April 5, 1938. D. E. CARNEY 2,113,170

REFILLABLE BLADE FUSE

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Fig. 1.

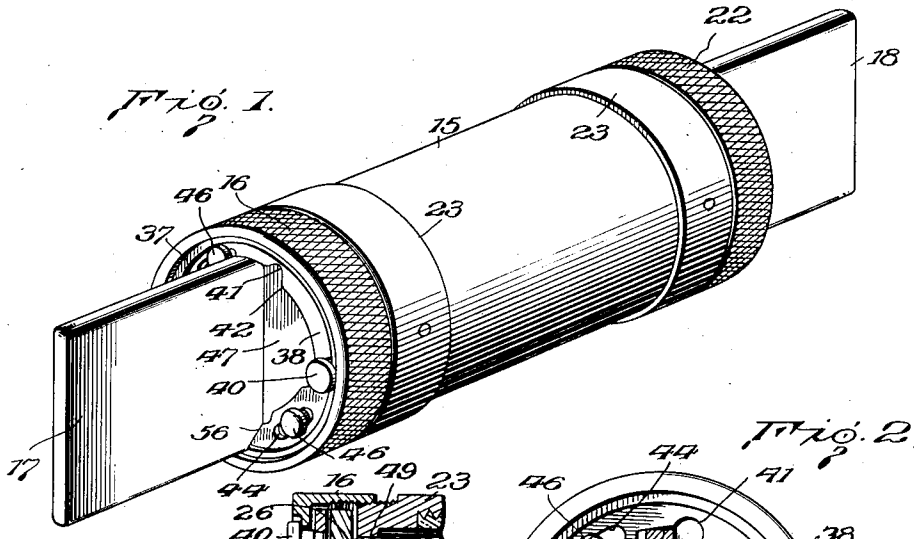


Fig. 2.

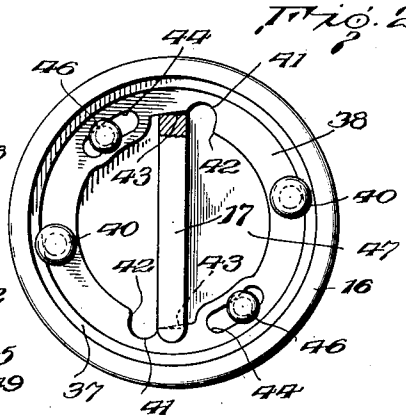
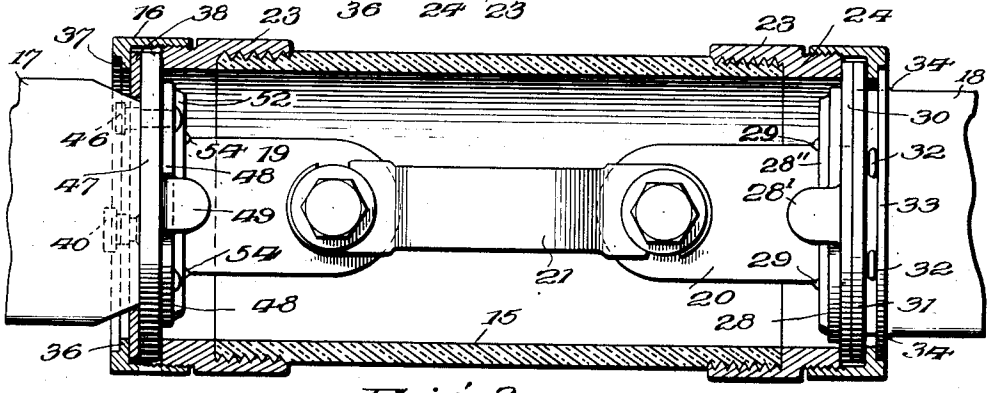


Fig. 3.



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REFILLABLE BLADE FUSE

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Fig. 4.

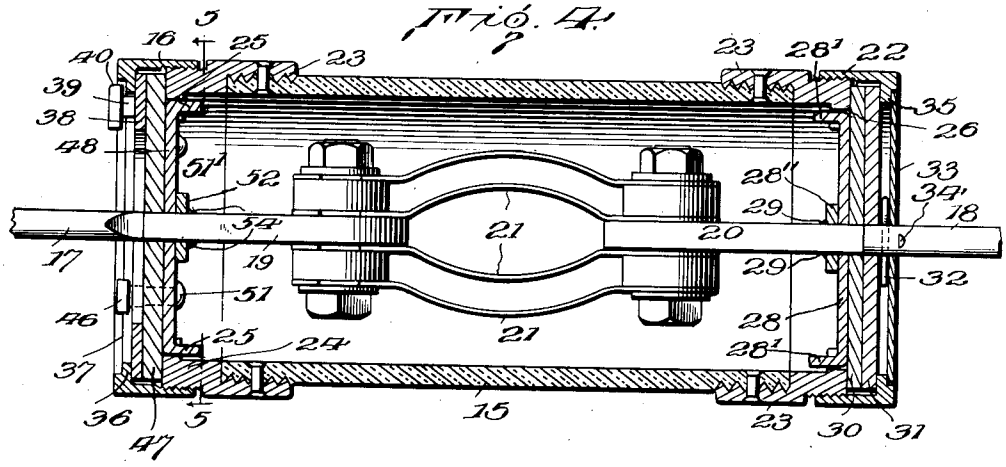


Fig. 5.

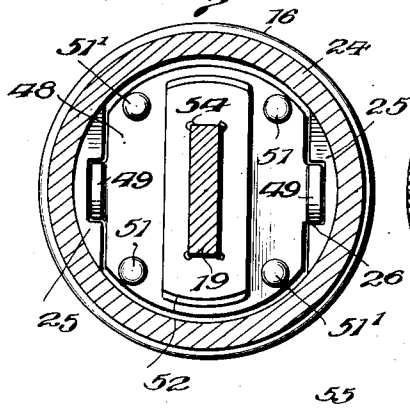
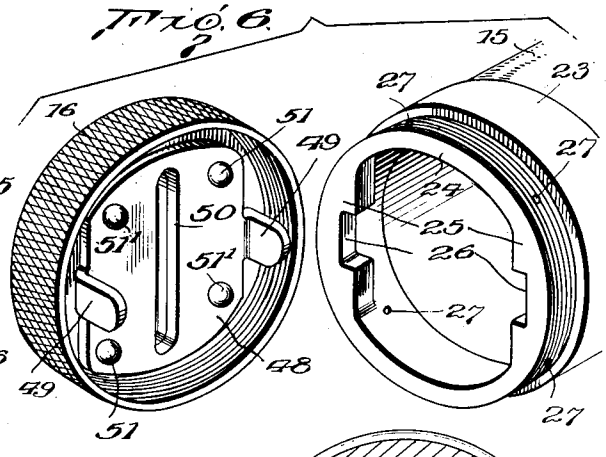


Fig. 6.



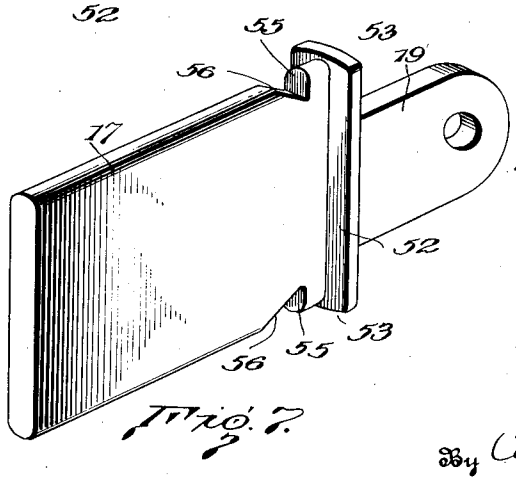


Fig. 7.

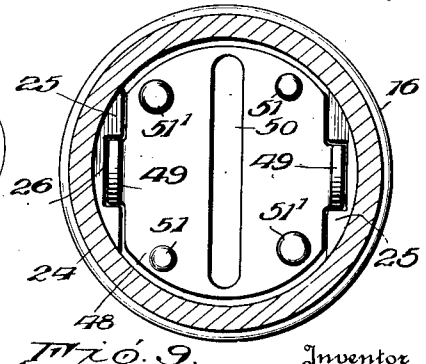


Fig. 9.

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FIG. 13.

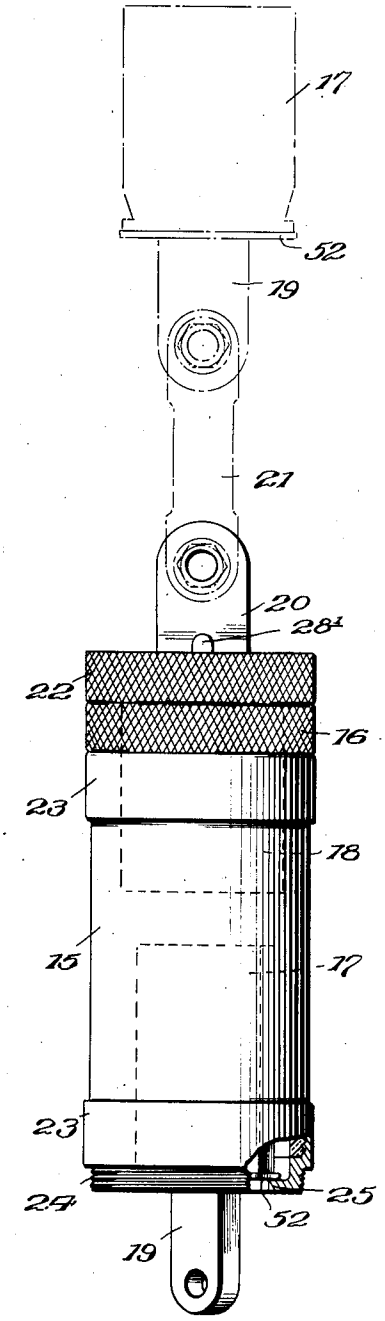


FIG. 10.

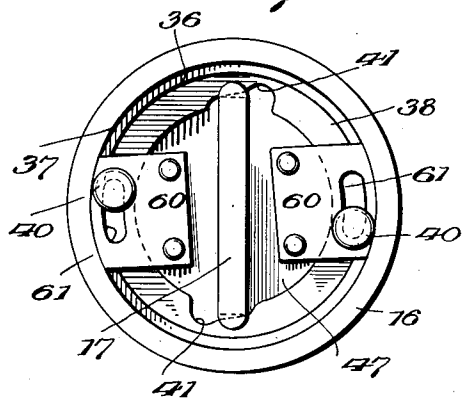


FIG. 11.

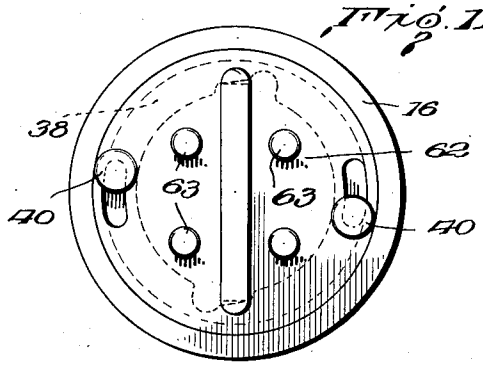
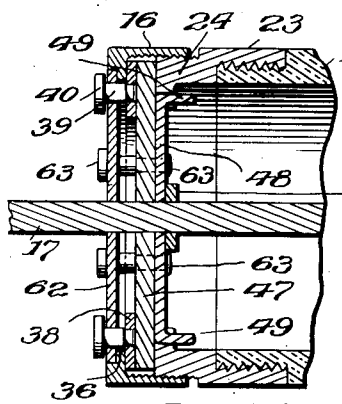


FIG. 12.



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Patented Apr. 5, 1938 2,113,170

UNITED STATES PATENT OFFICE

2,113,170

REFILLABLE BLADE FUSE

Daniel E. Carney, Pittsburgh, Pa., assignor, by direct and mesne assignments, of one-half to James M. Magee and one-half to Harry I. Neaman, both of Pittsburgh, Pa.

Application July 23, 1930, Serial No. 470,167
In Canada June 26, 1929

12 Claims. (Cl. 200—132)

This invention relates to electric fuses of the enclosed refillable type, and has particular reference to that class of cartridge fuses known in the art as the cartridge blade fuse.

All such fuses have certain characteristics in common in that they include an insulating casing containing a fuse strip assembly made up of a fusible means connecting spaced blade terminals which project beyond opposite ends of the casing. At the casing ends means are provided for holding the fuse strip assembly in fixed position relative to the casing, and for closing the casing ends, generally slotted washers, sectional disks, and like elements, which are separately assembled and retained in place by the clamping action of subsequently applied end caps.

Prior to this invention many refillable blade fuses have been developed, representative types of which are disclosed in the following United States patents: McDonald 1,311,661 of July 29, 1919; McDonald 1,702,353 of February 19, 1929; Bussmann 1,542,604 of June 16, 1926; La Mar 1,656,121 of January 10, 1928; Eustice 1,450,029 of March 27, 1923; Eustice 1,393,102 of October 11, 1921; Coote 1,308,000 of June 24, 1919; Conant 1,562,494 of November 24, 1925; and Lavarack 1,755,546 of June 22, 1930. Such fuses however, are open to objection due to the large number of separate members which have to be positioned in ordered sequence in the replacement and reassembly of a blown fuse. Under service conditions, in shops and the like, it is a practical impossibility to keep all of the various washers, plates, caps, etc., free of some dirt and grease in assembling a fuse, with the almost inevitable consequence that, due to the presence of such foreign matter, upon the occurrence of a blow-out there is an explosion of the fuse.

The present invention has been designed to avoid objectionable characteristics of prior art practice, and to this end it has as an essential object the provision of a refillable blade fuse capable of assembly as a two-part unit.

Other objects, in addition to such as will be apparent to those skilled in the art, include: the provision in a fuse of this character, of a detachable end cap having self-contained means automatically operable by manipulation of the cap for releasably locking a fuse terminal blade against movement relative to the fuse casing; the provision in such a fuse, of means rotatably associated with a portion of the assembled fuse casing structure, and arranged for cooperative locking engagement with a portion of the fuse strip assembly, to restrain the fuse strip assembly against movement axially of the assembled casing; the provision in such a fuse, of an end cap applicable longitudinally of the fuse casing and having self-contained terminal blade inter-locking means for preventing relative movement between the blade and cap axially of the cap; the provision, in such a fuse, of a casing structure formatively adapted to serve as a work holder in a refilling operation; and the provision of an end cap for fuse casings, having casing closure and terminal holding means permanently coupled thereto for freely rotatable and axially limited movement.

This specification and accompanying drawings are illustrative of certain physical embodiments of the principles underlying the invention, and constitute the best means I have thus far devised for reducing the invention to practice.

Figure 1 is a perspective of a preferred form of the fuse.

Figure 2 is an end view thereof.

Figure 3 is substantially a central longitudinal sectional view through the preferred form.

Figure 4 is a longitudinal section at a right angle relative to Figure 3.

Figure 5 is a section on line 5—5 of Figure 4.

Figure 6 is a group perspective illustrating the relative disposition of elements on an end cap and casing head in assembling.

Figure 7 is a perspective of one of the terminal blades of the fuse strip assembly.

Figure 8 is a fragmentary section through an end of the fuse as at the left of Figure 1.

Figure 9 is a section illustrating the cooperative engagement of the preferred casing head and end closure.

Figure 10 is an end elevation illustrating a modified form of detachable end cap and associated end closure and blade locking means.

Figure 11 is a similar elevation of a further modification of end cap and associated elements.

Figure 12 is a section, similar to Figure 8, but illustrating the attachment of the modification shown in Figure 11.

Figure 13 is an elevation, showing in dotted lines, the employment of the casing as a work support in refilling the fuse.

In detail, a preferred form of fuse consists of but two parts for assembly purposes, one part comprising a casing structure including a tubular shell 15 of insulating material carrying a detachable end cap 16 secured thereon with its associated elements later detailed, and the other part comprising a fuse strip assembly insertable

as a unit into and through the casing from the end opposite that carrying the cap 16.

This second part, or fuse strip assembly, includes two terminal blades 17 and 18 adapted to project beyond the casing ends and having reduced portions 19 and 20 connected by fusible link means here shown as a plurality of fuse links 21, having sufficient inherent stiffness to maintain the terminal blades in properly spaced and aligned relation in handling, without necessitating the employment of an insulating bridge. Secured to one blade, indicated as 18, in permanent fixed engagement against any movement longitudinally thereon is an end closure means, hereinafter described in detail, and which has rotatably and permanently coupled thereto an end cap 22 formed for threaded detachable engagement with one end of the casing.

Over each end of the shell 15 is threaded a metal head 23 formed with a reduced externally threaded portion 24 having an internal diameter identical with that of the shell. Each of the end caps 16 and 22 is internally threaded for detachable engagement interchangeably over either of the portions 24. The heads 23 are permanently fixed to the shell by retaining elements such as countersunk pins, rivets, or the like.

As best shown in Figure 6, each external end of the heads 23 is formed with diametrically opposed integral webs 25 having opposed edge opening notches 26, and the wall of each reduced portion 24 is formed with circumferentially spaced vent apertures 27 establishing communication between the interior of the shell and the exterior of the heads thereof at the threads, for gradual escape of gases generated by a blow-out. The heads are so fixed to the shell that the webs 25 and notches 26 thereof will be in fixed longitudinal alignment at each end of the casing.

The end closure means hereinbefore stated as permanently fixed to the terminal blade 18 may be varied within structural limits, it being here shown as a sealing plate 28 centrally slotted in conformity to that portion of the blade which passes centrally therethrough, and being rigidly attached to the inner face of a closure disk 30 which overlies and abuts the adjacent end of the casing head, cooperating with an additional sealing washer 31 to make an effective closure and seal for the end of the casing. The washer 31 is retained in place by cotter keys 32 passed transversely through the terminal blade, and a retainer disk 33 is positioned exteriorly of and covering the cotter keys, being held closely bearing thereagainst by striking down the metal of the blade, as shown at 34 in Figure 3. The peripheral edge portion of the retainer disk 33 engages over an internal annular flange 35 on the end cap 22, holding the end cap permanently coupled with the end closure and fixed against axial movement relative thereto, but capable of rotary movement thereon. Both washer 31 and the retainer disk 33 are centrally slotted in conformity with the blade terminal, having together with the plate 28, such close engagement with the blade as to prevent flashing along the blade upon a blow-out.

The anchor plate 28 carries guide lugs 28' which seat in the adjacent notches 26 of the head webs 25, holding the plates against rotation, and this plate is further provided with a flash bar 28'', against the inner face of which the metal of the blade shank 20 is struck up at the points 29. These struck metal portions 29 and 34 confine the plate 28, bar 28'', disks 30 and 31, and retainer disk 33 therebetween, preventing any movement of these parts on and longitudinally of the blade 18.

The detachable end cap 16 is internally threaded for attachment over the reduced portion 24 of the adjacent casing head 23, and it is a feature of this invention that this cap has permanently coupled therewith, in freely rotatable engagement, means for closing the adjacent casing end, and means for releasably locking the adjacent terminal blade 17 to the cap against movement axially thereof, the coupling connection being so arranged that the respective elements are capable of a limited movement relative to each other axially of the cap in the locking and unlocking operation. It is also a feature that the lock is automatically effected by and through manipulation of the end cap in the direction of its movement in engaging or disengaging the casing head.

One effective structural embodiment of such an arrangement is shown in the preferred form of this invention, and consists of an internal annular clamp flange 36 formed at the outer end of the cap 16 and having its outer face rabbeted to form an annular shoulder 37. In this respect caps 16 and 22 are identical, the rabbet in cap 22 serving to seat the retainer disk 33. In both instances the internal diameter of the cap flanges 35 and 36 is greater than the overall width of the terminal blades, providing a clearance sufficient to insure against any engagement of the blades and the cap flanges.

A locking means, here shown as a ring 38, having an external diameter less than the internal diameter of the cap 16 to provide a clearance, engages and seats against the inner face of the cap flange 36 in freely rotatable relation thereto. This ring 38 is permanently and loosely coupled to the cap by retaining means, here shown as circumferentially spaced studs 39 anchored in the lock ring and projecting laterally therefrom beyond the flange 36. These studs are formed with enlarged rounded heads 40 which engage over the flange shoulder 37 to maintain the coupling. The shanks of these studs have a bearing against the inner circumference of the cap flange 36 and their length is made such that a limited clearance exists between the stud heads 40 and the shoulder 37, thus permitting a limited relative movement between the cap and lock ring axially of the cap.

The internal diameter of the lock ring 38 is appreciably less than the overall width of the terminal blade 17, and in order that the blade may pass through the ring, diametrically opposed notches 41 are provided in the ring, opening to its inner circumference. One pair of diagonally opposed walls of the recesses or notches 41 is formed to provide a stop shoulder 42 at one edge of each notch, while the other pair is formed to provide cam portions 43 receding from the inner circumference of the ring substantially to the ends of the notches.

The ring 38 is provided with diametrically opposed arcuate closed end slots 44 through which are received the shanks 45 of rivet pins, the outer enlarged heads 46 of which engage and overlie the ring at the edges of the slots 44, with a certain clearance sufficient to permit of a limited relative movement between the lock ring and pins 45 axially of the ring and end cap. These rivets 45 serve to provide a permanent loose coupling between the lock ring and a casing end

closure member in the form of a solid circular disk 47 rotatably slidable on the inner face of the lock ring and coincident therewith with respect to its external diameter.

The inner face of the closure disk 47 overlies and seats against the outer end of the adjacent casing head portion 24 and webs 25. A sealing plate 48, a function of which is to prevent passage of molten metal on the occurrence of a blow-out, such as would weld the closure disk 47 to the casing end 24, is rigidly secured to the inner face of the closure disk 47, by the rivet pins 45 which are internally headed as at 51, and by additional rivets 51'.

The sealing plate 48 is shaped in conformity with the casing head 24 filling the space between the webs 25, so that relative rotation between these elements is prevented when the fuse is assembled. This plate 48 is provided on opposite sides with perpendicular guide lugs or fingers 49 which have substantially rounded ends and which extend appreciably beyond the plane of the inner end of the cap 16, their function being to engage in and pass through the casing head notches 26 as the cap is applied, providing a self aligning means for the cap. The width of guides 49 is less than the width of notches 26, providing a clearance which permits ease of assembly while at the same time providing an anchorage to enable the cap thread to take over the thread of the casing head 24.

A slot 50 is formed through disk 47 and sealing plate 48 in conformity with the shape of the terminal blade 17 which passes therethrough, the slot being made from .0018 to .0022 of an inch larger than the blade to permit of an approximate .0015 of an inch rotational movement of the blade relative to the slot to secure perfect alignment and seating of the terminal blade when engaged in the usual fuse clips, not shown.

Surrounding the reduced shank 19 of the terminal blade 17 and abutting the inner edge of the larger contact portion thereof, is a substantially rectangular flash bar 52, centrally slotted to embrace the blade shank. This bar is narrow, having a width not much greater than the thickness of its associated blade, and a length substantially, but not quite, equal to the maximum internal diameter of the adjacent portion 24 of the casing head 23. At its ends 53 the bar is curved in conformity with the curvature of the casing head wall. The bar is rigidly attached to the blade shank 19 as by striking over the metal thereof at the points 54, shown in Figure 4.

As best illustrated in Figure 7, the terminal blade 17 has its edges recessed to provide shoulders 55 in advance of the flash bar 52. These shoulders each form the rear wall of the formative recess, the forward wall of each recess being arranged on an incline from the bottom of each recess to the edge of the blade, forming forwardly inclined cam faces 56, which cooperate with the cam portions 43 of the locking ring in the assembly of the fuse.

In assembling the fuse, the casing 15 with its attached end cap 16 is held in one hand while the fuse strip assembly comprising the blade 18, its permanently carried end closure, and cap 22, fuse links 21 and blade 17, is inserted through the open end of the casing from right to left of Figure 1. The blade 17 and its flash bar pass freely through the casing in the ample clearance between the webs 25, and the blade 17 is projected through the slot 50 in the anchored sealing plate 48 and closure disk 47 carried by the cap 16, passing outwardly beyond the cap through the notches 41 in the locking ring 38, which are aligned with the slot 50, and bringing the cam faces 56 of the blade into the plane of the locking ring.

When the flash bar 52 abuts the sealing plate 48, the plate 28 will have advanced to engage the guide lugs 28' in the notches 26 of the webs 25 of the adjacent casing head sufficiently in advance of threading engagement of the cap 22 on its adjacent casing head end 24 to hold the plate 28, blade 18 and its attached closure members 30, 31 and 33 against rotation while the cap 22 is screwed home. The advancing movement of cap 22 causes its flange 35 to bear against and clamp the plates 31 and 30 into sealing engagement against the end of the casing head. In structure and function the guides 28' are identical with the guides 49 previously described.

Meanwhile, due to the engagement of blade 17 in the slot 50, rotation of the fuse strip assembly at the forward fuse end will have been prevented, and as the plates 28 and 48 are held in positive alignment by their respectively engaged casing head webs 25, the two terminal blades will be held in proper alignment.

When the cap 22 has been secured, an advancing turn is given the cap 16, which by reason of the clamping bearing of the cap flange 36, rotating over the locking ring 38, causes a frictional engagement between the cap flange and ring, rotating the ring in a clockwise direction and, as shown in Figure 2, advancing the ring cams 43 into the edge recesses of the blade 17 and into positive engagement with the blade cam faces 56. This action moves the ring notches 41 out of registry with the closure plug slot 50 thereby locking the blade 17 against movement longitudinally of the fuse casing. Under continued advancing rotation of the cap 16 the cooperative engagement of the cams 43 and 56 forces the blade 17 outwardly axially of the cap thereby bringing the flash bar 52 into tight sealing engagement with the inner face of the sealing plate 48 around the edges of its slot 50. Additionally, the bearing of the ring cams 43 prohibits any possible edgewise movement of the blade 17 in the plug slot 50.

In the views referring to the modified structures, all elements identical with the preferred form are indicated by like reference numerals. In the modification shown in Figure 10, the coupling between the closure disk 47, lock ring 38 and cap flange 36 is effected through means of diametrically opposed clips 60 having base portions riveted to the disk 47 and offset to extend over the ring 38 and seat on the cap flange shoulder 37. The clips are formed with arcuate slots 61 which receive the shanks of the ring carried studs, whose heads 40 overlie the edges of the slots.

In the modification shown in Figures 11 and 12 the lock ring 38 is not coupled directly to the closure disk 47, otherwise the relative arrangement is that of the preferred form except that a retainer plate 62 slotted to receive the blade, is seated on the shoulder of the cap flange 36. This retainer plate is anchored directly to the disk 47 by rivet pins 63 on opposite sides of the blade slot. The plate 62 is arcuately slotted to receive the lock ring studs 39, the heads 40 of which overlie the external face of the retainer plate.

In all forms herein referred to, the end cap 16 carries, in permanently coupled relation thereto, the means for holding the terminal blade against rotation in the casing, and the means for locking the blade and cap against relative movement

axially of the cap. The annular flange of the cap is so related to the associated elements that as the cap is advanced in applying movement, its flange clamps the closure disk **47** against the adjacent casing end, through pressure against the lock ring **38**, effectively sealing the end of the fuse casing.

Referring to Figures 1 and 13 and assuming the fuse to have been blown, a refilling can be accomplished without necessity of removing a plurality of elements and allowing them to lie on a work bench or shelf and thus pick up dirt and grease. In making a refill the cap **16** is retractively rotated, its movement causing the lock ring **38** to move out of engagement with the blade **17** and placing the notches **41** in registry with the closure slot **50**. In this movement of the lock ring the shoulders **42** abut the sides of the blade, serving as stop means which prevent any possibility of carrying the ring notches **41** beyond the point of registry with the slot **50**.

The cap **22** is then unscrewed, and by virtue of its permanent, non-slidable connection with the blade **18**, said blade and cap are removed as a unit. Holding the casing in a vertical position, as seen in Figure 13, the blade **17** is pushed inwardly and allowed to drop through the casing, its projecting portion **19**, shown at bottom of Figure 13, being given a slight turn to seat the flash bar **52** on the inner faces of the webs **25**, thus supporting the blade internally of the casing. Blade **18** is then inserted through cap **16**, seating in the slot of its associated structure until cap **22** rests on cap **16**, as seen at the upper part of Figure 13.

New fuse links **21** are then connected to the upstanding blade portion **20**, after which the terminal **17** is removed from the lower end of the casing and its end **19** connected with the free ends of the fuse links. This completes the assembly of the fuse strip which is then removed from cap **16** and inserted as an entirety through the open end of the casing, in a manner previously described in detailing the assembling of the two part fuse thus formed.

In the refilling operation the casing **15** serves as a work holder or supporting vise, and no part of the entire fuse leaves the hands of the person refilling.

I claim:

1. In a cartridge fuse, a casing, an end cap having detachable engagement with one end thereof, a closure member rotatably connected to said cap, a terminal blade projecting through said closure member and cap, and interlocking blade engaging means carried by said closure member.

2. In a cartridge fuse, a casing, an end cap having rotatably detachable engagement with one end thereof, a closure member in permanently coupled connection with said cap and shiftable relative thereto, a terminal blade movable axially through said closure member and cap, and blade locking means in permanently coupled shiftable association with said cap and closure member for locking said terminal blade against movement axially of said closure member and cap.

3. In a cartridge fuse, a tubular casing, a terminal blade projecting from an end thereof, a cap detachably engageable over said casing end and apertured to receive said blade therethrough, and means permanently and rotatably connected to said cap for interlocking with said blade to hold the same against movement relative to the casing.

4. In a cartridge fuse, a casing, a terminal blade projecting from an end thereof, a cap detachably engageable with said casing end and apertured to receive said blade therethrough, and means for interlocking said blade and casing against relative movement, said means having permanent connection with said cap in freely rotatable relation and having limited freedom of movement axially thereof.

5. A refillable cartridge fuse comprising an insulating casing, a fuse strip assembly insertable through an end of the casing, an end closure cap permanently fixed on said fuse strip assembly against movement longitudinally thereof and formed to secure said fuse strip assembly in and to the casing, a detachable end cap on the opposite end of the casing, and fuse assembly engaging means permanently connected to said detachable end cap in relative shifting relation therewith for locking said fuse assembly against movement relative to the casing.

6. An end cap for fuse casings, including a casing engaging portion, a member associated therewith and adapted for positive interlocking engagement with a terminal blade, and means permanently connecting said cap and member in shiftable relation relative to each other.

7. A fuse casing end cap, including a casing engageable sleeve portion, an internal annular flange thereon, a member formed for interlocking engagement with a terminal blade, and means coupling said flange and member in freely rotatable relation relative to each other.

8. An end cap for fuse casings, including a casing attachable portion, a fuse terminal engageable interlocking member permanently connected thereto and movable thereon, and a closure member coupled with said interlocking member.

9. An end cap for fuse casings, including a casing attachable portion, a fuse terminal engageable interlocking member permanently coupled thereto and movable thereon, and a closure member permanently coupled with said interlocking member and having limited movement thereon circumferentially of the cap.

10. An end cap for fuse casings, including a casing attachable portion, a fuse terminal engageable interlocking member rotatable thereon, and means permanently connecting said cap and interlocking member in a manner permitting limited relative movement therebetween axially of the cap.

11. An end cap for fuse casings, including a casing attachable portion, a fuse terminal engageable lock member rotatable thereon, means permanently connecting said cap and lock member in a manner permitting limited relative movement therebetween axially of the cap, a closure member rotatably movable relative to said lock member, and means permanently connecting said lock member and closure member in a manner permitting limited relative movement therebetween axially of the cap.

12. An end cap for fuse casings, including a casing attachable portion, a fuse terminal blade lock member in swivelled connection therewith, a closure member permanently and shiftably connected to said lock member, said lock member and closure member having apertures therein to receive a terminal blade therethrough when in registry, and means on said cap frictionally engageable with said lock member to shift the same on the closure member.

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