United States Patent [19]

Salzer

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[54] **HIGH-VOLTAGE FUSE WITH PLUGS OF SHEET METAL**

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[52] **U.S. Cl.** **337/161,** 337/159, 337/252

[51] **Int. Cl.** **H01h 85/02**

[58] **Field of Search** 337/159–162, 337/190, 231, 238, 248, 251, 252

[56] **References Cited**

UNITED STATES PATENTS

3,680,019	7/1972	Kozacka	337/161
3,810,061	5/1974	Salzer	337/159

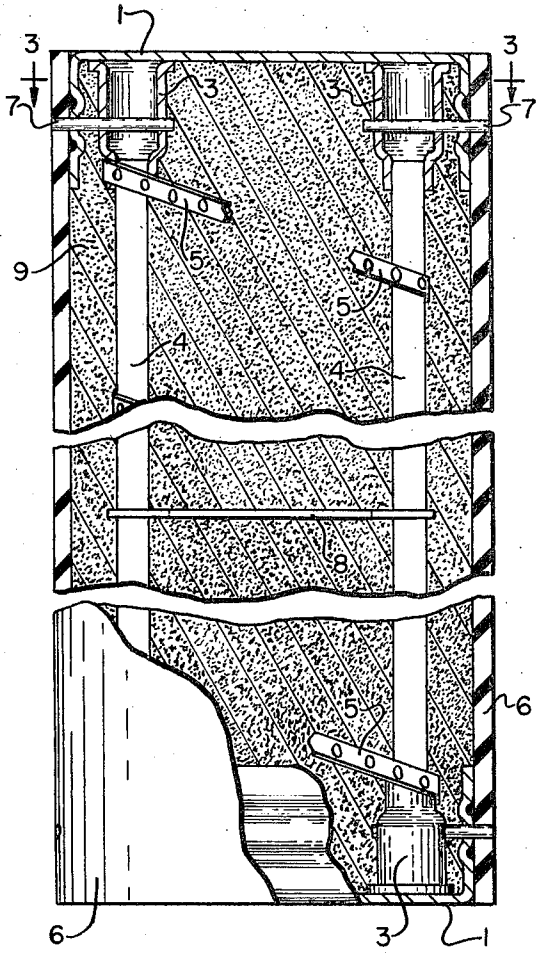
Primary Examiner—J. D. Miller

Assistant Examiner—Fred E. Bell

[57] **ABSTRACT**

A fuse for elevated circuit voltages having substantially helically wound fusible element means supported by a plurality of angularly displaced rods of electric insulating material. The casing of the fuse is closed by hollow plugs of sheet metal and the rods for supporting the fusible element means are supported by sheet metal supports affixed to the end surfaces of said hollow plugs.

6 Claims, 3 Drawing Figures



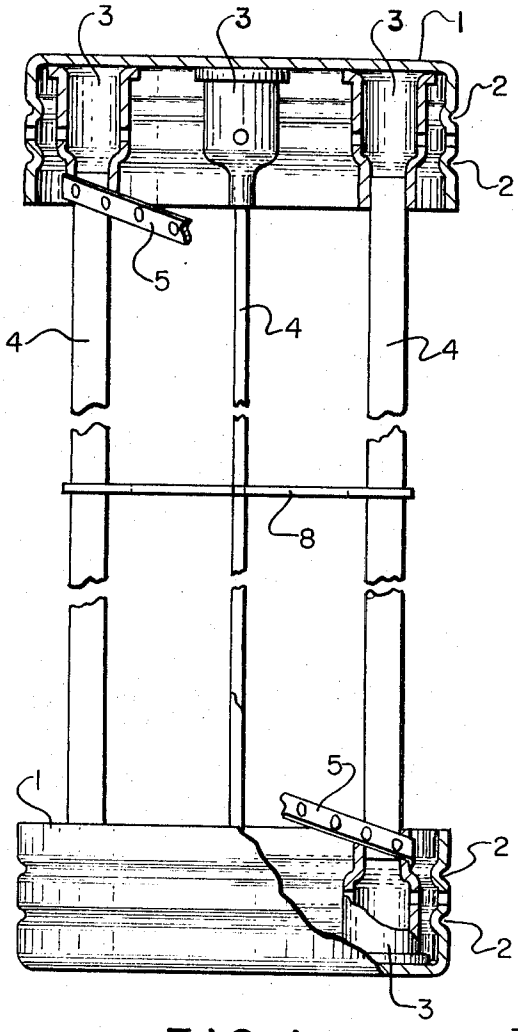


FIG. 1

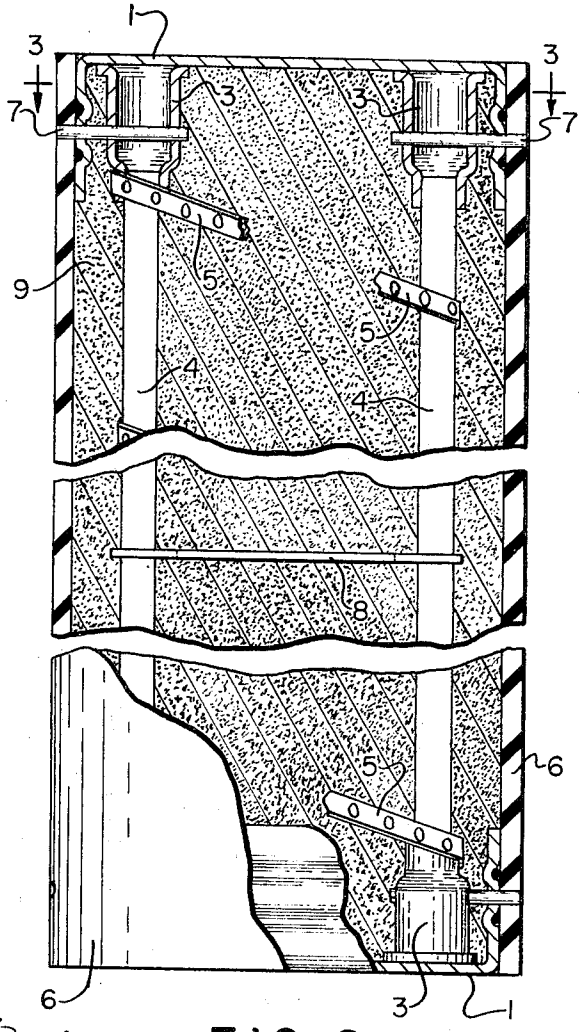


FIG. 2

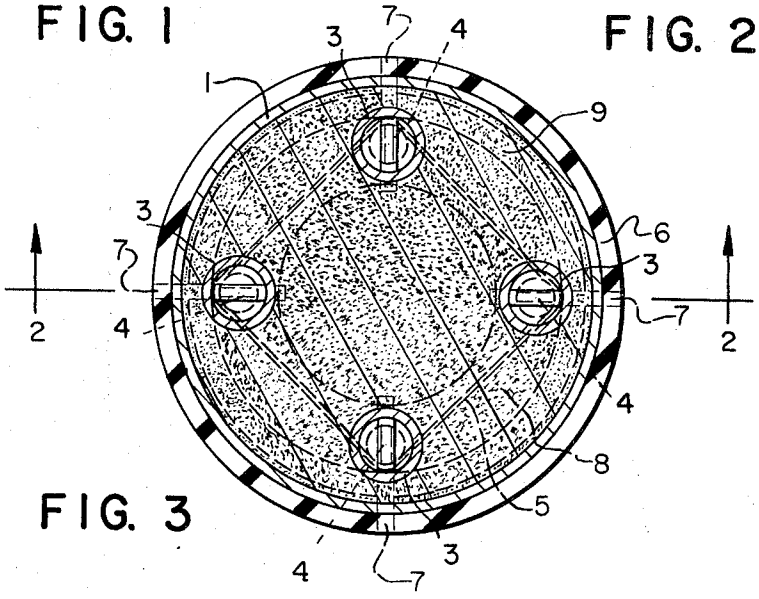


FIG. 3

HIGH-VOLTAGE FUSE WITH PLUGS OF SHEET METAL

BACKGROUND OF THE INVENTION

Many fuses for elevated circuit voltages require fusible element means exceeding in length the length of the casing, or fuse tube. In such instances the fusible element means are wound substantially helically. Conventional fuses having helically wound fusible element means include a mandrel arranged in coaxial relation to and inside of the casing, or fuse tube. This mandrel is star-shaped in cross-section. The fusible element means which are generally in ribbon-form are wound helically around the aforementioned mandrel. Mandrels of this description ought to be made of expensive electric insulating materials and this is one of the limitations of fuses relying on mandrels of the above description for supporting the fusible elements thereof. Another serious limitation of fuses relying on mandrels of the above description for supporting the helically wound fusible elements thereof resides in the fact that the volume of such mandrels is relatively large, and thus limits the volume inside of a casing, or fuse tube, of given size which is available for a pulverulent arc-quenching filler such as, for instance, quartz sand. Still another limitation of fuses having mandrels of the above description resides in the relatively large danger of tracking, or formation of more or less conductive surface layers.

U.S. Pat. No. 3,680,019 to Frederick J. Kozacka, July 25, 1972 for HIGH-VOLTAGE FUSE HAVING A PLURALITY OF FUSE LINKS WOUND HELICALLY AROUND AN INSULATING MANDREL discloses a fuse for elevated circuit voltages wherein the conventional mandrels of the above description are replaced by a fuse-link-supporting mandrel structure formed of four separate or individual plates of electric insulating material arranged edgewise relative to the helically wound fusible elements which they support. The copending patent application of Frederick J. Kozacka, filed Jan. 3, 1974, Ser. No. 430,477 for ELECTRIC FUSE FOR ELEVATED CIRCUIT VOLTAGES discloses a further improvement and a simplification of the fusible element supporting means disclosed in the above referred-to patent.

The present invention is based upon the structures disclosed in the above referred-to patent application and patent. Its principal object is to drastically reduce the amount of metal required for fuse structures of the kind disclosed in the above referred-to patent, and in the above referred-to patent application, in view of the current severe shortage of metals, in particular copper and copper alloys.

SUMMARY OF THE INVENTION

Fuses embodying this invention include a tubular casing of electric insulating material and a substantially helically wound fusible element means in ribbon form arranged inside and in coaxial relation to said casing. A pulverulent arc-quenching filler inside said casing embeds said fusible element means. Said fusible element means is or are supported by a plurality of separate angularly displaced rods of electric insulating material arranged parallel to the axis of said casing. The casing is closed by a pair of hollow plugs of sheet metal having end surfaces and having lateral surfaces engaging the inner surface of said casing and being provided with a sealing-medium-containing groove means. A plurality of sheet metal supports for said plurality of rods is affixed to said end surfaces of said pair of hollow plugs and engaged by the ends of said plurality of rods.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevation of a sub-assembly used in manufacturing a fuse embodying this invention, some portions of the sub-assembly being broken away to reduce the length of its pictorial representation;

FIG. 2 is in part a front view and mainly a longitudinal section along II—II of FIG. 3 of a complete fuse embodying this invention, some of the portions of the fuse being broken away to reduce the length of its pictorial representation; and

FIG. 3 is a cross-section of the structure of FIG. 2 substantially along III—III of FIG. 2.

DESCRIPTION OF PREFERRED EMBODIMENT

To manufacture a fuse embodying this invention involves making a sub-assembly as shown in FIG. 1. The sub-assembly is formed by a pair of hollow plugs 1 of sheet metal. Plugs 1 have end surfaces and lateral surfaces provided with a pair of circumferential grooves or groove means 2. Reference numeral 4 has been applied to indicate rods of electric insulating material, e.g. glass melamine, forming spacers for hollow plugs 1 and supports for one or more fusible elements 5 which are wound substantially helically around rods 4. FIG. 1 shows a structure including one single fusible element 5 of which but the ends immediately adjacent hollow plugs 1 have been shown, i.e., the intermediate portions of the fusible element 5 have been deleted in FIG. 1 (and the same also applies as to FIG. 2). Rods 4 are subjected to a radially inwardly directed bending action when ribbon fuse link 5 is helically wound around rods 4. To minimize bending of rods 4 their width in radial direction exceeds their thickness at right angles to said direction. To further minimize bending of rods 4 the same are also provided with one or more annular braces 8 between the ends thereof. Annular brace 8 is provided with four radial slots angularly displaced 90°, and the radially inner edges of rods 4 are coextensive with the closed ends of the slots in annular brace or braces 8. A plurality of sheet metal supports 3 for rods 4 is affixed to the end surfaces of hollow sheet metal plugs 1 and engaged by the ends of rods 4. Each of sheet metal supports 3 is preferably formed by a flanged tubular element affixed with the flanged axially outer end thereof to one of the end surfaces of hollow sheet metal plugs 1. The axially inner ends of flanged tubular elements are engaged by link-supporting spacing rods 4. The axially inner ends of flanged tubular elements 3 are preferably squashed around the ends of rods 4. The squashing operation may be effected before affixing flanged tubular elements 3 to hollow plugs 1. The flanged tubular elements 3 may be affixed to hollow plugs 1 by spot-welds along the flanges of elements 3. In the drawings the axially inner ends of parts 3 have a smaller diameter than the axially outer ends thereof, but this is not a necessary feature of the structure under consideration. Nor is it a necessary feature of the structure under consideration to squash the ends of the tubular elements 3 into which rods 4 project. Rods 4 may be simply press-fitted into tubular elements 3 and firmly positoned therein by a seal of an epoxy resin fully closing the axially inner ends of tubular elements

3. The ends of fusible element 5 are affixed to, and conductively connected to, tubular elements 3, e.g. by spot-welds.

After completion of the sub-assembly shown in FIG. 1 the latter is inserted into a tubular casing 6 of insulating material, e.g. melamine glass cloth and pinned to the latter. Preparatory to such insertion annular grooves 2 in hollow plugs 1 are filled with a sealing compound, preferably silicone rubber. Reference numerals 7 have been applied to indicate pins projecting transversely through casing 6, the lateral sides of hollow sheet metal plugs 1 and the portions of tubular elements 3 adjacent the end surfaces of plugs 1. Pins 7 are arranged at levels situated between grooves 2 in plugs 1 and project into the non-squashed portions of tubular elements 3. The final process step in manufacturing the fuse shown in FIGS. 2 and 3 consists in filling the pulverulent arc-quenching filler 9 into casing 6 by a filling aperture (not shown) in one of plugs 1 which is sealed upon completion of the filling operation.

For the purpose of better illustrating the structure under consideration FIG. 1 shows bores in hollow plugs 1 and in tubular elements 3 intended to receive the pins 7. These bores are actually drilled only upon insertion of parts 1,3,4 and 5 into casing 6 in one and the same drilling operation by which the registering pin-receiving bores in casing 1 are drilled.

I claim as my invention:

1. An electric fuse including

a. a tubular casing of electric insulating material;

b. substantially helically wound fusible element means in ribbon form arranged inside of and in coaxial relation to said casing;

c. a pulverulent arc-quenching filler inside said casing embedding said fusible element means;

d. a plurality of separate angularly displaced rods of electric insulating material arranged parallel to the axis of said casing supporting said fusible element means;

e. a pair of hollow plugs of sheet metal closing the ends of said casing, said pair of plugs having end surfaces and having lateral surfaces engaging the inner surface of said casing and being provided with a sealing-medium-containing groove means; and

f. a plurality of sheet metal supports for said plurality of rods affixed to said end surfaces of said pair of hollow plugs and engaged by the ends of said plurality of rods.

2. An electric fuse as specified in claim 1 including pins projecting through said casing and through said lateral surface of one of said pair of hollow plugs into one of said plurality of sheet metal supports for said plurality of rods.

3. An electric fuse as specified in claim 1 wherein each of said lateral surfaces of said pair of hollow plugs is provided with a pair of grooves and wherein said casing is affixed to said pair of hollow plugs by pins arranged between said pair of grooves and having radially inner ends projecting into one of said plurality of sheet metal supports for said plurality of rods.

4. An electric fuse as specified in claim 1 wherein each of the ends of said fusible element means is affixed to and conductively connected with one of said plurality of sheet metal supports for said plurality of rods.

5. An electric fuse as specified in claim 1 wherein said plurality of sheet metal supports for said plurality of rods is formed by a plurality of flanged tubular elements affixed with the flanged axially outer ends thereof to said end surfaces of said hollow plugs and being engaged at the axially inner ends thereof by said plurality of rods.

6. An electric fuse as specified in claim 5 wherein the axially inner ends of said plurality of flanged tubular elements are squashed, and wherein said casing is affixed to said hollow plugs by radially extending pins having radially inner ends projecting into the axially outer non-squashed portions of said flanged tubular elements.

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