Feb. 19, 1935. M. B. WOOD 1,991,876

RENEWABLE ELECTRIC FUSE

Filed Dec. 13, 1933

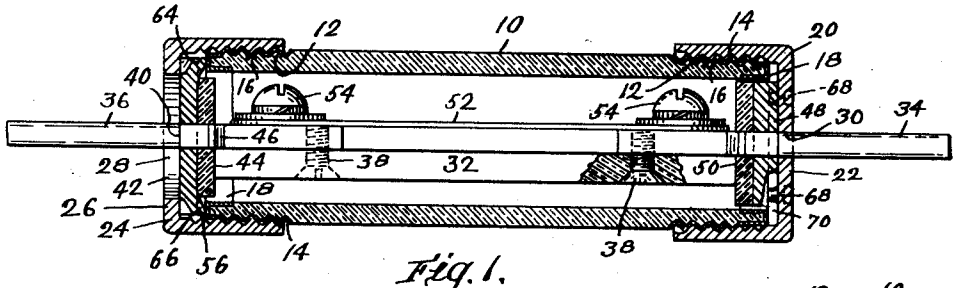


Fig. 1.

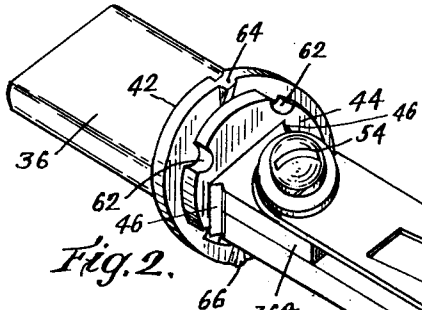


Fig. 2.

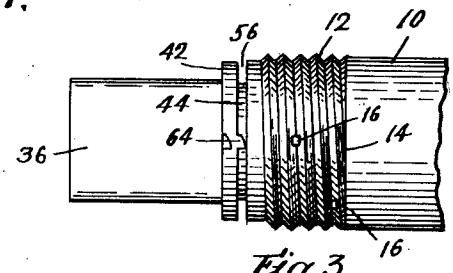


Fig. 3.

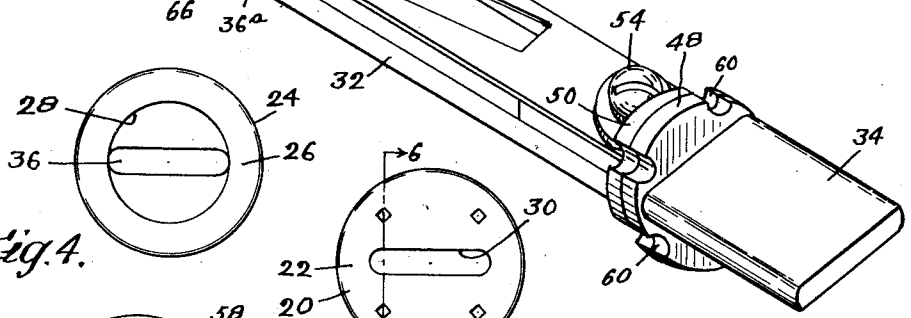





Fig. 4.




Fig. 5.

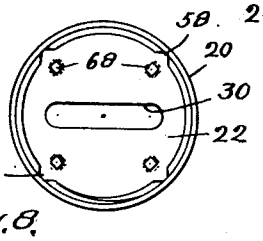


Fig. 8.

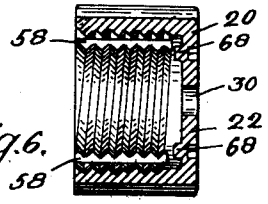


Fig. 6.

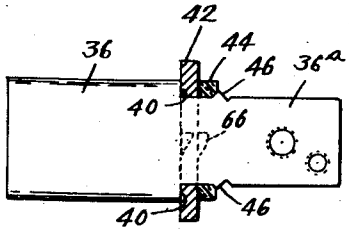


Fig. 7.

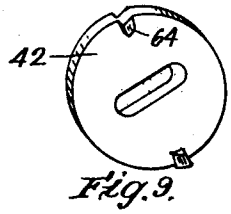


Fig. 9.

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# UNITED STATES PATENT OFFICE

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## RENEWABLE ELECTRIC FUSE

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Application December 13, 1933, Serial No. 702,147

12 Claims. (Cl. 200—131)

This invention relates to renewable electric fuses of the knife blade type and is intended as an improvement on that type of fuse disclosed in the Conant Patent No. 1,919,273, dated July 25, 1933.

The knife blade fuse of said patent comprises a tubular insulating enclosing casing having end caps removably screw-threaded thereon. The removable structure of the fuse comprises a pair of knife blades secured to the same face of an insulating bar at opposite ends thereof. One knife blade has a small plate or disc fixed thereto which can pass through the tubular casing and bears against the inner wall of one end cap. The other knife blade has a large plate or disc fixed thereto which overlies and confronts the outer end of the casing and is spaced therefrom to provide a gas outlet for the interior of the casing. The end cap presses against said large disc and exerts pressure through the insulating bar to press the small disc against the end wall of its associated end cap. The knife blades are adapted to lie in the center line of the casing so that the insulating bar is necessarily at one side of the center line. The end cap thus exerts a clamping pressure longitudinally of the insulating bar and eccentrically of the axis thereof so that the bar sometimes bends under the pressure with the result that the knife blades are deflected out of alignment.

An object of the present invention is the provision of means to prevent the bending of the insulating bar and the misalignment of the knife blades under the clamping pressure.

A specific object of the invention is to support the aforesaid large disc in its desired spaced relation away from the end of the cap and yet engage and be supported by the casing in such manner that a bending pressure on the insulating bar due to the clamping action of the end cap is avoided.

A further object is to provide the aforesaid large disc with a peripherally disposed projection located on the side of the knife blade opposite the insulating bar preferably in a line at right angles to the bar, or two projections on diametrically opposite sides of the bar, which projections extend axially of the removable structure of the fuse and engage the end face of the enclosing casing whereby to support the disc parallel with the end face and hence to resist the bending of the insulating bar.

A further object is to provide an end cap, and specifically the end cap that is engaged by the small disc of the removable fuse structure, with bosses which engage the associated end face of the enclosing casing to space the end wall of the end cap away from the end of the enclosing casing to provide a venting outlet for the interior of the casing.

Another object is generally to improve the construction and operation of renewable electric fuses.

Fig. 1 is a longitudinal sectional view through a renewable electric fuse of the knife blade type embodying the present invention, one of the end discs of a blade being broken away to illustrate a spacing projection of an end cap.

Fig. 2 is a perspective view of the removable fusible element.

Fig. 3 is a plan detail of an end of the casing, with the end cap removed and illustrating one of the projections on the large disc for preventing the bending of the insulating bar under the clamping action of the end cap.

Fig. 4 is an end view of the left hand end of the fuse of Fig. 1.

Fig. 5 is an end view of the right hand end of the fuse of Fig. 1.

Fig. 6 is a section taken along line 6—6 of Fig. 5 and illustrating particularly the projections formed in the inner face of the end wall of the end cap for providing a vent passage for the interior of the fuse.

Fig. 7 is a plan detail of the left hand knife blade terminal of Fig. 1, the large plate and its associated insulating disc being shown in section.

Fig. 8 is an interior end view of the end cap at the right hand end of the fuse.

Fig. 9 is a perspective detail of the large disc.

The renewable electric fuse embodying the present invention comprises a tubular enclosing casing 10 of suitable insulating material, as fibre, having external screw threads 12 at the opposite ends thereof. Thin walled internally and externally screw-threaded metal shells 14 are received on the screw-threads 12 and are retained against rotation by suitable means as spurs 16 pressed out of the shell and forced into the casing. The end portion 18 of each shell is reflexed over the end of the casing and into the interior thereof where it grips the casing firmly. An internally screw-threaded end cap 20 is adapted to be screw-threaded on the shell 14 at one end of the casing as at the right hand end, and has an end wall 22 which overlies the open end of the casing. Another internally screw-threaded end cap 24 is adapted to be screw-threaded on the shell 14 at the other end of the casing and has an end wall 26 therein which is adapted to

overlie the end of the casing. The end wall 26 has a circular aperture 28 therethrough through which one of the knife blades is extended freely and the end wall 22 of the other end cap 20 is provided with a transversely elongated slot 30, see especially Fig. 5, in which the other knife blade is adapted to be closely received and confined and to engage the end cap against independent rotation with respect thereto. The removable structure of the fuse comprises a flat bar 32 of rectangular cross section and composed of suitable insulating material as fibre having knife blades 34 and 36 secured to the same face thereof by suitable means as screws 38 and extended endwise of the bar. The knife blade 36 is adapted to extend loosely through the aperture 28 of the end cap 24 and the knife blade 34 is adapted to be received in the elongated slot 30 of the end cap 20. The knife blade 36 is provided with an inner end portion 36*a* which is laterally reduced in width with respect to the width of the outer end portion and thus provides a pair of shoulders 40 at the junction of the inner and outer portions. A large metal disc 42 is received on the reduced inner portion 36*a*, said disc having an elongated slot in the middle thereof through which said reduced portion passes and is seated upon the shoulders 40. A disc of insulating material 44 is located on the reduced portion against the inner face of the disc 42. Projections 46 struck out of the opposite ends of the reduced portion 36*a* bear against the inner face of the insulating disc and thus function to connect said discs rigidly with the knife blade so that said discs and particularly the disc 42 is in effect integral with the knife blade and is not free for independent movement thereon. The other knife blade 34 is similarly formed and is provided at the junction of the inner and outer portions thereof with an outer small metal disc 48 and an inner insulating disc 50. The discs 48 and 50 are at least as small as the internal diameter of the casing 10 so that they can pass therethrough from one end and be located with the small metal disc 48 against the inner face of the wall 22 of the end cap 20. The insulating disc 44 of the other knife blade is similarly arranged to be at least as small in diameter as the internal diameter of the fuse casing adjacent thereto so that it can enter said end of the fuse casing and be located therein with its periphery in close relation with the inner periphery of the casing. The large disc 42 has such diameter that it can not enter the casing and overlies and confronts the end wall of the casing adjacent thereto. A fusible link 52 has its ends removably secured by screws 54 to the inner ends of the knife blades 34 and 36 and is adapted to fuse upon overload. The fuse as thus described is generally as described in the above referred to Conant patent.

It has been the practice to have the length of the removable structure between the inner face of the large disc 42 and the outer face of the small disc 48 such that when the end cap 20 is screwed onto the fuse casing as far as it will go and the small disc 48 is in engagement with the inner face of the end cap there will be a small clearance 56, see Figs. 1 and 3, between the inner face of the large disc 42 and the end of the casing confronting the disc thereby to provide a vent passage from the interior of the casing to the screw threads or other venting means and to the atmosphere. As is here shown with respect to the end cap 20 in Fig. 8, both end caps are provided with longitudinally directed venting slots 58 which traverse the internal screw threads and establish communication between the space 56 and the atmosphere. The discs 48 and 50 are provided with notches 60 in their peripheral portions which establish communication between the interior of the fuse casing and the interior of the end cap 20 and the disc 44 is similarly provided with peripheral notches 62 which establish communication between the interior of the casing and the space 56.

With the fuse as thus constructed the end cap 24 applies pressure against the outer face of the disc 42 to urge the removable structure inwardly and the small disc 48 thereof against the inner face of the other end cap 20. Since the knife blades 34 and 36 are in the axial line of the enclosing casing the insulating bar 32 that connects said knife blades is necessarily eccentric of the axial line of the casing, and hence the clamping pressure is applied eccentrically with respect thereto. As a consequence the eccentric loading of the bar 32 causes it to deflect or bend away from the axis of the enclosing casing or toward the bottom of Fig. 1. Since the knife blades 34 and 36 are rigid with the insulating bar the outer ends of the knife blades are displaced in the opposite direction or upwardly in Fig. 2. Hence in the present invention means are provided to prevent the deflection or bowing of the insulating bar and the consequent misalignment of the knife blades under the clamping pressure. To this end the large disc 42 at the periphery thereof is provided with an inwardly directed struckout portion or projection 64 which confronts the peripherally smooth and unindented end of the casing and is disposed on the side of the knife blade 36 opposite the insulating bar 32 and in a line perpendicular to the flat face of said bar. Said projection 64 is of such height that it projects inwardly from the disc 42 to such an extent that it is in engagement with the end of the casing when the outer face of the small disc 48 on the other knife blade is in engagement with the inner face of the end cap 20. The projection 64 thereby prevents the downward bowing of the insulating bar 32 under the clamping pressure since the disc 42 is rigid with the insulating bar. Preferably the disc 42 is provided with a second diametrically opposed similar projection 66 so that bowing of the bar in opposite directions is prohibited. Thus the knife blades 34 and 36 remain in parallel alignment at all times under the clamping pressure.

The end cap 20 is provided with a plurality of inwardly directed bosses or projections 68 which outstand from the inner face of the end wall 22 thereof and bear against the end of the casing for the purpose of spacing the inner face of the end wall from the casing and thereby providing a communicating passage 70 between the end wall and the end of the casing from the interior of the fuse to the vent slots or equivalent means 58.

I claim:

1. A renewable electric fuse of the knife blade type comprising an insulating casing, an end cap thereon having integral therewith an end wall which overlies one end of the casing and is provided with a blade slot therethrough, a removable structure comprising an insulating bar extended lengthwise of said casing, knife blades fixed to the same face of said bar at the ends thereof, one of said knife blades being extended through said blade slot and having a disc which confronts the inner face of said end wall, said

other knife blade having rigid therewith a disc which overlies the other end of said casing, means exerting a clamping pressure between said casing and said removable structure lengthwise of said bar to force said first named disc against said end wall, said knife blades being in the axial line of said casing so that said clamping pressure is exerted endwise and eccentrically of said insulating bar, and means to support said bar against lateral deflection due to such eccentrically applied clamping pressure.

2. A renewable electric fuse of the knife blade type comprising a tubular enclosing casing having an end wall connected thereto which overlies one end thereof, a removable structure comprising an insulating bar which extends lengthwise of said casing, knife blades fixed to said bar at the ends thereof, one knife blade having a plate which engages the inner face of said end wall, means applied between said casing and a part of said structure remote from said plate which exerts pressure endwise and eccentrically of said bar to clamp said plate against said end wall, and means which supports said bar against lateral deflection due to said clamping pressure.

3. A renewable electric fuse of the knife blade type comprising an insulating enclosing casing having an end wall which overlies one end thereof, an insulating bar extended lengthwise of said casing, knife blades fixed to opposite ends of said bar and extended outwardly from the opposite ends of said casing, means which exerts a clamping pressure endwise and eccentrically of said bar, and means which supports said knife blades against misalignment due to said eccentric pressure.

4. A renewable electric fuse of the knife blade type comprising a tubular enclosing casing, an end cap screw-threaded on one end of said casing and having an end wall which overlies the end of the casing, a removable structure comprising an insulating bar extended lengthwise of said casing, knife blades fixed to the same face of said bar at opposite ends thereof and disposed in the axial line of said casing, one knife blade having fixed thereto an outstanding small disc which confronts and bears against the inner face of the end wall of said end cap, said other knife blade having rigid therewith a large disc which confronts and overlies the other end of said casing, an end cap in which said large disc is located, said end cap having a screw-threaded connection with said casing and exerting pressure on said disc axially of said casing and endwise on and eccentrically of said insulating bar to clamp said removable structure between said end caps, and means which supports said insulating bar against lateral deflection due to said eccentrically applied clamping pressure.

5. A renewable electric fuse as defined in claim 4, said last named means comprising a projection which is disposed between and is engaged with the peripheral portion of said large disc and the confronting end of said casing on the side of the knife blade opposite said insulating bar.

6. A renewable electric fuse as defined in claim 4, said last named means comprising a pair of diametrically opposed projections which are interposed between and engage the peripheral portion of said large disc and the end of said casing, one of said projections being disposed on the side of the knife blade opposite said insulating bar.

7. A renewable electric fuse as defined in claim 4, said last named means comprising a projection which is struck out from the peripheral portion of said large disc and is directed toward and engages the confronting end of said casing and is disposed on the side of the knife blade opposite said insulating bar.

8. A renewable electric fuse of the knife blade type comprising a tubular enclosing casing, an end cap screw-threaded on one end of said casing and having an end wall which overlies the end of the casing, a removable structure comprising an insulating bar extended lengthwise of said casing, knife blades fixed to the same face of said bar at opposite ends thereof and disposed in the axial line of said casing, one knife blade having fixed thereto an outstanding small disc which confronts and bears against the inner face of the end wall of said end cap, said other knife blade having rigid therewith a large disc which confronts and overlies the other end of the casing, an end cap in which said large disc is located, said end cap having a screw-threaded connection with said casing and exerting pressure on said disc axially of said casing and endwise on and eccentrically of said insulating bar to clamp said removable structure between said end caps, and means which supports said insulating bar against lateral deflection due to said eccentrically applied clamping pressure, said means comprising a pair of diametrically opposed projections which are struck out from the inner face of said large disc and are disposed between said disc and the confronting end of said casing and engage said confronting end, one of said projections being on the side of the knife blade opposite said insulating bar.

9. A renewable electric fuse of the knife blade type comprising a tubular enclosing casing, an end cap screw-threaded on one end of said casing and having an end wall which overlies the end of the casing, a removable structure comprising an insulating bar extended lengthwise of said casing, knife blades fixed to the same face of said bar at opposite ends thereof and disposed in the axial line of said casing, one knife blade having fixed thereto an outstanding small disc which confronts and bears against the inner face of the end wall of said end cap, said other knife blade having rigid therewith a large disc which confronts and overlies the other end of said casing, an end cap in which said large disc is located, said end cap having a screw-threaded connection with said casing and exerting pressure on said disc axially of said casing and endwise on and eccentrically of said insulating bar to clamp said removable structure between said end caps, and means which supports said insulating bar against lateral deflection due to said eccentrically applied clamping pressure, said means comprising a pair of diametrically opposed projections which are struck out from the inner face of said large disc and are disposed between said disc and the confronting end of said casing and engage said confronting end, one of said projections being on the side of the knife blade opposite said insulating bar, said projections also constituting means providing a passage from the interior of the casing around the end of said casing into said end cap.

10. In a renewable electric fuse of the knife blade type, the combination of an enclosing casing having external screw threads at an end thereof, an end cap having internal screw threads that are screw-threaded on the screw threads of said casing, said end cap having an end wall which overlies and confronts the ends of said casing and said end wall having internally pro-

jected projections which engage the end of said casing and maintain the inner face of said end wall in spaced relation with the end of said casing whereby to maintain a gas communicating passage from the interior of said casing around the end thereof to the vicinity of said screw threads.

11. A renewable electric fuse of the knife blade type comprising a tubular enclosing casing having external screw threads at the opposite ends thereof, an end cap having internal screw threads removably received on the screw threads at one end of said casing and having integral therewith an end wall which overlies the confronting end of said casing and has a blade slot therethrough, said end wall having internally directed projections which engage said end of said casing and maintain said end wall in spaced relation therewith whereby to provide a gas passage from the interior of said casing around the end thereof to the vicinity of said screw threads, a removable structure comprising an insulating bar extended lengthwise of said casing, knife blades fixed to the same face of said insulating bar at the opposite ends thereof and extended outwardly of said casing, one knife blade being extended through said blade slot and having an outstanding small disc fixed thereto which is disposed within the end of said casing and bears against the end wall of said end cap, said other knife blade having a large outstanding disc fixed rigidly thereto which overlies and confronts the other end of said casing, said large disc having inwardly directed projections which engage the confronting end of said casing and maintain the inner face of said disc in spaced relation with the ends of said casing, an end cap having internal screw threads received on the other set of screw threads of said casing and enclosing and bearing against the outer face of said large disc and exerting clamping pressure endwise of said structure.

12. A renewable electric fuse of the knife blade type comprising an insulating tubular casing having screw-threaded ends, an end cap screw-threaded on one end thereof having integral therewith an end wall which overlies the open end of said casing and has a knife blade slot therethrough and spaced internal projections which bear against the end of said casing and space said end wall therefrom, a removable structure in said casing comprising an insulating bar, knife blades on the ends thereof one of which is extended through said blade slot and has a small disc rigid therewith that bears against said end wall, said other blade having rigid therewith a large disc that is external of said casing and confronts the end thereof and has projections engaged with said end that holds said large disc in its spaced position, and a second end cap screwed on said casing and enclosing said large disc and having an end wall bearing against said large disc.

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