Oct. 3, 1933. T. W. KIRKMAN 1,928,997

ELECTRIC FUSE

Filed June 17, 1926

Fig. 1.

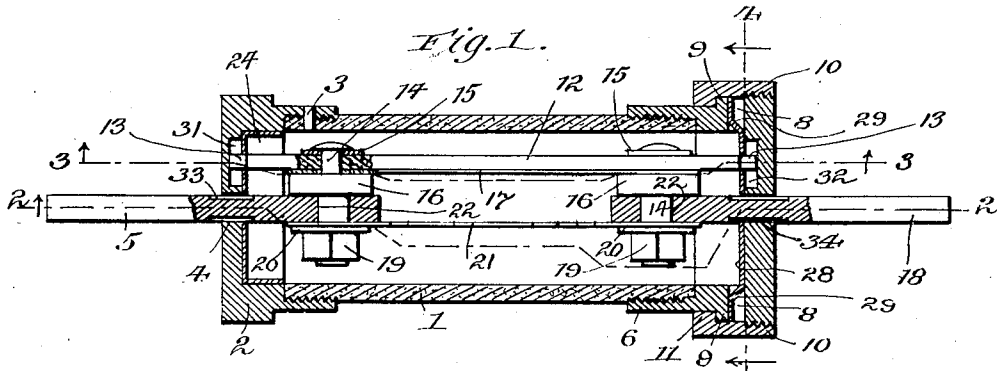


Fig. 2.

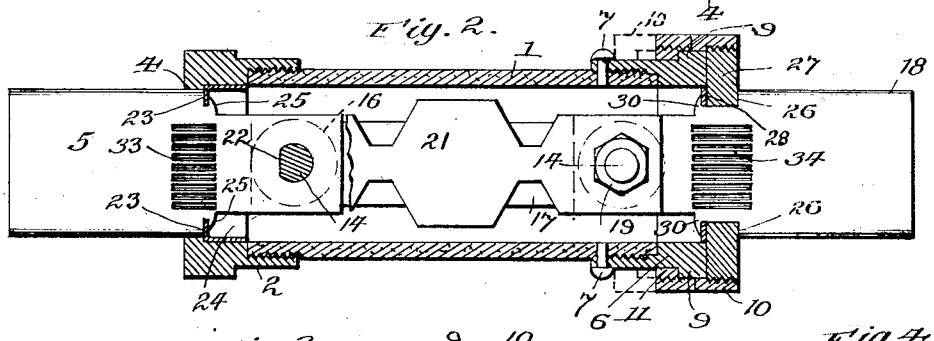


Fig. 3.

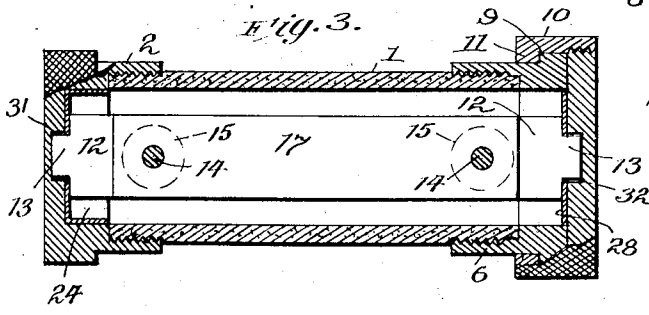


Fig. 4.

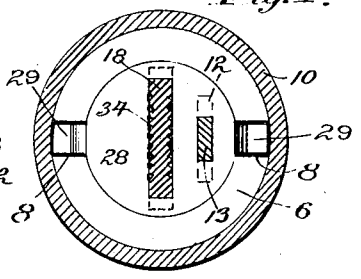
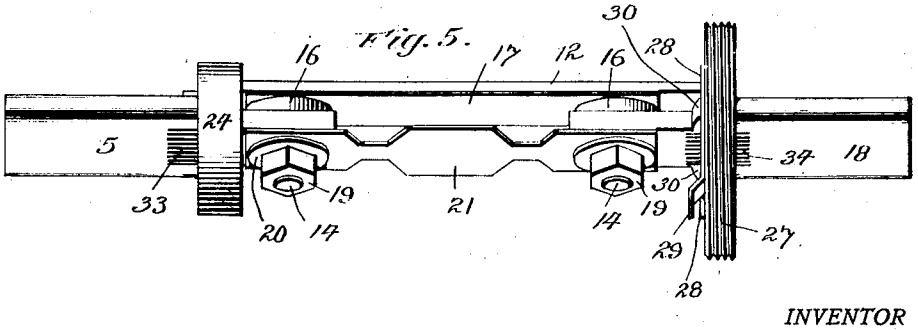


Fig. 5.



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ELECTRIC FUSE

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19 Claims. (Cl. 200—131)

This invention relates to electric fuses and particularly renewable or refillable cartridge fuses of the knife blade type.

Cartridge fuses generally are made up of a number of associated parts which are disassembled or separated when it is desired to inspect the inside of the fuse. The comparatively large number of loose parts produced by the disassembly of the fuse for inspection purposes frequently is the cause of the loss of one or more of the parts. It is one of the primary objects of this invention to produce a fuse structure adapted for ready assembly and disassembly for inspection and repair purposes and one in which the number of loose parts, such as those just mentioned, is reduced to a minimum.

Another fault in the past with fuses of this character is that arrangement of the fuse element in the shell or the manner in which it is placed in the shell results in damage to the element so that it is not capable of efficiently performing its function. In the present invention, it is sought to mount the fuse element on a holder which is inherently rigid and is adapted to be located in and removed from the fuse shell with practically no chance of damage to the fuse element.

A further object is the provision of means for effectively venting the fuse when it blows. Other objects include the furnishing of protecting means for the fuse element holder, which is preferably of fiber, from the heat from the fuse element and the provision of means for guiding and properly locating the fuse element holder and the attached parts properly within the shell of the fuse.

In the accompanying drawing, wherein there is illustrated a practical embodiment of the invention

Figure 1 is a longitudinal, vertical section of an assembled fuse;

Fig. 2, a longitudinal section of the same taken on line 2—2 of Fig. 1;

Fig. 3, a similar view taken on line 3—3 of Fig. 1;

Fig. 4, a transverse section taken on line 4—4 of Fig. 1; and

Fig. 5, a perspective view of the fuse-element-and-fuse-element-holder assembly, which includes the knife blade terminals of the fuse, removed from the fuse shell.

The cartridge or shell of the fuse is shown at 1, this preferably being of fiber or other suitable insulating material. The left end of shell 1 is threaded to receive a metal cap 2. Separation of these parts is prevented by a pin 3. Metal cap 2 has a slot 4 through which extends the left-hand knife blade terminal 5 when the fuse is in assembled condition, as shown in Fig. 1.

On the opposite or right-hand end of shell 1, there is mounted a metal ferrule 6, these parts also having a screw threaded connection with each other. Separation of the parts is prevented by pins 7, 7, as shown in Fig. 2. The outer end of ferrule 6 projects beyond the end of shell 1 and is provided with a pair of diametrically opposed slots 8, 8 (Fig. 4), the purpose of which will appear hereinafter.

On its outer end ferrule 6 is also formed with an external, circumferential flange 9, thus furnishing a continuous shoulder around the outer end of the ferrule. The purpose of flange 9 is to retain on ferrule 6 a second ferrule 10 which telescopes on the former. At its inner end ferrule 10 has an internal flange 11 which fits loosely about the inner ferrule 6. Flange 11 cooperates with flange 9 to prevent removal of ferrule 10 from the outer end of the inner ferrule 6. It will thus be seen that ferrule 10 is mounted on ferrule 6 so that it may be rotated and moved longitudinally thereon. If found desirable, as shown in Fig. 2, pins 7, 7 may be provided with heads on their outer ends to limit the rearward sliding movement of ferrule 10, which is shown in dotted lines in its retracted positon. Any other suitable means might be provided to limit the inward sliding movement of ferrule 10. The function of ferrule 10 is to provide an easily manipulated and efficient means for retaining the fuse-element-and-fuse-element-holder assembly in place within shell 1.

The fuse element holder consists principally of a fiber strip or bar 12 having reduced end portions 13, 13. Near each end thereof bar 12 is perforated to receive the shank of a bolt or stud 14, the upper extremity of which is upset over a washer 15 to rigidly secure the stud in place on the bar. Each stud 14 is provided intermediate its ends with a circumferential separating flange 16 between which and fiber bar 12 is clamped a mica strip 17. The latter is provided with suitable perforations through which studs 14 extend. The purpose of mica strip 17 is to protect fiber bar 12 from the heat generated when the fuse blows. This heat dries out the fiber and weakens bar 12.

Each stud 14 below its flange 16 extends through a perforation in the inner end of one of the knife blade terminals 5 and 18 of the fuse. The lower extremity of each stud 14 is threaded to receive a nut 19 and washer 20 by means of which a fuse

element 21 is clamped in place on the holder in firm electrical contact with the inner ends of the knife blade terminals 5 and 18. Fuse element 21 is provided with suitable perforations through which the shanks of studs 14, 14 extend. As shown at 22 in Fig. 2, the shanks of studs 14, 14 and the openings in the inner ends of knife blade terminals 5 and 18 are irregularly formed so as to prevent the terminals from twisting or swinging out of alinement. This construction adds considerably to the rigidity of the removable assembled parts and aids in their proper location in the shell.

Knife blade terminal 5, that at the left-hand end of the fuse, is made of a reduced width at its inner end and provided with shoulders 23, 23. On this reduced portion of the terminal there is mounted a slotted cup shaped metal member 24 which abuts against shoulders 23, 23 and is secured rigidly in place by upsetting a portion of the metal of terminal 5 thereagainst as shown at 25. Cup shaped member 24 fits snugly within the metal cap 2 of the shell and thus serves as a means for firmly locating the removable parts within the left-hand end of the shell 1.

Knife blade terminal 18 is of substantially the same form as terminal 5. Mounted on terminal 18 and abutting against its shoulders 26, 26 is a slotted disk 27, the periphery of which is provided with screw threads. Also mounted on terminal 18 against the inner face of disk 27 is a second, but thinner, slotted disk 28 on the periphery of which is formed a pair of diametrically opposed lugs 29, 29. Disk 27 and disk 28 are rigidly secured on the terminal 18 by upsetting the metal of the terminal thereagainst as shown at 30, 30, Fig. 2.

Lugs 29, 29 of disk 28, when the fuse is assembled, rest in slots 8, 8 in the end of ferrule 6. Since disk 28 is rigidly connected to terminal 18, when the fuse is assembled the engagement of lugs 29, 29 with slots 8, 8 and the engagement of knife blade terminal 5 with slotted cap 2 will effectually prevent any twisting of the removable parts within the shell 1 and will hold them properly in alined position.

In order that the removable parts, by which is meant, the fuse element holder, the fuse element and the pair of knife blades, may take the form of a rigid removable unit and thereby lessen the likelihood of damage to the fuse element 21 in handling, suitable slots are provided in cup shaped member 24 and disk 28 through which the reduced extremities 13, 13 of fiber bar 12 extend. These parts are thereby all firmly connected together and a practically inflexible unit furnished. To accommodate the projecting extremities 13, 13 of fiber bar 12 slotted cap 2 is provided with recess 31 and disk 27 with a recess 32 into which these extremities project. With this construction there is no likelihood of the ends of fiber bar 12 becoming disengaged from member 24 and disk 28.

Ventilation of the gases from the fuse to the outer atmosphere when it blows is provided for by forming a series of grooves 33 on knife blade terminal 5 and a corresponding series 34 on knife blade terminal 18, these grooves being of sufficient length to connect the interior of shell 1 with the outer atmosphere through the slots in cap 2 and disks 27, 28. The number and depth of the series of grooves is made sufficient to obtain proper ventilation. If desired the grooves may be provided on both sides of the knife blade

As shown in Figs. 1—3, the outer end of ferrule 10 is provided with internal screw threads which engage with the threaded periphery of disk 27. Since disk 27 forms an integral part of the inner, removable unit, when ferrule 10 is screwed up into the position shown in the drawing, the ferrule serves to securely bind the unit in position within the shell 1.

In the operation of the fuse, when the fuse element 21 blows and is to be renewed, ferrule 10 is unscrewed until it is disconnected from disk 27, whereupon the fuse-element-and-fuse-element-holder assembly or unit may be withdrawn. Nuts 19 and washers 20 are then removed from the assembly and a new fuse element put in place after which the nuts and washers are replaced. The assembly is then replaced in shell 1 as before and ferrule 10 screwed back into place. The engagement of lugs 29, 29 with slots 8, 8 of ferrule 6 function to prevent any torsional strain on the unit within shell 1 when ferrule 10 is being screwed back into place.

The term "fuse-element-and-fuse-element-holder assembly" is intended to include the fuse element 21, the parts, such as fiber bar 12 and studs 14, which go to make up the fuse element holder, and any means used for electrically connecting fuse element 21 with the usual spring clamps in which the fuse is mounted when in use. It is in this sense that the term is used in the accompanying claims.

What is claimed is:

1. In an electric fuse, the combination of a tubular shell; a fuse element holder located in said shell; a fuse element detachably mounted on the holder; a knife-blade terminal on one end of said holder and projecting outside the shell; a disk rigidly mounted on said knife blade; and a ferrule having a swivel connection with one end of the shell and a screw-threaded connection with said disk.

2. In an electric fuse, a fuse-element-and-fuse-element-holder assembly adapted for insertion in and removal from a fuse shell as a unit, comprising a fuse element; a rigid, fiber fuse-holder member; means for detachably securing said fuse element and fiber member together in spaced relation to each other; a knife blade terminal projecting from each end of the unit; a cup-shaped, guide member rigidly secured on one of said knife-blade terminals to aid in properly locating the unit in the shell; and a guide disk, having a pair of lugs on its periphery, rigidly secured on the other terminal for also aiding in properly locating the unit in the shell.

3. The combination in an electric fuse of a hollow body of insulating material; a slotted cap on one end of said body; an inner ferrule on the opposite end of said body; an outer ferrule mounted for rotation and limited longitudinal movement on the inner ferrule, the outer end of said outer ferrule being threaded internally and projecting beyond the adjacent end of the inner ferrule; a removable fuse element holder within the hollow body; a terminal blade on each end of said holder, one of said blades projecting through said slotted cap; and a disk rigidly mounted on the other terminal blade, the periphery of said disk being in threaded engagement with said outer ferrule.

4. In an electric fuse, the combination of a fuse element holder, including a rigid, insulator bar; a fuse element disposed in spaced relation to said fuse element holder; a knife blade terminal

holder; means for securing said fuse element, fuse element holder and knife blade terminals in assembled relation, so as to provide a rigid unit; and a transverse member rigidly secured on each of said knife blade terminals and with which the ends of said insulator bar engage to further stiffen the unit.

5. In an electric fuse, a tubular shell; a slotted cap on one end thereof; a ferrule on the opposite end thereof having diametrically opposed slots; a fuse element holder, including a rigid fiber bar, located in the shell; a fuse element detachably secured to the fuse element holder; a knife blade terminal extending from each end of said holder; means for securing the holder, the fuse element and the knife blade terminals in assembled relation; a transverse guide member rigidly secured on each of said knife blade terminals and having an opening therein through which the adjacent end of said fiber bar projects; a disk rigidly mounted on one of the knife blade terminals; a second ferrule swiveled on said slotted ferrule and having a screw-threaded engagement with said disk to clamp the disk against the first mentioned ferrule, said slotted cap and disk being provided on their inner faces with depressions to receive the ends of the fiber bar.

6. The combination in an electric fuse of a tubular shell of insulating material, a ferrule on one end of the shell; a fuse-element-and-fuse-element-holder assembly located in said shell and removable therefrom as a unit; a transverse disk forming a rigid part of said unit and located at one end thereof; and a second ferrule having a swiveled connection with said first-mentioned ferrule and a threaded connection with said disk to secure said unit in place in the shell.

7. In an electric fuse, a hollow body of insulating material closed at one end except for a slot therein; a fuse element holder located in said body and carrying knife blade terminals, one of which is adapted to project through said slot; a disk permanently secured to the other terminal and adapted to close the other end of said body, said disk being screw-threaded on its periphery; and a ferrule mounted for rotation and limited longitudinal movement on the adjoining end of said body and having screw-threads adapted to engage with the threads on said disk to clamp it in place; and means on said body for limiting the longitudinal movement of said ferrule thereon.

8. An electric fuse comprising a tube of insulating material; a metal cap having a slot therein fixedly mounted on one end of the tube; a fuse element holder within said tube; a pair of knife blades, carried by said holder, one of which is adapted to project through said slotted cap; a disk fixedly mounted on the other blade and adapted to be clamped against the opposite end of the tube; and transverse guide members rigidly secured on said blades within the tube, one of said guide members being provided with a circumferential flange adapted to fit snugly within said slotted cap and the other guide member being provided on its periphery with lugs engaging with corresponding slots in the adjoining end of the tube.

9. The combination in an electric fuse of a tubular shell of insulating material open at one end and closed at the other except for a slotted opening therethrough, a fuse-element-and-fuse-element-holder assembly disposed within said shell, knife blade terminals on the ends of said assembly, one of the blades extending through said slotted opening, a member carried by the other of the blades to close the open end of the shell; and members carried by the knife blades for properly locating said assembly in the shell, the knife blade terminals being provided on their faces with longitudinally-extending, spaced grooves at the joints between the terminals, said shell closing member and said assembly locating members, the grooves being of sufficient length to afford ventilation between the interior of the shell and the outer atmosphere.

10. A terminal blade unit for cartridge fuses comprising in combination a pair of terminal blades; an insulating bridge securing said blades in spaced relation; a fuse element connected to said blades; and a transverse member rigidly secured on each of said knife blade terminals and having openings therein through which the extremities of said insulating bridge project.

11. A renewable electric fuse comprising a fuse structure including knife blades, an insulating member holding said knife blades in spaced relation, a fuse element connecting the blades, and a closure member fixed on one of said blades; an enclosing structure into only one end of which said fuse structure is adapted to be inserted; and means permanently located on said end of the enclosing structure for direct and positive interlocking engagement with said closure member to secure said structures in assembled relation.

12. The combination of claim 11 further characterized in that said closure member and said securing means are threaded for engagement with each other.

13. The combination of claim 11 further characterized in that said closure member is in the form of a threaded disc and said securing means is in the form of an internally threaded ferrule permanently located on the enclosing structure.

14. A renewable electric fuse comprising an enclosing structure; a fuse structure including a fuse element holder and a fuse element mounted thereon, said fuse structure being insertible into only one end of the enclosing structure; and permanent means on said end of the enclosing structure for direct and positive interlocking engagement with a fixed part of the fuse structure to secure said structures in assembled relation.

15. The combination of claim 14 further characterized in that said securing means comprises a swiveled ferrule on the enclosing structure, and said ferrule and said fixed part of the fuse structure are provided with interlocking means for securing the structures together.

16. A renewable electric fuse comprising a fuse structure including knife blades, an insulating member holding said knife blades in spaced relation, and a fuse element connecting the blades; an enclosing structure into which said fuse structure is adapted to be inserted; and a threaded ferrule swiveled on the enclosing structure for engagement with the fuse structure to secure said structures in assembled relation.

17. A fuse structure for renewable electric fuses comprising knife blades, an insulating member securing said blades in spaced relation, and a fuse element connected to the blades, said fuse structure being adapted for insertion into an enclosing structure; and means fixedly mounted on the outer end of the fuse structure for positive and direct interlocking engagement with the enclosing structure to secure the fuse structure therein.

18. A fuse structure including a fuse element holder and a fuse element mounted thereon, said structure being adapted for insertion into an en-

closing structure; and fixed means provided on the outer end of the fuse structure for positive and direct interlocking engagement with the enclosing structures to secure said structures in assembled relation.

19. A fuse structure including knife blades, an insulating bridge securing said blades in spaced relation, and a fuse element connected to said blades, said fuse structure being adapted for insertion into only one end of an enclosing structure; and a threaded closure disc fixedly mounted on the trailing blade for engagement with an internally threaded ferrule permanently mounted on the enclosing structure.

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