United States Patent

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[33] **Great Britain**
[31] **11,079/69**

[54] **CARTRIDGE FUSES**
7 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **337/161,** 337/229
[51] **Int. Cl.** **H01h 85/12**
[50] **Field of Search** 337/158, 159, 161, 164, 229, 293, 248

[56] **References Cited**

UNITED STATES PATENTS

3,400,235	9/1968	Howard et al.	337/229
3,287,525	11/1966	Mikulecky	337/161
2,866,037	12/1958	Stewart	337/161
2,680,173	6/1954	Hitchcock	337/229
2,209,823	7/1940	Lohausen	337/229

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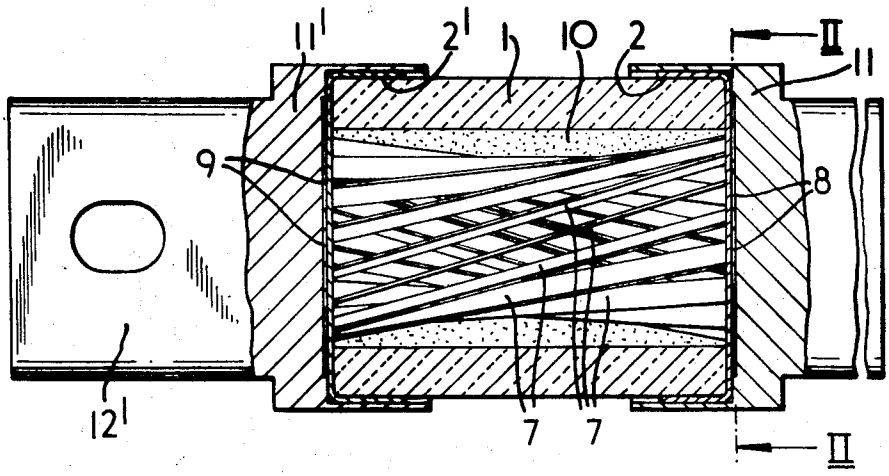
ABSTRACT: A cartridge fuse comprising a tubular body, a pair of end caps for the body and a plurality of fusible metallic strips extending through the body between the ends caps, the strips being secured to each end cap at positions spaced apart in the circumferential direction thereof, such that the strips are spaced apart from each other along their whole lengths intermediate the end caps, the position of one end of each strip being circumferentially staggered with respect to the other end thereof. Also one end portion of each strip is inclined to a radius of the end cap to which it is secured in one direction circumferentially of the end cap and the other end portion of the strip is inclined to a radius of the end cap to which it is secured in the other direction circumferentially of the end cap, whereby an intermediate portion in the length of the strip is directed widthwise of the strip radially of the tubular body to reduce thermal shock on the body when the fuse blows.



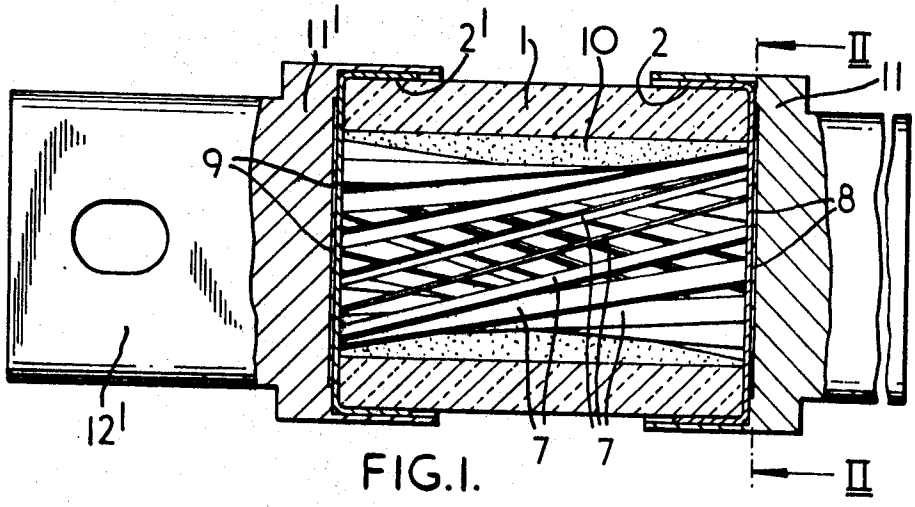


FIG. 1.

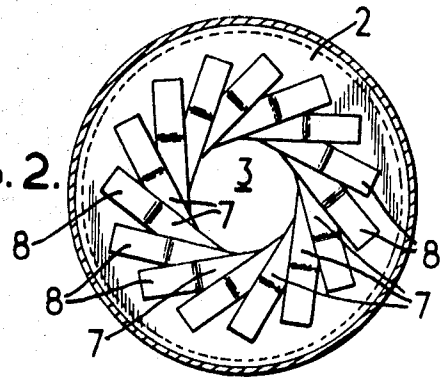


FIG. 2.

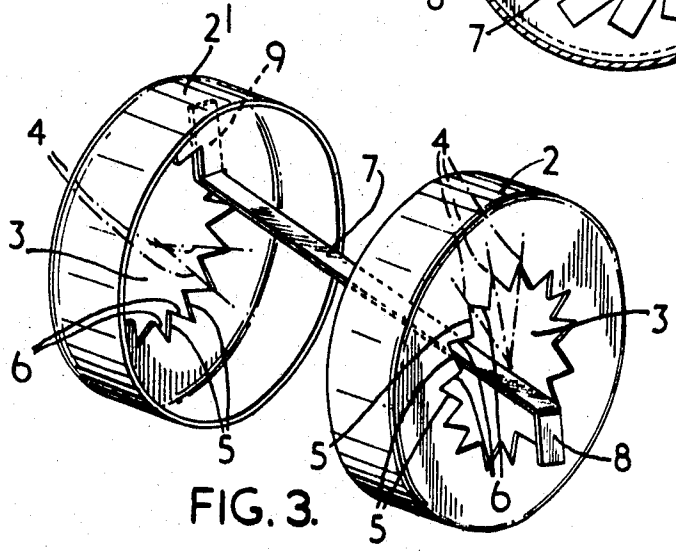


FIG. 3.

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CARTRIDGE FUSES

The invention relates to a cartridge fuse of the kind used in the electrical industry and comprising a tubular body, a pair of end caps for the body and a plurality of fusible elements extending through the body between the end caps.

Where high currents are to be carried by a fuse, the elements are usually strips of metal and in known fuses of the foregoing kind the strips have been arranged to extend substantially parallel with the longitudinal axis of the body and side-by-side in one or more rings concentric with the longitudinal axis of the body. Some disadvantages of such an arrangement are that the number of strips which can be accommodated in a body of a certain internal diameter is limited; as the strips nearest to the tubular wall of the body have their full width facing the tubular wall, the latter may be subjected to high thermal shock when operation of the fuse occurs, and as the spacing between elements may not be constant, the fusion characteristics of different elements may be different and also high current densities may be produced in the end caps.

An object of the invention is to provide a fuse in which the arrangement of the fusible elements is such that accommodation for an optimum number of elements is provided consistent with acceptable current density in the end caps, reduced thermal shock to the tubular body on operation of the fuse and substantially constant fusion characteristics for each element.

According to the invention, a cartridge fuse comprises a tubular body, a pair of end caps for the body and a plurality of fusible elements extending through the body between the end caps, the elements being in the form of metallic strips secured to each end cap at positions spaced apart in the circumferential direction thereof, such that the strips are spaced apart from each other along their whole lengths intermediate the end caps, the position of one end of each strip being circumferentially staggered with respect to the other end thereof.

Preferably, one end portion of each strip is inclined to a radius of the end cap to which it is secured in one direction circumferentially of the end cap and the other end portion of the strip is inclined to a radius of the end cap to which it is secured in the other direction circumferentially of the end cap, whereby an intermediate portion in the length of the strip is directed widthwise of the strip substantially radially of the tubular body.

Conveniently each end cap comprises an inner member to which the strips are secured and an outer member engaging the inner member and by which the fuse is connected in an electrical circuit, each inner member having a circumferentially serrated aperture therein closed by the adjacent outer member, the side edges of the serrations forming end locations for the strips.

The serrations may be of substantially V-shape and each have side edges inclined equiangularly in opposite directions to a radius of the end cap.

The strips conveniently extend through the inner end caps and are bent to lie on the outer surfaces thereof to which they are secured.

A fuse in accordance with the invention is now described with reference to the accompanying drawings in which:

FIG. 1 is i side elevation of and part axial section through the fuse;

FIG. 2 is a section on the line II—II in FIG. 1, and

FIG. 3 is a diagrammatic perspective view of the inner end cap members and one fusible element.

Referring to FIGS. 1 and 2, the fuse comprises a tubular body 1 of a ceramic material on to the ends of which inner end cap members 2, 2′ are fitted. Each member 2, 2′ has a central aperture 3 therein having a serrated circular boundary formed by substantially V-shaped serrations symmetrical about radii indicated at 4 in FIG. 3. The side edges of the serrations are indicated at 5 and 6 respectively. The fuse also includes a plurality of fusible elements which are in the form of strips 7 of fusible metal which are located at their ends on the members 2, 2′.

Each strip 7 is located against one of the side edges 6 of a serration in one member 2, and against the other of the side edges 5 of a serration in the other member 2′, as indicated in FIG. 3 and a portion at each end of the strip projects through the member 2 or 2′ and is then bent over to form a tab 8, 9, which is secured to the outer end face of the member 2 or 2′ by soldering or similar process. Because opposite ends of the portion of the strip 7 between the members 2, 2′ are located against side edges 6 and 5 respectively of serrations thereof and the edges 6 and 5 are inclined in opposite circumferential directions to the respective radii 4, a portion of the strip 7 substantially midway between the members 2, 2′ will have its width extending radially of the body 1, thereby reducing to a minimum thermal shock to the material of the body 1.

As can also be seen in FIG. 3, the opposite ends of the strip 7 are staggered circumferentially with respect to each other. That is the serration having the locating edge 5 employed for locating the left-hand end of the strip 7, as viewed in FIG. 3, and the serration having the locating edge 6 employed for locating the right-hand end of the strip 7 are spaced apart in the circumferential direction instead of being axially aligned. This means that a plurality of strips will together generate a convergent-divergent tubular cagelike structure in the form of a hyperboloid. This is more clearly seen in FIG. 1. By staggering the end locations of the strip 7 circumferentially an optimum number of strips can be accommodated and the spacing between adjacent strips can be kept substantially constant, thereby ensuring that the fusion characteristics of the strips are substantially the same, i.e., they will fuse at substantially the same time, and thereby maintaining substantially constant current density in the members 2 and 2′. In FIG. 3 a circumferential "pitch" between opposite ends of the strip 7 of four serrations is indicated; but other circumferential pitches may be employed.

As is well known in cartridge fuses employing metal strips, the strips usually have longitudinally spaced notches in their longitudinal edges to aid their fusion; but the strips have been shown as being unnotched to avoid complication in the drawings.

Also as is well known in cartridge fuses, the ceramic body 1 is packed with a quenching medium such as dry, nonmetallic, silica sand. The quenching medium is indicated at 10 in FIG. 1 between the outside of the cagelike structure and the body 1 only, although in practice, the quenching medium will completely fill the interior of the body 1, that is the strips 7 will be completely embedded in the quenching medium.

Besides the advantage of ensuring that the strips 7 are radial at their midlength positions, the symmetrical V-shaped serrations in the members 2, 2′ avoid the need for having left-handed and right-handed members 2, 2′. The members 2, 2′ are identical and can be interchanged. This means that the members can be mass produced, for example, by stamping.

The members 2, 2′ are a tight fit into outer members 11, 11′, which close the respective apertures 3 and also enable electrical connections to be made to the fuse, one connection position being indicated at 12′. The members 2 and 11 and 2′ and 11′ respectively constitute the end caps of the fuse.

What I claim as my invention and desire to secure by Letters Patent of the United States is:

1. A cartridge fuse comprising a tubular body, a pair of end caps for the body and plurality of fusible elements in the form of metallic strips extending through the body between the end caps, the end caps having locating surfaces of which, locating surfaces of the two end caps are respectively inclined in opposite directions, relative to a radial direction thereof, the elements being secured to each end cap at positions spaced apart in the circumferential direction thereof, such that the strips are spaced apart from each other along their whole lengths intermediate the end caps, the position of one end of each strip being circumferentially staggered with respect to the other end thereof and one end portion of each strip being inclined by one of said locating surfaces to a radius of the end cap to which it is secured in one direction circumferentially of the

end cap and the other end portion of the strip being inclined by another of said locating surfaces to a radius of the end cap to which it is secured in the other direction circumferentially of the end cap, whereby an intermediate portion in the length of the strip is directed widthwise of the strip substantially radially of the tubular body.

2. A fuse as claimed in claim 1 in which each end cap comprises an inner member to which the strips are secured and an outer member engaging the inner member and by which the fuse is connected in an electrical circuit, each inner member having a circumferentially serrated aperture therein closed by the adjacent outer member, the side edges of the serrations forming end locations for the strips.

3. A fuse as claimed in claim 2 in which the serrations are of substantially V-shape and each have side edges inclined equiangularly in opposite directions to a radius of the end cap.

4. A fuse as claimed in claim 2 in which the strips extend through the inner members and are bent to lie on the outer surfaces thereof to which they are secured.

5. A fuse as claimed in claim 1 in which the tubular body contains a quenching medium surrounding the strips.

6. A cartridge fuse comprising a tubular body, a pair of end caps for the body and a plurality of fusible elements in the form of metallic strips extending through the body and secured between the end caps, each end cap comprising an inner member to which the strips are secured and an outer member engaging the inner member and by which the fuse is connected in an electrical circuit, each inner member having a circumferentially serrated aperture therein closed by the adjacent outer member, the serrations being of substantially V-shape and each having side edges inclined equiangularly in opposite directions to a radius of the end cap, one end portion of each strip being located against one side edge of a serration of one inner member and the other end portion of the strip being located against the oppositely directed side edge of a circumferentially spaced serration of the other inner member, whereby the strips are spaced apart from each other along their whole lengths intermediate the end caps and an intermediate portion in the length of each strip is directed widthwise of the strip substantially radially of the tubular body.

7. A fuse as claimed in claim 6 in which the end portions of the strip extend through the inner members and are bent to lie on the outer surfaces thereof to which they are secured.

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