July 21, 1942. E. F. BOOTHE 2,290,733

FUSE LINK

Filed Jan. 27, 1940

Fig. 1

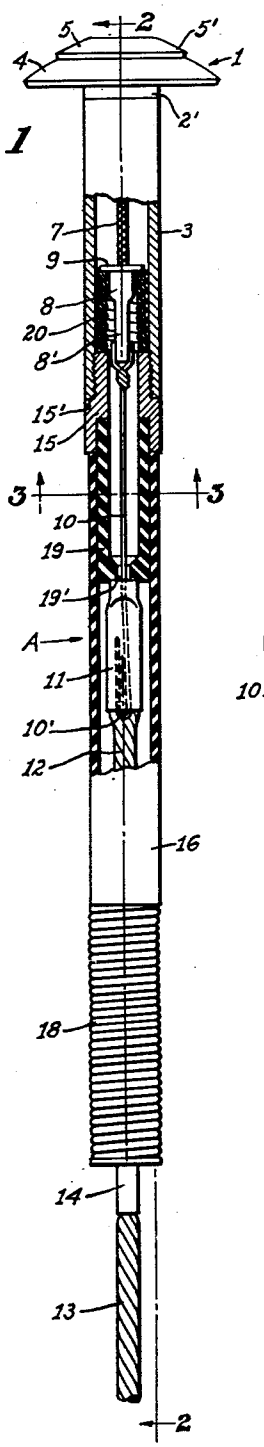


Fig. 2

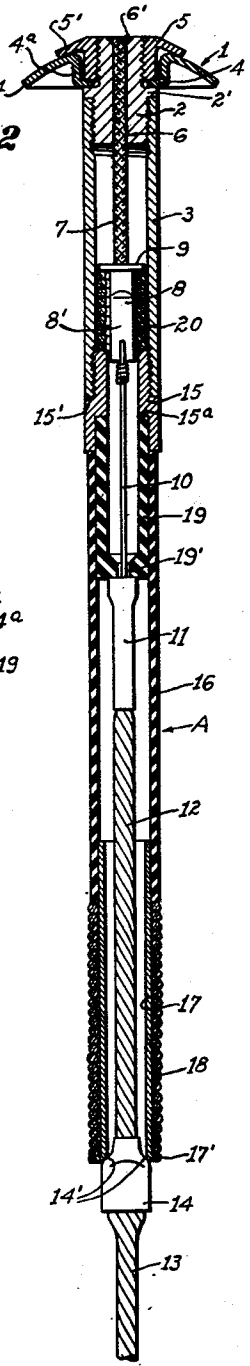
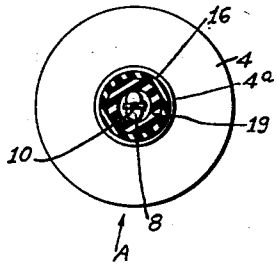


Fig. 3



INVENTOR
EUGENE F. BOOTHE
BY Ernest Harrington
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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7 Claims. (Cl. 200—135)

This invention relates generally to fuse links, and more specifically to fuse links of the tension type adapted particularly for use in association with protective apparatus designed and employed to protect articles of electrical equipment from the damaging effects of short circuits and overloads, the predominant object of the invention being to provide a fuse link, which, because of its improved and unique construction and arrangement is capable of performing its intended function in an improved and highly efficient manner.

A heretofore prevailing difficulty inherent in tension fuse links, particularly those of low or fractional ampere current carrying capacity, resulted from the tendency of the fusible elements of the fuse links to become severed by reason of the mechanical forces applied thereto in use, or if not actually severed the application of such forces to the fusible elements for long periods of time resulted in alteration of the operating characteristics, or rating of the fuse links. In other words, it has been determined that a fuse wire which is intended normally to become ruptured upon passage therethrough of, say, three-fourths of an ampere, will, when held under excessive mechanical tension, be ruptured by currents of a magnitude substantially less than the figure specified.

One important purpose of this invention is to provide a fuse link construction which will not be harmfully affected by the application thereto of relatively high mechanical forces this end being attained by pre-tensioning the fusible element of the fuse link with the aid of an internal coil spring which is so arranged and associated with related parts of the fuse link that tension on the fusible element is constant regardless of the tension which may be applied to the link by the protective apparatus with which it is associated. The presence in the fuse link structure of the internal coil spring referred to also makes certain that the ruptured ends of the fuse element will separate when the fusible element has blown, and gives a gradual slope to the time-current curves which adds greatly to the ability of the fuse link to withstand lightning surges and harmless overloads.

Another very important feature of the present invention has to do with the construction and arrangement of the terminal head at an end of the fuse link. Heretofore these terminal heads frequently comprised each a fixed button of relatively small diameter and a loosely supported button of larger diameter, and under certain circumstances disadvantages were found to exist in connection with the use of such earlier terminal heads. However, by constructing the terminal head of a fuse link in accordance with the present invention all such disadvantages are eliminated and the terminal head performs its intended function in the desired efficient manner.

Fig. 1 is an enlarged view partly in elevation and partly in vertical section of the improved fuse link.

Fig. 2 is a vertical section of the improved fuse link taken on line 2—2 of Fig. 1.

Fig. 3 is a horizontal section of the improved fuse link taken on line 3—3 of Fig. 1.

In the drawing, wherein is shown for the purpose of illustration, merely, one embodiment of the invention, A designates the improved fuse link generally. The improved fuse link A is provided with a contact head 1 at one end thereof which is generally of button form, said contact head 1 comprising a supporting member 2 whose lower portion, as said supporting member is illustrated in Fig. 2, is externally screwthreaded. The screwthreaded lower end of the supporting member 2 is screwed into the internally screwthreaded upper end portion of a tubular element 3 which is formed of fiber or other suitable electrical insulating material. The upper portion of the supporting member 2, which is of slightly less diameter than the lower portion thereof, is also externally screwthreaded, and an outstanding annular flange 2' is formed on said supporting member which separates the externally screwthreaded lower and upper portions of the supporting member and contacts with the upper edge of the tubular element 3.

The contact head 1 includes also a button 4 of relatively large diameter which is of generally curved formation, said button 4 including an annular inner vertically disposed wall 4a from the lower end of which an inwardly projected annular flange 4b is extended. The flange 4b of the larger button 4 contacts with the top face of the flange 2' of the supporting member 2, and said larger button is clamped in place by a button 5 of smaller diameter which is screwed on the upper portion of the supporting member 2 and whose lower edge engages the top face of the flange 4b of the larger button so as to clamp said flange between said lower edge of said smaller button and the top face of the flange 2' of the supporting member 2. The smaller button 5 is provided with an outwardly and downwardly inclined annular flange

portion 5' which overlaps and engages a portion of the larger button 4.

The supporting member 2 has formed longitudinally therethrough an opening 6 in which is fixedly disposed the upper portion of a conductor 7, said supporting member being provided with a tapered cavity 6' at the upper end of said opening 6 that receives the upper end portion of the conductor 7 and wherein said upper end portion of said conductor is soldered or otherwise secured to the supporting member. At its lower end the conductor 7 has secured thereto an element 8 which is formed of electrical conducting material, the upper portion of said element 8 being hollow to fixedly receive the lower portion of said conductor 7 and the lower portion of said member being flattened as indicated at 8' in Fig. 1. Also at its upper end the element 8 is provided with an outwardly projected, annular flange 9.

Secured to the element 8 is the fusible element 10 of the improved fuse link A, the upper portion of said fusible element being passed through an opening formed through the flattened lower portion of said element 8 and being twisted about itself to provide for its secure attachment to the element 8. At its lower end the fusible element 10 is attached to an element 11, formed of electrical conducting material, which also has secured thereto a conductor 12, said element 11 being of tubular formation and the doubled back lower portion of the fusible element and the upper portion of the conductor 12 being disposed within the flattened lower portion of the element so as to securely connect the element 11, the fusible element 10, and the conductor 12 together. If desired the connection between the element 11, fusible element 10, and the conductor 12 may be made more secure by applying a body of solder at the point where the loop 10' of the doubled back portion of the fusible element is exposed below the lower edge of the element 11. The conductor 12 has another conductor 13 attached thereto at its lower end by means of a suitable clamping element 14, said clamping element including a flattened lower portion which is wider than the upper portion thereof whereby said clamping element is provided with opposed shoulders 14' at the points where the wider lower portion of the element merges into the narrower upper portion thereof.

The lower end portion of the tubular element 3 is internally screwthreaded and screwed into said screwthreaded portion is the externally screwthreaded upper portion of a member 15. The lower portion of the member 15 is of slightly greater diameter than is the upper screwthreaded portion thereof and an annular shoulder 15' is provided at the junction of the larger and smaller portions of said member with which the lower edge of the tubular element 3 contacts. The bottom edge of the lower portion of the member 15 receives in contact therewith an elongated tube 16 formed of fiber or any other suitable electrical insulating material, and telescoped into the lower portion of this elongated tube is a tubular element 17 which is preferably formed of metal. The lower end of the tubular element 17 is provided with an outstanding annular flange 17', and this annular flange is disposed in contact with the opposed shoulders 14' of the clamping element 14. Also interposed between the annular flange 17' of the tubular element 17 and the bottom edge of the tube 16 so that it is under compression is an expansible coil spring 18.

Disposed within the upper portion of the tube 16 and within the lower portion of the member 15 is a tubular insert 19 which preferably, though not necessarily, is formed from Lavite, which is an electrical insulating material, said tubular insert being of such diameter that it contacts with the inner faces of the tube 16 and the lower portion of the member 15. Also the upper edge of the tubular insert 19 contacts with an annular, internal shoulder 15a formed within the member 15. The tubular insert 19 is provided with a bottom wall through which an opening 19' is formed, the fusible element 10 being extended through this opening and the bottom wall contacting with the top edge of the element 11. Above the member 15 an expansible coil spring 20 is disposed in such position within the tubular element 3 that it surrounds the element 8 and contacts at its upper end with the flange 9 of said element 8 and at its lower end with the top edge of the member 15.

The function of the coil spring 20 is to provide the fuse link A with means for pre-tensioning the fusible element 10 of the fuse link. In other words the desired and proper tension of the fusible element is established at the factory when the fuse link is assembled with the coil spring in place therein and such established tension of the fusible element will not be disturbed during use of the fuse link. It will be noted that because of the construction and arrangement of cooperating parts of the fuse link the coil spring 20 will place the fusible element 10 under a predetermined tension, ten pounds, for instance, and that the member 15 and tubular insert 19 are placed under ten pounds compression. If, therefore, a maintenance man, applies the fuse link to a protective apparatus, so that the conductor 13 is subjected to an excessive and unnecessary pulling force, such additional pulling force will not increase the tension in the fusible element 10 because the additional pulling force applied to the link will be offset and balanced by the force exerted by the coil spring 20. The only effect of the excessive pulling force on the link would be that the compressive force to which the member 15 and tubular insert 19 are normally subjected would be reduced in proportion to the excessive pull applied to the fuse link. Of course if the excessive pulling force applied to the fuse link exceeded the force exerted by the coil spring 20 the tension in the fusible element 10 would be increased, but the application to the fuse link of such greatly excessive pulling force is highly unlikely.

In the use of the improved fuse link the accurately pre-tensioned fusible element provides the fuse link with a high degree of operating accuracy. Also the presence of the coil spring 20 and the coil spring 18 makes certain that the ruptured ends of the fusible element will quickly separate, and additionally this construction gives a gradual slope to the time-current curves which adds greatly to the ability of the fuse link to withstand lightning surges and harmless overloads.

In addition to the foregoing the rigidly clamped larger button 4 of the contact head 1 eliminates the disadvantages heretofore encountered in the use of a contact head which included a loosely supported larger button. Also the improved construction of the contact head 1 of the fuse link disclosed herein permits of the larger button 4 being removed when it is desired to use

the fuse link with only the smaller button as a part of the contact head thereof.

1. A fuse link assembly including a housing, and a contact head arranged at an end of said housing, said contact head comprising a body portion which includes a screwthreaded portion which is arranged in screwthreaded engagement with said housing and a second screwthreaded portion, a contact member supported by said body portion, said contact member being in the form of a button which embraces said body portion and extends outwardly with respect thereto, and means comprising a contact element which is arranged in screwthreaded engagement with said second screwthreaded portion of said body portion and releasably engages a portion of said contact member to clamp same to said body portion.

2. A fuse link assembly including a housing, and a contact head arranged at an end of said housing, said contact head comprising a body portion which includes a screwthreaded portion which is arranged in screwthreaded engagement with said housing and a second screwthreaded portion, said body portion including also an outstanding flange which contacts with said housing, a contact member supported by said body portion, said contact member including a flange which contacts with the flange of said body portion and having a portion which embraces said body portion and extends outwardly therefrom, and means comprising a contact element which is arranged in screwthreaded engagement with said second screwthreaded portion of said body portion and serves to clamp the flange of said contact member between the flange of said body portion and a portion of said contact element.

3. A fuse link assembly including a housing, and a contact head arranged at an end of said housing, said contact head comprising a body portion that includes an inner part arranged in engagement with said housing and a part located outwardly of said inner part, a contact member supported by said body portion, said contact member being in the form of a button which embraces said body portion and extends outwardly with respect thereto, and means comprising a contact element which is arranged in engagement with said outer part of said body portion and releasably engages a portion of said contact member to secure said contact member to said body portion.

4. A fuse assembly including a pair of spaced conducting elements, a fusible element for electrically connecting said spaced conducting elements, a housing embracing portions of said spaced conducting elements and said fusible element, said housing comprising a pair of alined tubular housing members which are spaced apart at their adjacent ends, and a tubular element disposed in the space between the adjacent ends of said tubular housing members in associated relation with said pair of tubular housing members, said tubular element providing a shoulder within the housing, and a coil spring interposed between the shoulder provided by said tubular element and a part of one of said spaced conducting elements for imparting tension to said fusible element.

5. A fuse assembly including a pair of spaced conducting elements, a fusible element for electrically connecting said spaced conducting elements, a housing embracing portions of said spaced conducting elements and said fusible element, said housing comprising a pair of alined tubular housing members which are spaced apart at their adjacent ends, and a tubular element disposed in the space between the adjacent ends of said tubular housing members in associated relation with said pair of tubular housing members, said tubular element providing a shoulder within the housing, a coil spring interposed between the shoulder provided by said tubular element and a part of one of said spaced conducting elements for imparting tension to said fusible element, and a tubular insert formed of electrical insulating material disposed within the housing in embracing relation with respect to a portion of said fusible element.

6. A fuse assembly including a pair of spaced conducting elements, a fusible element for electrically connecting said spaced conducting elements, a housing embracing portions of said spaced conducting elements and said fusible element, said housing comprising a pair of alined tubular housing members which are spaced apart at their adjacent ends, and a tubular element disposed in the space between the adjacent ends of said tubular housing members in associated relation with said pair of tubular housing members, said tubular element providing a shoulder within the housing, a coil spring interposed between the shoulder provided by said tubular element and a part of one of said spaced conducting elements for imparting tension to said fusible element, a tubular insert formed of electrical insulating material disposed within the housing in embracing relation with respect to a portion of said fusible element, and an abutment member associated with the assembly made up of the spaced conducting elements and the fusible element which is drawn into abutting relation with a portion of said tubular insert by the force exerted by the coil spring to place said fusible element under tension.

7. A fuse assembly including a pair of spaced conducting elements, a fusible element for electrically connecting said spaced conducting elements, a housing embracing portions of said spaced conducting elements and said fusible element, said housing comprising a pair of alined tubular housing members which are spaced apart at their adjacent ends, and a tubular element disposed in the space between the adjacent ends of said tubular housing members in associated relation with said pair of tubular housing members, said tubular element providing a shoulder within the housing, a coil spring interposed between the shoulder provided by said tubular element and a part of one of said spaced conducting elements for imparting tension to said fusible element, a tubular insert formed of electrical insulating material disposed within the housing in embracing relation with respect to a portion of said fusible element and in contact with an abutment surface formed on said tubular element, and an abutment member associated with the assembly made up of the spaced conducting elements and the fusible element which is drawn into abutting relation with a portion of said tubular insert by the force exerted by the coil spring to place said fusible element under tension.

EUGENE F. BOOTHE.