April 21, 1942. M. B. WOOD 2,280,565

CARTRIDGE FUSE

Filed Nov. 30, 1940

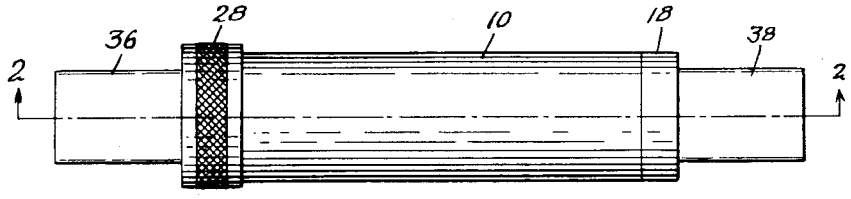


Fig. 1.

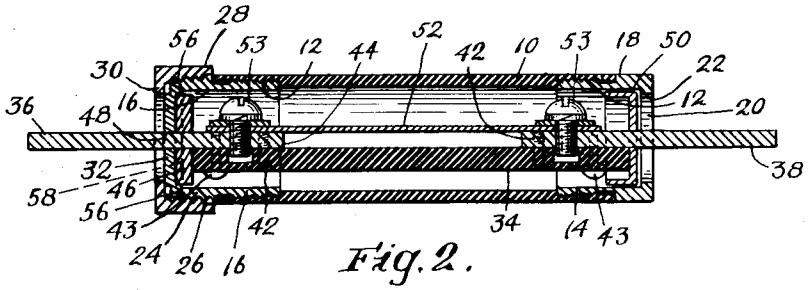


Fig. 2.

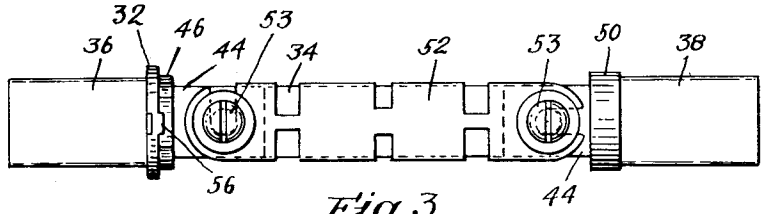


Fig. 3.

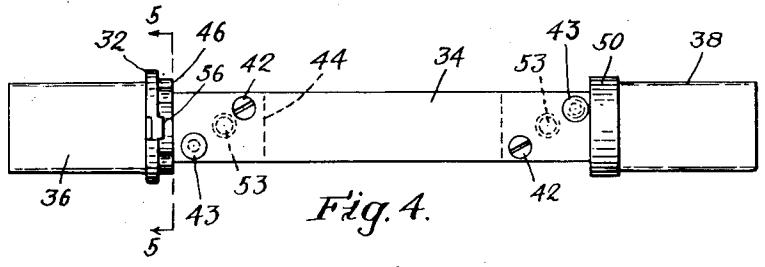


Fig. 4.

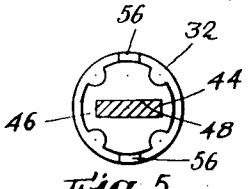


Fig. 5.

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UNITED STATES PATENT OFFICE

2,280,565

CARTRIDGE FUSE

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Application November 30, 1940, Serial No. 368,018

27 Claims. (Cl. 200—131)

The present invention relates to fusible electric protective devices and, as illustrated herein, relates more particularly to renewable electric fuses of the knife blade type.

Knife blade fuses, as heretofore constructed, include a tubular insulating enclosing casing having end caps removably screw-threaded thereon. The renewable structure of the fuse includes a pair of knife blades secured to the same face of an insulating bar at opposite ends thereof. One of the knife blades is provided with a small plate or disc fixed thereto and which can pass through the tubular casing and bear 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 slightly spaced therefrom to provide a gas outlet from the interior of the casing. The knife blades are arranged to lie in the center line of the casing so that the insulating bar is located at one side of the center line. The end cap thus exerts a clamping pressure longitudinally of the insulating bar which sometimes results in bending of the bar so that the knife blades are deflected out of alignment. Furthermore, when clamping pressure is applied to the insulating bar by tightening the screw-threaded end caps, there is considerable friction between the small disc and the inner face of the screw cap with which it is in engagement and between the large disc and its associated end cap with the result that there has been a tendency to twist the renewable assembly with a resulting misalignment of the knife blade terminals. This objection has been overcome in prior devices by providing notches at one or both ends of the casing into which cooperating feet on the washers at both ends can fit. This construction has minimized the twisting and consequent misalignment of the knife blade but has not entirely eliminated this condition since it has been necessary to provide a relatively substantial tolerance between the notches and the cooperating feet to permit ready assembly of the parts.

Renewable knife blade fuses constructed as described above have been and are being used successfully. Twisting and bending of the insulating fibre bar has not destroyed or interfered with the effectiveness of the fuse for circuit interruption. The misalignment of the knife blades and the bending and twisting of the insulating bar, however, has sometimes made it difficult to remove and replace the removable structure of the fuse and to insert the misaligned blades in the fuse clips. It has been stated above that the removable elements of the fuse are clamped to the enclosing casing by the clamping action of the screw-threaded end caps at both ends of the casing. This has been necessary heretofore to insure that tight joints were formed between the discs engaging the inner surfaces of the screw threaded end caps. This aided in controlling the venting of the arc gases produced upon fusing of the fuse link under moderate or heavy overload conditions, since venting passages of predetermined cross-sectional area are ordinarily provided in such fuses. The venting of the fuses is controlled entirely by these venting openings since there is little or no possibility of gas leakage due to the pressure engagement of the end caps on the discs on the knife blade members.

One object of the present invention is to provide a fusible protective device of the renewable knife blade type wherein the casing and the renewable elements may be firmly and rigidly connected together without applying longitudinal clamping pressure to the insulating bar of the renewable elements. As illustrated herein, this object is attained by making the length of the renewable element between the outside surface of the small disc and the inner surface of the large disc shorter than the distance between the clamping surfaces of the end caps when the end caps are in clamping position. Thus, by this construction, no longitudinal clamping pressure can be applied to the insulating bar and, furthermore, expansion and contraction of the insulating bar or enclosing casing or both may occur without bending of the insulating bar longitudinally.

Another object of the present invention is to provide an improved renewable fuse construction wherein the arc gases generated within the casing, upon fusing of the fusible element or elements of the casing under heavy overload currents, may quickly and safely be permitted to escape from the casing to relieve the pressure therein. To this end, the arc gases are caused to travel between two closely spaced walls for a relatively long distance so that the maximum amount of hot gas is exposed to the walls and thus the temperature of the moving gases is reduced substantially so that there is no danger of burning any substance with which they might be brought into contact. To this end, and as illustrated, one end of the enclosing casing is provided with a bushing having an inwardly extending shoulder at its outer end and a relatively long bore extending inwardly toward the middle

of the enclosing casing. One end of the insulating bar is provided with a relatively long cup-shaped end sealing member which has a diameter only slightly less than the inside diameter of the shouldered end cap. Thus, the gases may escape between the outer wall of the cup-shaped member and the internal wall of the bushing. The cup-shaped member and the bushing are formed of metal and hence can be made to accurate dimensions and tend to cool the escaping gases quite rapidly.

In the case of the prior art, wherein the insulating blade-connecting bar is under constant endwise compression, the end caps and the enclosing casing have to resist the internal pressure developed upon fusing of the fuse link under heavy load. An object of the present invention is to have the end discs on the knife blades and at the ends of the fibre bar of approximately equal diameter. Thus when the casing is under internal pressure, the pressure is taken almost entirely by the end discs through the fibre bar which is placed under tension, and only the residual pressure due to difference in diameters of the end discs has to be supported by the enclosing casing. As a result the fuse of the present invention is better able than heretofore to resist the pressure effects of heavy overloads.

Another object of the invention is to provide a removable knife blade type of fuse which may be quickly and readily taken apart to replace a fused link and then quickly and easily put together.

Another object of the invention is to improve generally upon the construction and operation of fusible electric protective devices.

With the above and other objects and features in view, the invention will now be described with reference to the accompanying drawing in which—

Fig. 1 is a plan view of a knife blade cartridge fuse embodying the present invention;

Fig. 2 is a view in section taken along the line 2—2 of Fig. 1;

Fig. 3 is a top plan view of the removable structure;

Fig. 4 is a view similar to Fig. 3 but showing a bottom plan view, and

Fig. 5 is a view in section taken along line 5—5 of Fig. 4.

The renewable electric fuse embodying the present invention comprises a tubular enclosing casing 10 of suitable insulating material, such as vulcanized fibre, having internal screw-threads 12 at the opposite ends thereof. Externally threaded metal bushings 14 and 16 are threaded into the ends of the casing. The bushing 14 is provided with a shouldered portion 18 which bears against the end of the enclosing casing and is provided with an internal bore 20 which is only slightly smaller in diameter than the inside diameter of the enclosing casing 10. The outer end of the bushing 14 is provided with an inwardly extending annular shoulder 22 for purposes which will later be described.

The other bushing 16 is provided with a shouldered portion 24 which is arranged to fit against the other end of the enclosing casing 10. This shouldered portion is provided with external threads 26 on which is threaded an end cap 28. The end cap 28 is provided with an inwardly extending annular shoulder 30 which is arranged to clamp a metal end disc 32 against the outer end portion of the bushing 16.

The renewable structure of the fuse comprises a flat bar 34 which is rectangular in cross-section and which is composed of suitable insulating material, such as vulcanized fibre. Knife blades 36 and 38 are secured to the same face of the bar 34 by suitable screws 42 and rivets 43. The knife blade 38 is adapted to extend loosely through the aperture in the bushing 12 and the knife blade 36 is arranged to be received in and project through the circular aperture formed by the annular shoulder 30 on the end cap 28. The knife blade 36 is provided with an inner end portion 44 which is reduced laterally in width with respect to the outer end portion and thus provides a pair of shoulders against which the disc 32 is seated. An iron disc 46 is located on the reduced portion of the knife blade 36 against the inner face of the disc 32. The slot 48 of disc 46 is provided with a lip which is upset onto the knife blade to hold the two discs firmly thereon. The other knife blade 38 is similarly formed and is provided at the junction of the narrower and wider portions thereof with a cup-shaped member 50 having a slot therein for receiving the reduced end of the knife blade 38. The closed end of the cup-shaped member 50 is seated against the shoulders formed between the laterally reduced and wider portions of the knife blade 38 and is fixed to the knife blade in the manner described in connection with the discs 32 and 46. The knife blades 36 and 38 are electrically connected together by a renewable fuse link 52 of any well-known type secured to the knife blades by the screws 53.

It is to be noted that the diameter of the bore formed in each of the bushings 14 and 16 is substantially the same and that the exterior diameter of the cup-shaped member 50 is only slightly less than the diameter of the bore of each of these bushings. Thus, the cup-shaped member 50, which has a substantially long face confronting the bore of the bushing, is prevented from substantial movement laterally of the casing, thus, preventing the knife blade 38 from moving out of alignment with the knife blade 36. The small differences in diameter between the internal diameter of the bushing 14 and the outside diameter of the cup-shaped member 50 provides an effective venting opening from the interior of the casing 10 to the exterior thereof. The hot arc gases in their passage from the interior of the casing must pass between the walls of the bushing 14 and the cup-shaped member 50. Since the difference in diameter is small it is apparent that the gases as they pass between these two surfaces are rapidly cooled and hence when they are discharged out of the end of the bushing 14 they will not be hot enough to cause any damage to articles outside of the casing with which these gases might come into contact. The outer end wall of the cup-shaped member 50 is spaced an appreciable distance from the inner wall of the shoulder 22 as will later become apparent.

The present construction is so designed that the length of the renewable structure between the inner surface of the disc 32 and the outer surface of the cup-shaped member 50 is appreciably less than the distance from the outside end of the bushing 28 to the inner surface of the shoulder 22. This difference in length may be small but is sufficient to compensate for any increase or decrease in length of either the insulating bar 34 or the casing 10. Thus, when the parts are in the position shown in Fig. 2 with the disc 32 clamped against the end of the bush-

ing 16 by the apertured end cap 28, there will be a substantial gap between the inner surface of the shoulder 22 and the outer surface of the closed end of the cup-shaped member 50. Thus, the insulating bar is rigidly supported at only one end and the other end is free to move axially relatively to the bushing 14 or to float, whenever any variation in length of either the enclosing casing 10 or the insulating bar 34 occurs.

This construction also presents a further advantage since the only end of the renewable structure which is clamped in position is the portion adjacent to the end cap 28. The disc 32, in the event that it is frictionally engaged by the inturned shoulder 30 of the threaded end cap 28, is free to turn therewith and no twisting of the removable structure results. Hence, with the present construction, the knife blades 36 and 38 are not thrown out of alignment due to any bending or twisting of the insulating bar 34.

The primary purpose of the internal rib, flange or shoulder 22 is to prevent the knife blade from being blown out of the casing in the event the bar 34 should be burned through and rupture. The shoulder 22 also performs another useful function. That is, the shoulder 22 operates as a baffle for the arc gases escaping between the cup member 50 and the bore of the bushing 14, thus deflecting the escaping gases inwardly and causing them to impinge against the knife blade member 38, thus further cooling the gases and thus further reducing the possibility of damage by fire.

It is to be noted that in the illustrated embodiment of the invention, the bushing 14 is plain and its outside diameter is approximately equal to the outside diameter of the enclosing casing 10. The end cap 28, however, is somewhat larger than the outside diameter of the enclosing casing 10 and further it is provided with a knurled outer surface 58. Thus, the person who is to renew a blown fuse is enabled by inspection to determine which end of the construction is to be unscrewed to permit separation of the renewable structure. It is to be further noted that with the present invention there are only three separate and distinct parts; the enclosing casing 10, the renewable structure including the knife blades 36 and 38 and the insulating bar 34, and the end cap 28. Thus, there are only a minimum number of parts to be taken apart and to be put together again. This, of course, presents a considerable saving of time in replacing blown fuses.

It is to be noted that under ordinary conditions of use the venting about the cup-shaped member 50 is sufficient to prevent arc gas pressure from building up within the casing to a point which is great enough to rupture the casing 10. Under some other conditions, for example, upon failure of the insulating bar 34, it may also be desirable to vent the fuse casing at the end of the fuse adjacent to the disc 32 to prevent excessive pressure from being built up within the casing 10. Venting at this end of the fuse body may be accomplished in any well known manner, for example, by providing diametrically opposed inwardly extending projections 56 on the disc 32. These projections 56 are arranged to engage the end of the threaded bushing or nipple 16 and thus space the disc 32 away from the end thereof to provide a venting space 58 communicating with the threads of the nipple 16 and the end cap 28 so that the arc gases can vent at the threads of the nipple or bushing 16 and the end cap 28 in the usual manner to relieve the arc gas pressure within the casing 10, as illustrated, for example, in United States Patent No. 1,991,876, granted February 19, 1935, to Morris B. Wood.

The discs 32 and 50 are of approximately the same diameter. Hence internally-elevated pressure within the casing acts oppositely on the discs and is tensionally resisted by the fibre bar 34. Thus, the enclosing casing 10 is subjected only to tension due to any difference in area there may be in cross-sectional areas of the end discs. Shearing of the fibre screw threads of the casing 10, a frequent cause of failure of enclosed fuses, thus is largely eliminated.

Although the present invention has been described with particular reference to the illustrated construction, it is evident that the details of construction might be varied as desired without departing from the spirit of the present invention.

I claim:

1. A renewable fuse having an insulating casing, bushings fixed to each end of said casing, and a renewable fuse structure including an insulating supporting bar, end terminals fixed to the opposite end portions of said bar and adapted to receive a fusible element therebetween, a member fixed to one end terminal and having a relatively long cylindrical surface loosely fitting the bore of one of said bushings to provide a relatively long and narrow annular vent opening between the interior of the casing and the exterior end of the bushing, a disc fixed to the other end terminal and arranged to overlie the outer end of the other bushing, and means associated with said other bushing for clamping the disc to said other bushing to maintain the renewable fuse structure in position in said casing, said one of said bushings being free from endwise pressure engagement with said renewable fuse structure when said structure is clamped to said other bushing.

2. A renewable fuse having an insulating casing, bushings fixed to each end of said casing, one of said bushings having an inwardly extending shoulder on its outer end portion, and a renewable fuse structure including an insulating supporting bar, end terminals fixed to the opposite ends of said bar and arranged to receive a fusible element therebetween, a member fixed to one end terminal and having a relatively long cylindrical surface fitting the bore of the bushing having the inwardly extending shoulder to provide a relatively long narrow annular venting opening, a disc fixed to the other end terminal and arranged to overlie the outer end of said other bushing, and means associated with said second bushing for clamping the disc to said bushing to seal the casing and to maintain the member fixed to the other terminal spaced inwardly from the shoulder in the other bushing and to maintain the renewable fuse structure in position in said casing.

3. A renewable fuse of the knife blade type comprising an enclosing insulating casing, bushings fixed to opposite ends of the casing, and a renewable fuse structure including an insulating bar, knife blade terminals fixed to the opposite end portions of said bar and adapted to receive a fuse element, a sealing member fixed to one of said knife blades and having an inwardly extending relatively long cylindrical surface loosely fitting the bore of one of said bushings to provide a relatively long and narrow annular vent-

ing opening between the interior of the casing and the outer end of the bushing, a disc fixed to the other knife blade terminal and arranged to overlie the outer end of the other bushing, and means associated with said second bushing for clamping the disc to said bushing to maintain the renewable fuse structure in position in said casing, said one of said bushings being free from endwise pressure engagement with said renewable fuse structure when said structure is clamped to said other bushing.

4. A renewable electric fuse of the knife blade type comprising an enclosing insulating casing, bushings fixed to opposite ends of said casing, one of said bushings being provided at its outer end portion with an inwardly extending annular shoulder, a renewable fuse structure including an insulating supporting bar, knife blade terminals fixed to opposite end portions of said insulating bar and arranged to receive a fusible element, a venting member fixed to one of said knife blade terminals and having a relatively long cylindrical surface loosely fitting the bore of the bushing having the inwardly extending shoulder to provide a relatively long and narrow annular venting opening to the exterior end of the bushing, a disc fixed to the other knife blade terminal and arranged to overlie the outer end of the other bushing, and means for clamping the disc to said bushing to maintain the end of said member having the long cylindrical surface in a predetermined axially spaced position from the annular shoulder on its associated bushing and to maintain the renewable fuse structure in position in said casing.

5. A renewable fuse of the knife blade type comprising an enclosing insulating casing, bushings fixed to opposite ends of the casing and a renewable fuse structure including an insulating bar, knife blade terminals fixed to the opposite end portions of said bar and arranged to receive a fuse element, a sealing member fixed to one of said knife blades and having an inwardly extending relatively long cylindrical surface fitting the bore of one of said bushings to provide a relatively long and narrow annular venting opening, a disc fixed to the other knife blade terminal and arranged to overlie the outer end of the other bushing, and means associated with said second bushing for clamping the disc to said bushing to seal the casing and to maintain the renewable fuse structure in position in said casing, the length of said insulating bar being substantially less than the length of the insulating casing to prevent axial clamping pressure from being applied to said insulating bar.

6. A renewable fuse having an insulating casing, bushings fixed to opposite ends of said casing, one of said bushings having an inwardly extending shoulder on its outer end portion, and a renewable fuse structure including an insulating supporting bar, end terminals fixed to the opposite ends of said bar and arranged to be electrically connected by a fusible element, a member fixed to one end terminal and having a relatively long cylindrical surface fitting the bore of the bushing having the inwardly extending shoulder to provide a relatively long narrow annular venting opening, a disc fixed to the other end terminal and arranged to overlie the outer end of the other bushing, and means associated with said second bushing for clamping the disc to said bushing to seal the casing and to maintain the member fixed to the other terminal spaced inwardly from the shoulder in the other bushing and to maintain the renewable fuse structure in position in the casing, the length of the insulating bar being substantially less than the length of the insulating casing to prevent clamping pressure from being applied lengthwise of said bar.

7. A renewable electric fuse having an insulating enclosing casing, bushings fixed to opposite ends of said casing, one of said bushings having an inwardly extending annular shoulder on its outer end portion, and a renewable fuse structure including an insulating supporting bar, end terminals fixed to the opposite ends of said bar and arranged to be electrically connected by a fusible element, a cup-shaped member fixed to one of said end terminals and having a relatively long cylindrical surface fitting the bore of said shouldered bushing to provide a relatively long and narrow annular venting opening, a disc fixed to the other end of said terminal and arranged to overlie the other end of said bushing, and means associated with said bushing for clamping the disc to said bushing to seal the casing and to maintain the renewable fuse structure in position in said casing with the closed end of the cup-shaped member spaced inwardly from the shoulder on the shoulder bushing.

8. A renewable fuse of the knife blade type comprising an insulating casing, bushings fixed to opposite ends of said casing, one of said bushing being provided with an inwardly extending annular shoulder at its outer end portion, and a renewable fuse structure including an insulating supporting bar, knife blade terminals fixed to the opposite ends of the bar arranged to be electrically connected by a fusible element, a cup-shaped member fixed to one of said knife blade terminals having a relatively long cylindrical surface fitting the bore of said shouldered bushing to provide a relatively long and narrow venting opening, a disc having a slot therein for receiving the other knife blade terminal and rigidly secured to said knife blade terminal, said disc being arranged to overlie the outer end of the other bushing, and means associated with said bushing for clamping the disc to the bushing to seal the casing and to maintain the closed end of the cup-shaped member spaced inwardly from the shouldered portion in the other bushing.

9. A renewable enclosed cartridge fuse including an enclosing casing, a fibre bar within the casing, terminals fixed to the ends of the bar and adapted to receive a fusible element therebetween, means including an end cap screw-threaded axially on an end of the casing operative to move said bar axially and clamp a terminal thereof to the end of the casing, the other terminal being free from clamping engagement with the other end of the casing and being also free from endwise compression.

10. A renewable fuse of the knife blade type comprising an insulating casing, bushings fixed to opposite ends of the casing, one of said bushings being provided with an inwardly extending annular shoulder at its outer end portion, and a renewable fuse structure including an insulating supporting bar, knife blade terminals fixed to the opposite ends of the bar and arranged to receive a fusible element therebetween, a cylindrical member affixed to one of said knife blade terminals having a relatively long cylindrical surface fitting the bore of the shouldered bushing to provide a relatively long and narrow venting opening, a disc rigidly fixed to the other knife blade terminal and arranged to overlie the outer

end of the other bushing, means associated with said other bushing for clamping the disc to its associated bushing to maintain the closed end of the cylindrical member spaced inwardly from the shouldered portion in said shouldered bushing, and means for venting the casing at the end having said clamping means.

11. In a renewable electric fuse, the combination of a casing having an inwardly directed flange at one end, a unitary removable structure comprising a spacing bar, knife blade terminals fixed to the ends of the bar and extended through both ends of the casing and arranged to receive a fusible element therebetween, a cylindrical vent-controlling member fixed to said removable structure in said casing and positioned loosely in the casing inwardly of and spaced from and confronting said flange, means for clamping said structure to said casing only at the other end thereof, and means cooperating with the clamped part of the structure for venting the casing independently of said vent-controlling member.

12. A renewable electric fuse of the cartridge type comprising an insulating enclosing casing, a removable fuse link supporting structure within said casing, terminals on the opposite end parts of said structure, means at one end part thereof for securing the removable structure within the casing against axial movement in opposite directions, said structure having means at the other end part thereof operative to position said end part laterally within the casing and being constructed and arranged to permit free movement of the removable structure axially of the casing due to changes in length of the structure and casing without the application of axially directed stress on the structure and casing.

13. A renewable electric fuse of the cartridge type comprising an insulating enclosing casing, a removable fuse link supporting structure within the casing including an insulating, terminal carrying bar, means located at one end part of said structure for securing the structure removably to said casing against lengthwise displacement, means located at the other end part of said structure for positioning said end part against undue lateral displacement in said casing, said last named means being constructed and arranged to permit its associated end part to float lengthwise within the casing to permit unopposed changes in length of said structure and casing.

14. A renewable electric fuse of the cartridge type comprising an insulating enclosing casing, a removable fuse link supporting structure within the casing including an insulating, terminal-carrying bar, means located at one end part of said structure for securing the structure removably to said casing against lengthwise displacement, means located at the other end part of said structure for positioning said end part against undue lateral displacement in said casing, said last named means being constructed and arranged to permit its associated end part to float lengthwise within the casing to permit unopposed changes in length of said structure and casing, and means for preventing escape of a part of said structure from said casing in the event of rupture of said bar.

15. A renewable electric fuse of the cartridge type comprising an insulating enclosing casing, a removable fuse link supporting structure within said casing having means associated with one end part of said structure for removably securing said structure within said casing against undue lateral and axial movement, means associated with the other end part of said casing having a construction and arrangement to prevent undue lateral movement of said end part while permitting said end part to float axially within the casing.

16. A renewable electric fuse of the cartridge type comprising an insulating enclosing casing, a removable fuse link supporting structure within said casing having means associated with one end part of said structure for removably securing said structure within said casing against undue lateral and axial movement, means associated with the other end part of said casing having a construction and arrangement to prevent undue lateral movement of said end part while permitting said end part to float axially within the casing, and means effective only on an improper operation of the fuse to engage said other end part and restrict its axial movement in one direction.

17. A renewable electric fuse having an insulating enclosing casing, a renewable fuse link supporting structure within said casing including an insulating supporting bar, end terminals fixed to the opposite end portions of said bar having means for connection with a fusible link adapted to be extended between them, a member fixed to one terminal having a relatively long cylindrical surface loosely fitting the interior of said casing and providing between it and said casing a relatively long and narrow annular vent opening, said member under all normal operating conditions of the fuse being free for movement axially within the casing, and means associated with the other end terminal for removably securing said renewable fuse structure within said casing and for normally positioning said member within the casing for freedom for movement axially thereof.

18. A renewable electric fuse having an insulating enclosing casing, a renewable fuse link supporting structure within said casing including an insulating supporting bar, end terminals fixed to the opposite end portions of said bar having means for connection with a fusible link adapted to be extended between them, a member fixed to one terminal having a relatively long cylindrical surface loosely fitting the interior of said casing and providing between it and said casing a relatively long and narrow annular vent opening, said member under all normal operating conditions of the fuse being free for movement axially within the casing, and means associated with the other end terminal for removably securing said renewable fuse structure within said casing and for normally positioning said member within the casing for freedom for movement axially thereof, and means operative only upon an improper operation of the fuse for engaging said member and preventing lateral displacement thereof in one direction.

19. A renewable fuse having an insulating enclosing casing provided with openings at both ends and an internally extending shoulder at one end part, a removable fuse link supporting structure within said casing including an insulating supporting bar, end terminals fixed to the opposite ends of said bar having means engageable with a renewable fuse link extended between them, a member associated with one end terminal having a relatively long cylindrical surface loosely fitting the interior of said bushing and

providing a narrow annular vent opening between itself and said casing, said member being positioned in confronting relation with said shoulder and inwardly spaced therefrom, and means associated with the other end terminal operative to secure said structure removably in said casing and to maintain said member in the aforesaid spaced relation with respect to said casing-shoulder.

20. A renewable electric fuse of the cartridge type including an enclosing casing, a removable fuse link supporting structure within said casing including a fibre bar, terminals fixed to the ends of the bar having means connecting them with a fuse link extended between them, and means for securing said structure removably to said casing in axially and laterally defined positions with respect thereto under conditions maintaining said fibre bar free from endwise compression under all normal conditions of operation of the fuse.

21. A renewable electric fuse of the cartridge type including an enclosing casing, a removable fuse link supporting structure within said casing including a fibre bar, terminals fixed to the ends of the bar having means connecting them with a fuse link extended between them, and means for securing said structure removably to said casing in axially and laterally defined positions with respect thereto under conditions maintaining said fibre bar free from endwise compression under all normal conditions of operation of the fuse, said securing means comprising means associated with one of said terminals for securing one end part of said structure to said casing against undue lateral and axial movement, and means positioning said other terminal within said casing free for unrestricted axial movement relative to said casing under all normal conditions of operation of the fuse.

22. A renewable electric fuse of the cartridge type including an enclosing casing, a removable fuse link supporting structure within said casing including a fibre bar, terminals fixed to the ends of the bar having means connecting them with a fuse link extended between them, and means for securing said structure removably to said casing in axially and laterally defined positions with respect thereto under conditions maintaining said fibre bar free from endwise compression under all normal conditions of operation of the fuse, said securing means comprising means associated with one of said terminals for securing one end part of said structure to said casing against undue lateral and axial movement, and means positioning said other terminal within said casing free for unrestricted axial movement relative to said casing under all normal conditions of operation of the fuse, said last named means also providing a narrow annular venting passage of which the inner face of the casing constitutes a wall.

23. A renewable electric fuse as in claim 12, having means providing a vent passage from the interior of the casing to the atmosphere having constant venting properties irrespective of changes in length of said casing and removable fuse link supporting structure.

24. A renewable electric fuse as in claim 12, having means providing a vent passage from the interior of said casing to the atmosphere having constant venting properties irrespective of changes in length of said casing and removable fuse link supporting structure, and means for preventing escape of a part of said removable structure from said casing in the event of rupture thereof between said terminals.

25. A renewable electric fuse as in claim 12, cooperating parts of the casing and the removable structure providing a vent passage from the interior of the casing to the exterior thereof unchanged in its venting characteristics irrespective of changes in length of the casing and structure.

26. A renewable electric fuse of the cartridge type comprising an enclosing casing, a fuse link and terminal supporting structure removably positioned within the casing having means for fixing one end part of said structure and the corresponding part of said casing together against relative axial movement, the casing and structure being otherwise free for unopposed axial movement due to variations in lengths of said casing and structure, and means located at the other end part of said casing providing a vent passage from the interior of said casing to the exterior thereof unchanged in its venting characteristics by changes in length of said casing and structure.

27. A renewable electric fuse of the cartridge type comprising an enclosing casing, a fuse link and terminal supporting structure removably positioned within the casing having means fixing one end part of said structure and the corresponding part of said casing together against relative axial movement, the casing and structure being otherwise free for unopposed axial movement due to variations in lengths of said casing and structure, and means comprising parts of said casing and structure forming a venting passage from the interior of said casing to the exterior thereof insensitive in its venting characteristics to relative variations in length between said casing and structure.

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