April 16, 1935. E. F. BOOTHE 1,998,042

FUSE LINK

Filed April 29, 1933

Fig. 1.

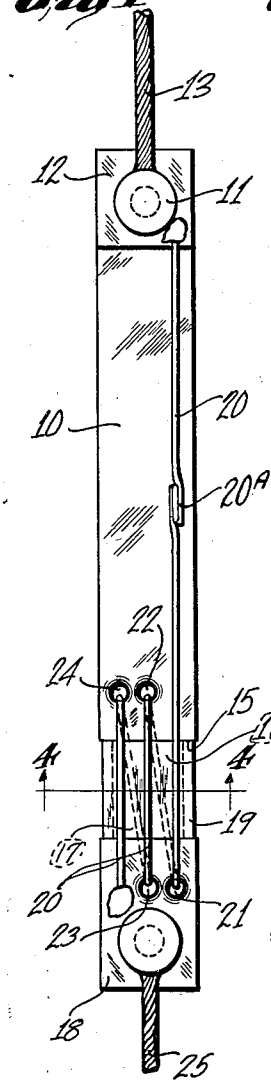


Fig. 2.

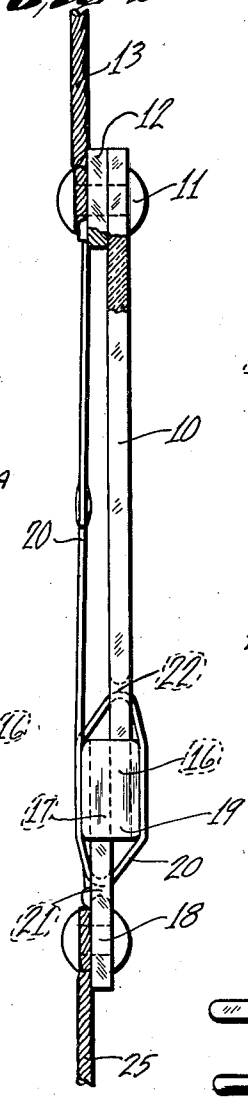


Fig. 3.

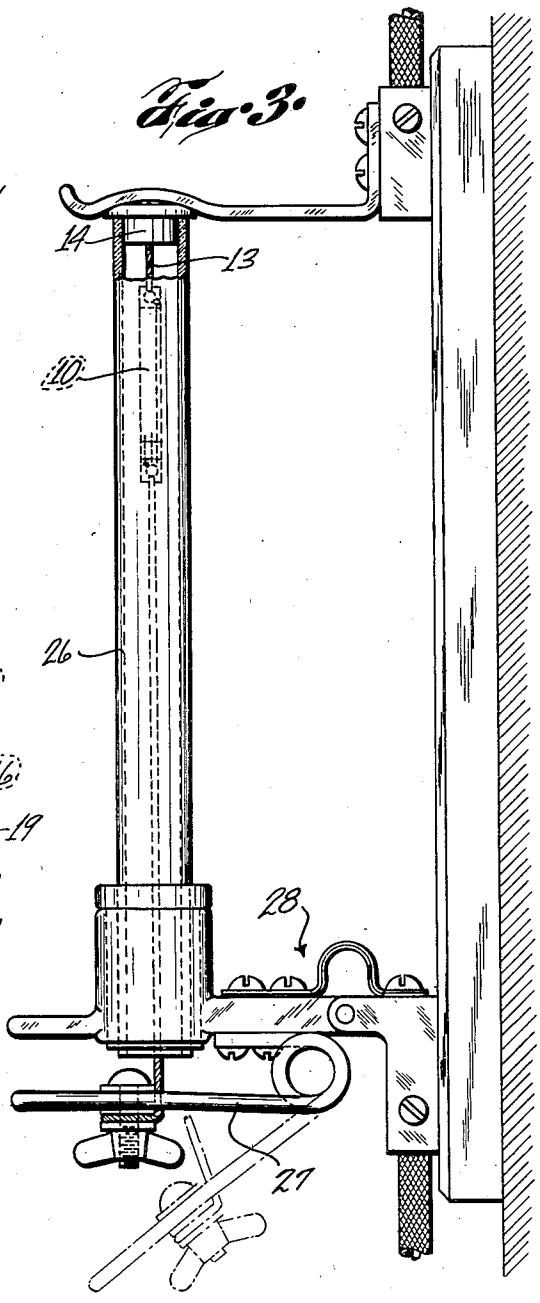


Fig. 4.



INVENTOR
EUGENE F. BOOTHE
BY Ray W. Giles
ATTORNEY

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FUSE LINK

Eugene F. Boothe, St. Louis, Mo., assignor to James R. Kearney Corporation, St. Louis, Mo., a corporation of Missouri

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6 Claims. (Cl. 200—135)

This invention relates to fuse links for high voltage electrical protective apparatus, and more particularly to fuse links of so-called tension type.

Fuse links of the type referred to above are those which are adapted to be held under a mechanical tension produced by means of a spring which forms a part of the protective apparatus, the purpose being to create a wide gap between the severed ends of the fuse after the same has become ruptured by abnormal current, and to quickly extinguish any arc attending the blowing of the fuse by causing the ruptured fuse ends to fly apart under the action of the spring tension.

A heretofore prevailing difficulty inherent in tension fuses, particularly those of low, or fractional ampere current carrying capacity, results from the tendency of the fuse to become severed by reason of the mechanical forces applied thereto, or if not actually severed the application of such forces to the link for a long period of time results in an alteration of the operating characteristic, or rating of the fuse link. For example, it has been determined that an unstressed fuse wire which is intended to become ruptured upon the passage therethrough of currents in excess of, say, three-fourths of an ampere, when held under a mechanical tension of the order produced by spring means found in the usual types of protective apparatus, are ruptured by currents of a magnitude substantially less than the figure specified. However, the operating characteristics of the fuse link are not materially altered when only relatively small mechanical forces are applied thereto. It will appear obvious that the forces which are permissible for a particular fuse depend upon its mechanical strength which, in most cases, is a function of the current carrying capacity of the fuse. However, since it is customary to provide protective devices, each of which is adapted to accommodate fuse links in a wide range of sizes or capacities, the link tensioning means ordinarily produce excessive strains in fuse links of the smaller capacities.

To overcome this undesirable feature, I have provided, as an object of my invention, a fuse link construction, especially applicable for fuses of low current carrying capacity, resulting in an improved link which will not be harmfully affected by the application thereto of relatively high mechanical forces.

Another object of my invention is to provide, in a device of the character described, improved means for relieving the fusible element of a predetermined fractional portion of the forces produced by the tensioning means.

A further object of my invention is to provide improved means operable when the fuse blows to cause the ruptured ends of the fusible element to fly apart with multiplied velocity.

Yet another object of my invention is to embody the aforementioned features in an improved device of simple, sturdy and practical construction.

These and other objects and advantages will appear from the following description and accompanying drawing, in which:

Fig. 1 is an enlarged plan view of a presently preferred embodiment of my invention; Fig. 2 is a side elevation of the construction illustrated in Fig. 1; Fig. 3 is a side elevation of my improved device as installed in a fuse switch, and Fig. 4 is a sectional view taken at the line 4—4 of Fig. 1.

My improved fuse link consists in a bar of insulating material, near the ends of which are mounted terminal members, one thereof being permanently fastened to the bar, and the other being mounted to permit of its movement along the bar in a direction away from the fixed terminal when a current conducting fusible element interconnecting the terminal members becomes ruptured. The fuse device embodying my invention is especially designed for use in apparatus having means for applying mechanical forces to the terminal members referred to above, which forces tend to move the terminal members in relatively opposite directions. Such apparatus is exemplified in Fig. 3 of the drawing. Under normal operating conditions, relative movements of the terminal members tending to increase the distance therebetween is prevented by the connecting fusible element which, obviously, is placed under tension. It will appear, however, that only a definite predetermined fractional part of the force tending to separate the terminal members is applied to the fusible element, and that the remainder of such force or mechanical load is carried by the insulating bar.

Describing the device of my invention in greater detail, reference numeral 10 designates the insulating bar, preferably formed of fiber. Secured at one end of the bar by means of a rivet 11 is a metal plate 12 constituting a terminal member, the rivet 11, in the present example, also serving to connect a wire conductor 12 to the terminal member 12. The outer end of wire 13 may be provided with a metal button or contact head 14 (Fig. 3).

The opposite end of the bar 10 is preferably shouldered as indicated at 15 to form a tongue 16. Disposed in overlying relation with the tongue 16 is a projecting portion or tongue 17 formed on a metal plate 18 constituting a second terminal member. The tongue portions 16 and 17 are engirdled by a metal band or collar 19 which produces a substantially rigid connection between the bar 10 and the terminal 18, but which in no wise prevents movement of the terminal 18 along the bar 10 in a direction away from the terminal 12. Such movement, however, is normally prevented

by a fusible element 20, consisting of a wire or filament which is adapted to become ruptured by the fusing of solder joining together two component parts of the element when current of predetermined magnitude is passed therethrough, the soldered junction being indicated at 20A. One end of the element 20 is soldered, or otherwise suitably fastened to the fixed terminal 12. The element extends from the terminal 12 to an aperture 21 in the terminal 18, through which aperture the element passes. On the opposite side of the assembly the element extends backwardly toward the terminal 12 to an aperture 22 in the bar 10. After passing through such aperture, the element extends again to the terminal 18 where it may be fixedly secured, or if desired the filament may be passed through a second set of apertures 23 and 24 in the terminal and bar respectively as shown, prior to its ultimate securement to the terminal 18. Thus, it will appear that the bar 10 and terminal 18 are substantially laced together by means of the fusible element 20. The apertures 21, 22, 23 and 24, by preference, are free of any sharp corners which would tend to cut the element 20, and are sufficiently large to permit the filament to move freely therethrough, which movement, as will hereinafter be explained, occurs when the element becomes ruptured. A conductor 25 has one of its ends attached to the terminal 18 and serves to connect such terminal to a spring or other tensioning means on the switching apparatus.

Such apparatus is exemplified in Fig. 3 and for purposes of completeness may be briefly described as follows: The device is provided with a removable fuse cartridge 26 through which the fuse link of my invention extends, the contact head 14 of the link engaging one end of the cartridge and the conductor 25 projecting through the opposite end of the cartridge which is preferably open. A spring 27 associated with the switch terminal assembly, designated generally at 28, is adapted to engage the conductor 25 of the fuse link and hold the link under tension, the stressed position of spring 27 being shown in full lines, and the relaxed position of such spring being shown in broken lines.

From the foregoing description it will appear that I have provided a fuse link of tension type which will safely withstand mechanical forces of magnitude substantially greater than the forces required to break the fusible element, and yet which device retains all of the desirable characteristics of a tension link. In other words, a device constructed in accordance with the present invention employing a fusible element having tensile strength of, for example, ten pounds may be safely installed in a switch or cut-out having tensioning means adapted to exert a force of between 40 and 50 pounds. This desirable feature results from the fact that the tensioning forces are not applied directly to a single strand of the filament constituting the fusible element, as is customary in heretofore prevailing devices, but that such forces are equilibrated by a plurality of filament portions arranged in multiple relation. In accordance with certain well known principles of mechanics governing the operation of simple pulley systems, which principles also apply to the device of my invention, only a fractional part of the forces exerted at the ends of the fuse link will be imparted to the fusible element. Further, when the filament becomes ruptured by the passage of abnormal current, the ruptured ends will fly apart with multiplied velocity, a feature which is conducive to a rapid clearing of the line protected by the device of my invention.

Having described my invention with reference to a single presently preferred embodiment thereof, I realize that certain changes may be made in the structure herein shown and described without departing from the spirit and full intended scope of my invention as defined by the appended claims.

I claim:

1. In a fuse assembly of tension type, an insulating bar, a terminal member fixedly positioned on said bar and a terminal member adapted for displacement longitudinally of said bar, a fusible element connecting said terminal members, said fusible element having a section thereof looped about portions of said bar and said last named terminal member.

2. In a fuse link, a pair of spaced terminal members, an insulating tension strip extending between said members, and a fusible element having its ends connected to said terminal members, said fusible element having a looped portion of at least one full turn normally interlinking, and preventing separation of said tension strip and one of said terminal members.

3. In a fuse device, an insulating bar, a terminal member mounted for movement along said bar, a terminal member spaced from said movable terminal member and fixedly secured to said bar, a fusible conductor interconnecting said terminal members and having portions thereof extending transversely through said bar and said movable terminal member.

4. In a fuse device of the tension type, relatively separable terminal members, a bar of insulating material extending between said terminal members, one of said terminal members being engaged by, and adapted for movement along said bar, a conducting element having a fusible section, electrically interconnecting said terminal members, said element having a looped portion forming a linking connection between one of said terminal elements and said bar.

5. In a fuse device of tension type, spaced, relatively separable terminal members, an integral bar of insulating material extending between, and engaging said terminal members, a current conducting element electrically interconnecting said terminal members, said element having a looped portion normally preventing displacement of one of the terminal members endwise of said bar, and means permanently securing the other of said terminal members to said bar.

6. In a fuse link of tension type, a bar of insulating material, a terminal member fixedly secured to one end of said bar, a displaceable terminal member near the opposite end of said bar, means constraining said displaceable terminal member for movement endwise of said bar, and a fuse wire interconnecting said terminal members, said fuse wire having a looped portion extending through said displaceable terminal member and bar, and normally preventing endwise movement of the displaceable terminal member relative to said bar.

EUGENE F. BOOTHE.