffusion involving the formation of alloys having a relatively high resistivity. Ferrules 2 are also conductively interconnected by a second fusible element 5 which has a relatively small current-carrying capacity, i.e. the current-carrying capacity which is considerably smaller than that of main fusible element 3. The second fusible element 5 is enveloped by a sleeve 6 of woven glass cloth. Sleeve 6 is shorter than fusible element or wire 5 and there is a layer of quartz sand 7 between the inner surfaces of ferrules 2 and the axially outer open ends of glass cloth sleeve 6. This layer of quartz sand protects the axially inner surfaces of caps or ferrules 2 against jets of hot products of arcing which may issue from the axially outer ends of sleeves 6 when the fusible element or wire 5 which is enclosed in it fuses and vaporizes under the heat of an arc taking the place of wire 5, or of parts thereof. Fusible element or wire 5 fits loosely into sleeve 6 of woven glass cloth, i.e. the O.D. of wire 5 is considerably less than the I.D. of sleeve 6. The inner surface of sleeve 6 condenses the hot products of arcing resulting from fusion and vaporization of wire 6, and for this reason this surface should be relatively large, which is achieved by the above relation between the O.D. of wire 5 and the I.D. of sleeve 6. It will be understood that the inner surface of sleeve 6 is in physical engagement with fusible element or wire 5 at some points thereof, and is spaced from fusible element or wire 5 at other points thereof. The body 7 of quartz sand inside of casing 1 laterally surrounds the first fusible element 3 and laterally surrounds the sleeve 6 of glass cloth enveloping the second fusible element or wire 5. In order to achieve a balanced low current and high current interrupting performance, i.e. in order to impart to the fuse structure a good high current interrupting ability in addition to the good low current interrupting ability it has as a result of the provision of the glass cloth sleeve 6 mounted on fusible element 5, the grain size of the body 7 of quartz sand must be finer than 40 U.S. Standard Sieve number size, preferably 50–70 U.S. Standard Sieve number size, which is coarser than 100 U.S. Standard Sieve number.

The presence of overlay 4 on fusible element 3 limits the temperature to which the body 7 of quartz sand is

heated before a break is formed in fusible element 3 as a result of the flow of a protracted small overload current and an arc is kindled across that break. The presence of overlay 4, therefore, greatly limits the heat absorbing duty to which the fine quartz sand filler is subjected at small protracted overload currents which the filler as such is ill suited to interrupt, and with which it could hardly cope successfully if the second link 5 and its glass cloth sleeve 6 were not present.

The main or first fusible element 3 may, if desired, be replaced by a plurality of fusible elements whose aggregate current-carrying capacity is high, and whose aggregate ohmic resistance is low in comparison to the current carrying capacity or resistance of fusible element or wire 5.

It will be understood that I have illustrated and described a preferred embodiment of the invention, and that various alterations may be made in the details thereof without departing from the invention as defined in the appended claims.

I claim:

1. An electric fuse comprising in combination:

(a) a substantially tubular casing of insulating material;

(b) a pair of terminal elements closing the ends of said casing;

(c) a fusible ribbon of a high conductivity high fusing point metal having a relatively large current-carrying capacity conductively interconnecting said pair of terminal elements;

(d) an additional fusible element having a relatively small current carrying capacity conductively interconnecting said pair of terminal elements;

(e) a sleeve of woven glass cloth enveloping said additional fusible element; and

(f) a body of quartz sand finer than 40 U.S. Standard Sieve number size but coarser than 100 U.S. Standard Sieve number size inside said casing laterally surrounding said first fusible element and laterally surrounding said sleeve of woven glass cloth.

2. An electric fuse as specified in claim 1 wherein said fusible ribbon supports an overlay of a relatively low fusing point metal, and wherein said additional fusible element is in the form of a wire loosely fitted into said sleeve of woven glass cloth.

3. An electric fuse as specified in claim 1 wherein said body of quartz sand is 50–70 U.S. Standard Sieve number size.

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BERNARD A. GILHEANY, *Primary Examiner.*

H. B. GILSON, *Assistant Examiner.*