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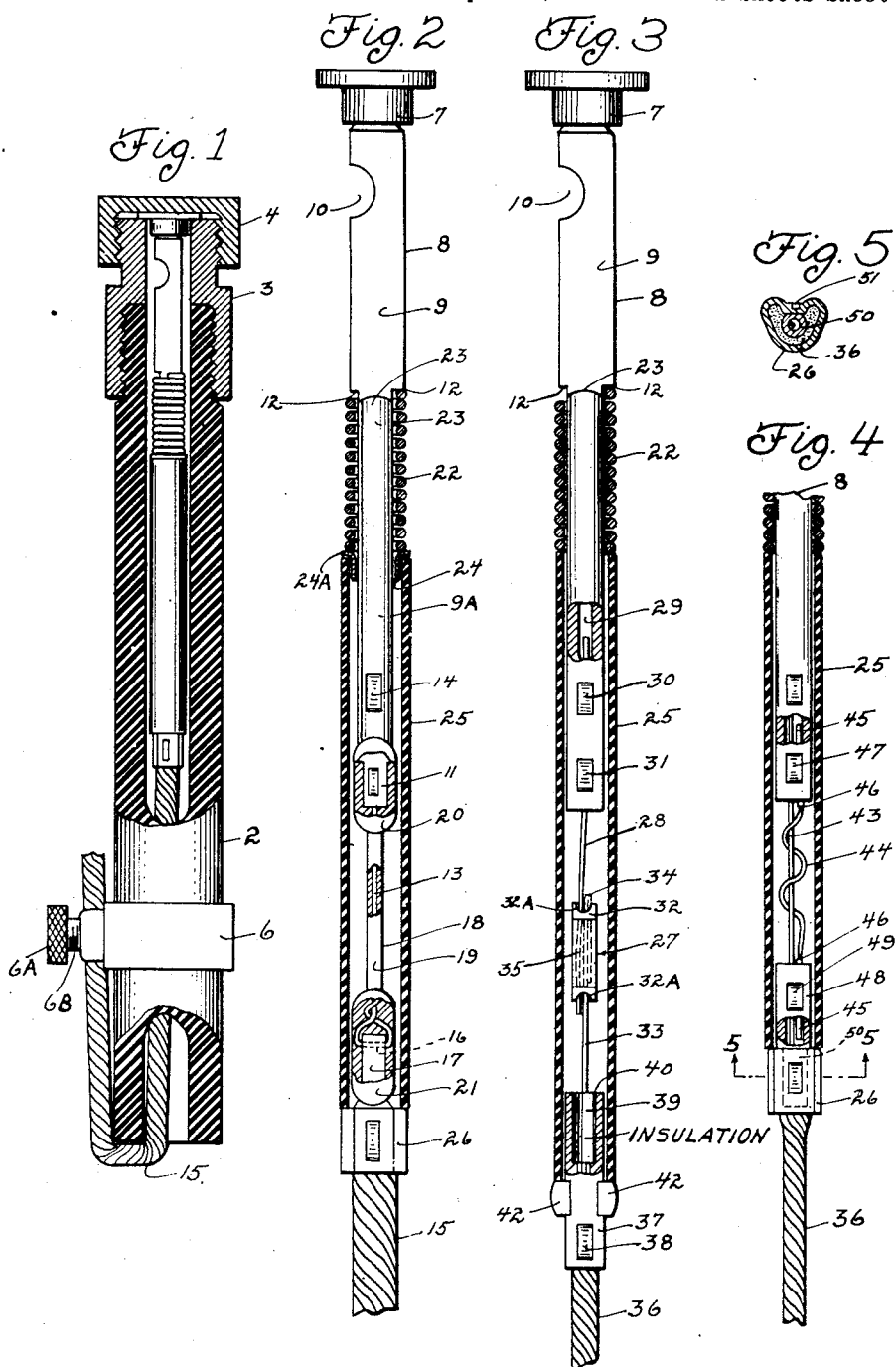
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PRETENSIONED FUSE LINK

Filed April 1, 1938

2 Sheets-Sheet 1



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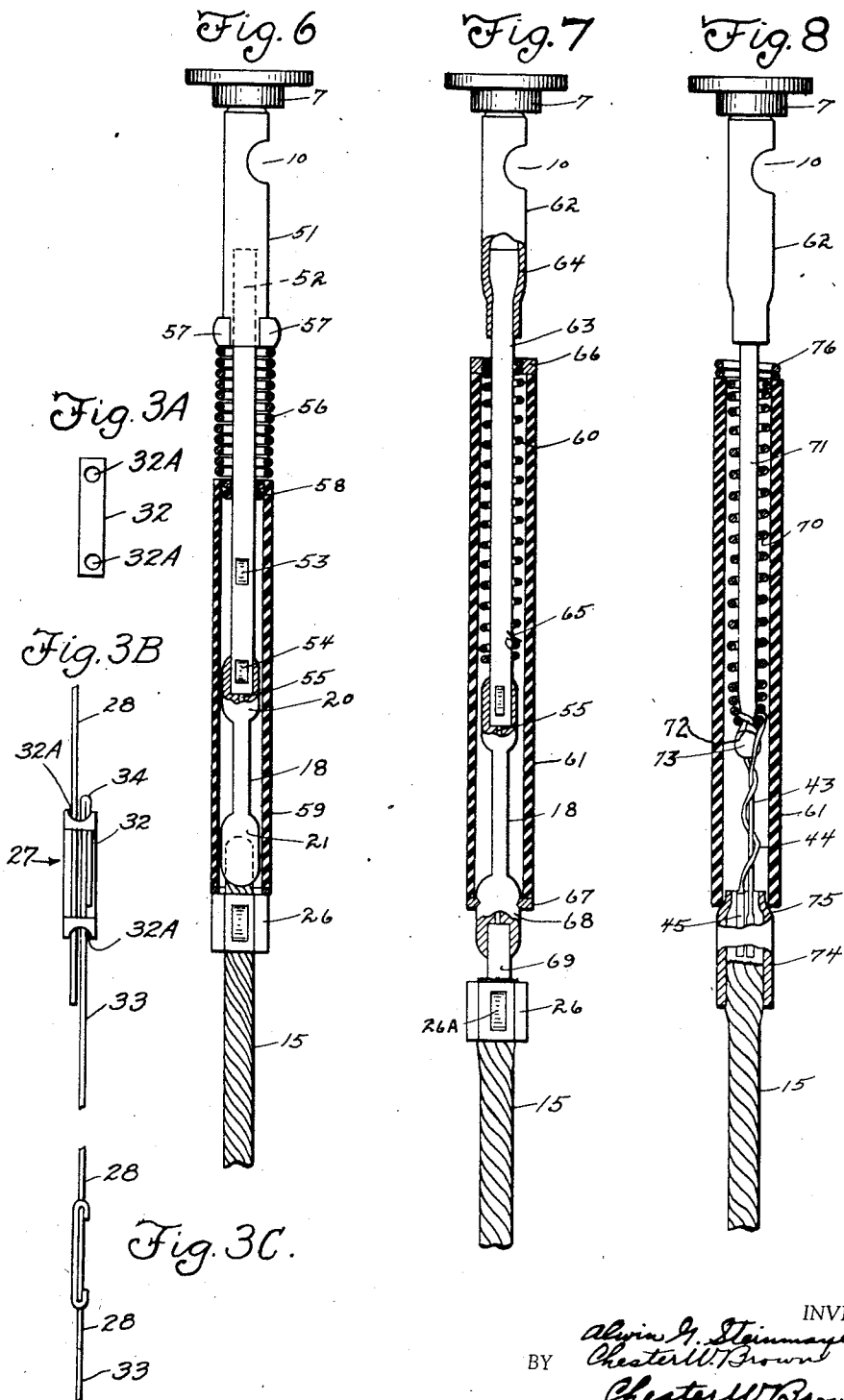
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PRETENSIONED FUSE LINK

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13 Claims. (Cl. 200—135)

This invention relates to improvements in pre-tensioned fuse links.

It is an object of this invention to provide for expulsion cartridges a unitary pre-tensioned fuse link having an insulating tube surrounding the fusible section of the link and expelled from the cartridge, after the fusible section is ruptured, by means of a spring which remains in the cartridge out of the path of an arc which is established upon rupture of the fusible section.

Another object is to provide a pre-tensioned fuse link with a tensioned spring relatively placed with respect to the tube so that its kinetic energy will transmit the motion of the spring to the expellable portion of the link through the medium of the tube, the tube moving with the expellable portion and surrounding the arcing path while it is in motion.

Also an object is to provide a pre-tensioned fuse link in which the tensioning spring is prevented from entering the arcing path, moves the insulating tube as the length of the arc is extended, and causes separation of the tube and the expellable portions of the link after the potential energy of the spring has been dissipated, thereby facilitating expulsion of the expellable portion of the link from short fuse cartridges.

A further object is to provide for a spring in a pre-tensioned fuse link, a guiding member adapted to align the spring concentrically relative to the link and to retain the spring above the arcing path when the fusible section has ruptured.

Other features and advantages of the present invention will be apparent from the following detailed description taken in connection with the accompanying drawings, in which

Fig. 1 is a view in side elevation partly in section illustrating an embodiment of this invention mounted in a fuse cartridge.

Fig. 2 is an enlarged view in side elevation partly in section of the fuse link shown in Fig. 1.

Figs. 3 and 4 are views in side elevation similar to Fig. 2 showing modified forms of fuse links embodying this invention.

Figs. 3A, 3B, and 3C are fragmentary detail views of a portion of Fig. 3.

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 4.

Figs. 6, 7 and 8 are sectional views in side elevation showing further modified forms embodying this invention.

The fuse shown in Fig. 1 comprises an elongated cylindrical casing or cartridge 2 which is open at the lower end. This cartridge is preferably formed of "Bakelite" with a hard insulating

fiber liner known as "Conite" or as "Horn fiber" which does not carbonize under heat, but it is understood that any other suitable insulating material may be used. A contact ferrule 3 of cast hard bronze or other suitable material is secured to the upper end of the tube 2 and is provided with a cap 4 threadedly engaged therewith and closing the upper end of the cartridge. Adjacent the lower end of the cartridge 2, a contact 5 is provided with a stud 6B thereon and having a clamping unit 6A engaged therewith.

The fuse link shown in Figs. 1 and 2 comprises a contact button 7 secured to the ferrule 3 by means of the cap 4, a stiff tubular contact terminal portion 8 flattened at 9 and notched at 10 adjacent its upper end. The terminal portion 8 is provided with a pair of anchor shoulders 12 which are cut therein by any practical or suitable method, intermediate the flattened and tubular portion of the contact terminal 8.

A strain wire 13 is inserted in the lower open end 11 of the tubular portion 9A of the terminal 8 and is securely held therein by crimping the tubular portion 9A at 14 upon the wire 13. The other end of the strain wire 13 is secured to the flexible leader 15 by threading it through the aperture 16 which is pierced through the tinned and reduced end 17 of the leader. The strain wire 13 is then embedded in a sheathing of fusible material 18 which terminates at each end in enlarged knobs 20 and 21 respectively embedding the reduced end 11 on the terminal 8 and the reduced end 17 on the leader 15. Thus a fusible section 19 of fusible material is provided which is calibrated to insure failure of the fuse link between these two knobs when subject to a predetermined overload current.

A coil spring 22 is mounted on the tubular section 9A of the contact terminal 8 and is anchored thereto against the flattened surface of the terminal 8 just above the shoulder 23 between the flat portion 9 and tubular portion 9A. Tendency of the spring to expand upward is checked by the shoulder 12 on the contact terminal 8.

A sleeve 24 mounted on the tube portion 9A is provided with a radially extending flange portion 24A against which the coil spring 22 bears. An insulating tube 25 is mounted on the tubular portion 9A and is of sufficient length to extend from the flanged portion 24A to and coextensively with the lower end of the enlarged knob 21, thereby effectively enclosing a substantial portion of the tubular portion 9A of terminal 8, enlarged knobs 20 and 21, and the fusible section 19.

The tube 25 is placed in position by forcing

it upwardly against the flange 24A of sleeve 24 which in turn compresses the spring 22 as shown in Fig. 2. The spring 22, a collar 24 and tube 25 are permanently maintained in the above-described position by crimping an anchor collar 26 onto the leader 15 which bears against the lower portion of the tube 25.

The completed fuse link 1 is assembled in the cartridge 2 by securing the contact button in place against the upper face of the ferrule 3 by screwing the cap 4 on the ferrule and passing the flexible leader 15 out through the open end of the cartridge 2 and connecting it to the terminal 6 by means of the clamping screw 6A as shown in Fig. 1.

The fuse link operates when an overload current melts the fusible section 19, thus releasing the potential energy of the spring 22 which immediately acts with the gases formed on burning to expel the tube 25 and leader portion 15, including the collar 26, the fuse knob 21 and the lower portion of the strain wire 13 out of the fuse cartridge 2 at the lower end.

With the spring 22 anchored as shown on the shank portion of the terminal 8, the arcing zone characteristics are maintained, because the spring is not allowed to pass into this zone. Otherwise, the arc lengthening characteristic of the link would be interfered with and the fixed arcing length would not be maintained between the separated portions of the fusible section of the link.

The modified form shown in Fig. 3 is similar to that shown in Fig. 2, with the exception of the difference in the arrangement of the fusible section 27 and the leader connection 37. The fusible section includes an upper strain wire 28 anchored in the bore 29 of the tubular terminal 8 which is stapled or crimped as shown at 30 and 31 to clamp the strain wire in the bore. Also included in the fusible section is a lower strain wire 33 which is attached, bound, or tied to the upper wire 28 by means of a high resistance, thin metal tying strip 32.

Figs. 3A, 3B, and 3C more clearly disclose the manner in which the fusible section 27 is constructed. The metal strip 32, which is preferably foil-like and mechanically weak, is provided with a hole 32A at each end. This strip is then folded at each end diametrically across the holes 32A and the ends of the strain wires 28 and 33 are passed through the holes 32A so that they are disposed adjacent each other and overlying the strip 32 between the folded ends, as may be clearly seen in Figs. 3B and 3C. When the strip 32 and wires 28 and 33 have been assembled in the manner indicated, they are secured together by solder 35 lying between the folded ends of the strip as indicated in Fig. 3. The strain wire 33 is shown folded at 34 to provide additional soldering surface, and it will be obvious that the wire 28 may likewise be folded for the same purpose.

The lower end of the strain wire 33 is secured in the bore of the tube 37 at 38, the bore being countersunk to provide an enlarged portion 40 of appreciable depth and diameter to receive a tubular insulating element 39 which surrounds the wire 33. This element allows the use of a wire 33 of predetermined conductive length and a tube 25 which is shorter by at least the length of the element 39 than would be normally required. Thus a maximum heating area between the flexible leader 36 and the tubular terminal 8 is retained.

The flexible leader 36 is anchored in the lower

end of the tube 37 at 38 at the time the strain wire 33 is anchored therein as previously described.

As in the Fig. 2 construction, the spring 22 is mounted and placed under compression on the tubular terminal 8 by means of the tube 25 which is held in position by means of the anchor ears 42 formed out of the periphery of the anchor tube 37.

The fuse link shown in Fig. 3 is mounted in a similar manner as described in reference to the fuse link shown in Fig. 2.

The fuse link operates to open circuit a line when an overload melts the solder or fusible material 35 allowing the strip 32 to collapse under the influence of the spring 22 and permitting the spring to separate the strain wires 28—33 and move the tube 25 and the lower portions of the fuse link toward the open lower end of the cartridge 2. As in the Fig. 2 fuse link, the spring is retained on the terminal 8 by reason of its engagement at its upper end with the shoulder 23 on the terminal 8.

Another modified form of fusible section is shown in Fig. 4 wherein the fusible section comprises a strain wire 43 anchored to the terminal 8 in a manner similar to that shown in Fig. 3 and a fusible wire 44 soldered to a copper rod 45 at 46. The copper rod 45 is secured in the bore of the terminal 8 adjacent the strain wire 43 by punching or crimping the terminal 8 at 47.

The lower ends of the strain and fusible wires are secured in the bore of the tube 48 by punching or crimping the tube at 49. As indicated, the lower end of the fusible wire 44 is secured to a second rod 45. The lower end of the tube 48 is turned to a smaller radius at 50 in order to provide for the crimping of the flexible leader 36 thereon by means of the crimping collar 26 which clamps the leader upon the reduced section 50.

A cross-section of this crimping arrangement is shown in Fig. 5. The collar 26 is originally circular in cross-section and takes approximately the form shown when pressed at 51 into clamping relation to the flexible leader 36.

In the modified form of this invention illustrated in Fig. 6, the contact button 7 is provided with a tubular contact shank 51 which is mounted on a tubular rod 52. The upper portion of the shank 51 is flattened and crimped upon the upper portion of the rod to securely hold the rod in the flattened part of the shank as indicated by the broken lines adjacent the lower end of the shank. The lower portion of the rod 52 is punched or stapled at 53 and 54 to hold the strain wire 55 which extends into the bore of the rod.

The fusible section comprises the strain wire 55 which is attached to the leader 15 at its lower end in a manner similar to that shown in reference to Fig. 2, and a readily fusible material 18 molded or cast about the strain wire as described with reference to Fig. 2.

The compression spring 56 encircles the rod 52 and is held in place against upward expansion by the ears 57 which are pressed out from the edges of the flattened shank portion 51. The convolutions 58 at the lower end of the spring are of smaller diameter than the remaining coils and fit loosely into the upper end of the insulating tube 59 surrounding the fusible section 18 and serve to attach the spring to the tube 59 and keep the two aligned relatively. The spring is held under compression by means of the tube 59 engaging the collar 26 crimped in place in a manner similar to that disclosed with reference to Fig. 2.

When the fuse link shown in Fig. 6 is mounted in a cartridge and subjected to an overload in an electric circuit, the fusible section will melt and release the spring 56 for expansive movement downwardly. This movement of the spring will cause the tube 59 and the leader 15 to move toward the lower open end of the cartridge 2 and to the exterior thereof. The spring 56 will be prevented from leaving the rod 52 when the convolutions 58 contact the fuse knob 20, the diameter of which is greater than the inner diameter of the convolutions.

In a further modification of this invention illustrated in Fig. 7, the spring 60 is mounted within the insulating tube 61 on the rod 63.

The contact terminal 62 is mounted on the rod 63 and secured thereto by flattening the terminal 62 onto the rod as shown in the cut-away cross-section 64.

The lower end of the rod 63 is provided with a spring spur anchor 65 by chipping or cutting the surface of the rod at a slight angle. The spur 65 is cut sufficiently to provide an anchorage for the lower convolutions of the spring 60 by protruding between them as the spring is threaded upon the spur. The upper part of the spring is pressed together to form a thread base for the nut 66 which is turned on the spring before the spring is mounted on the rod.

A strain wire 55 is stapled in the lower end of the rod 63 as described with reference to Fig. 6. At the lower end of the wire a tubular rod 69 is secured when the leader 15 and collar 26 are stapled or punched at 26A. A fusible element similar to the one described in Fig. 6 is cast or molded around the strain wire substantially as shown.

The spring 60 is tensioned by mounting an insulating tube 61 over the spring and forcing it against the under portion of the washer 66. The tube is held in position by pressing a washer 67, having a V-shaped inner circumference, into the lower fusible knob 68.

When the fuse link shown in Fig. 7 is mounted in a cartridge and subjected to an overload current, the fusible section melts and the tensioned spring 60 pulls down on the washer 66 forcing the tube 61 against the washer 67 which in turn pulls the fuse section away from any established arc and pushes the leader 15 out the lower open end of the cartridge. The spring 60 will be prevented from leaving the rod 63 after its energy is expended, thus keeping it from possibly re-establishing another arc.

In a still further modification of this invention illustrated in Fig. 8, the contact button 62 is mechanically joined to a stiff rod 71 as shown with reference to Fig. 7 at 64. The lower end of the rod is swaged to a smaller diameter at 72 and a spring 70 mounted thereon. The lower portion of the spring 70 is made smaller to conform with the swaged portion of the rod 71 and prevents any upward tendency of the spring to slip while it is under tension.

The upper convolutions of the spring are gradually flared to a great diameter to provide frictional contact with the inner surface of the tube 61 and the last two convolutions 76 are enlarged sufficiently to form an anchor base against which the upper end of the tube 61 may press. A fuse base 73 is formed on the lower end of the rod 71 by flattening it into a shovel-like flat surface. A fuse wire 44 is soldered to the base and the other end attached by solder to a small copper anchor rod 45. A strain wire 43

is twisted and anchored about the lower turns of the spring 70.

The tube 61 is then mounted over the spring and fusible section. The two convolutions 76 prevent the tube from slipping on the spring when the spring is under tension.

The tube is anchored in place by flattening the anchor tube 74 on the copper rod 45, the strain wire 43, and the flexible leader 15 which is assembled into the lower portion of the tube 74. During the flattening operation, support shoulders 75 are formed which act to hold the tube 61 in place.

The fuse link shown in Fig. 8 is assembled in a cartridge as heretofore described with reference to the fuse link shown in Fig. 2.

An overload current causes the fuse section to melt and the spring 70 to snap the tube in a downwardly direction, thus pushing the leader end of the link out the open end of the fuse cartridge 2. Because of the partial contact of the upper coils of the spring 70 against the inner surface of the tube 61, the tube is momentarily stopped or checked in its downward movement, thus allowing the tube to separate from the lower portion of the link. This separation allows a more positive clearance for the tube and leader portion when the two are expelled from the fuse cartridge.

It is believed that the above shown and described invention, with its various modifications, satisfactorily carries out the objects of the invention and satisfies the demand for a better and more positive acting spring type fuse link.

We claim:

1. A unitary spring-tension fuse link for expulsion fuse tubes, said link comprising a tubular member having an upper and lower end, a rigid contact member extending from the upper end of said tubular member and having a flanged contact end remote from said tubular member, a fusible section within said tube connected at one end with said contact member, a flexible conductor secured to the other end of said fusible section and extending from the lower end of said tubular member to a point sufficiently remote from said tubular member to extend to the exterior of a fuse tube, a coil expansion spring mounted on said contact member and held under compression between said contact member and tube, and means on said flexible conductor engaging the lower end of said tubular member to hold said spring under compression.

2. A unitary spring-tensioned fuse link for expulsion fuse tubes, said link comprising a tubular member having an upper and lower end, a rigid contact member extending from the upper end of said tubular member and having a flanged contact end remote from said tubular member, a fusible section within said tube connected at one end with said contact member, a flexible conductor secured to the other end of said fusible section and extending from the lower end of said tubular member to a point sufficiently remote from said tubular member to extend to the exterior of a fuse tube, a coil expansion spring mounted on said contact member and held under compression between said contact member and tube, and means on said flexible conductor engaging the lower end of said tubular member to hold said spring under compression, the end of said spring remote from said tubular member being anchored to said contact member, whereby on expansion of said spring after the fusible section is ruptured, the spring will be prevented from

moving into the arcing area of said fusible section.

3. A unitary spring-tensioned fuse link for expulsion fuse tubes, said link comprising an elongated rigid contact member having a flanged contact end, a fusible section connected to the opposite end of said member, a flexible conductor connected to the end of said fusible section remote from said member, an insulating tube surrounding said fusible section and a portion of said member, a coil spring on said member strained between said tube and member, and anchorage means on said conductor holding said tube in spring-straining relation, said conductor extending from said tube to a point sufficiently remote therefrom to be projected from a fuse tube, whereby on rupture of said fusible section said tube and conductor will be projected from said member.

4. A unitary spring-tensioned fuse link for expulsion fuse tubes, said link comprising an elongated rigid contact member having a flanged contact end, a fusible section connected to the opposite end of said member, a flexible conductor connected to the end of said fusible section remote from said member, an insulating tube surrounding said fusible section and a portion of said member, a coil spring on said member strained between said tube and member, and anchorage means on said conductor holding said tube in spring-straining relation, said conductor extending from said tube to a point sufficiently remote therefrom to be projected from a fuse tube, whereby on rupture of said fusible section said tube and conductor will be projected from said member, the end of said spring engaging said member being anchored thereto to prevent its removal from said member when said fusible section is ruptured.

5. A unitary spring-tensioned fuse link for expulsion fuses, said link comprising an elongated rigid contact member having a contact flange at one end, a fusible section connected to the other end of said member, a flexible conductor connected to the end of said section remote from said member, an insulating tube surrounding said fusible section and a portion of said member, anchorage means on said conductor engaging said tube, a coil spring on said member exteriorly of said tube, and a shouldered portion on said member holding said spring in compressive engagement with said tube, whereby on rupture of said fusible section said tube and conductor will be projected by said spring from said member.

6. A unitary spring-tensioned fuse link for expulsion fuses, said link comprising an elongated rigid contact member having a contact flange at one end, a fusible section connected to the other end of said member, a flexible conductor connected to the end of said section remote from said member, an insulating tube surrounding said fusible section and a portion of said member, anchorage means on said conductor engaging said tube, a coil spring on said member exteriorly of said tube, and a shouldered portion on said member holding said spring in compressive engagement with said tube, whereby on rupture of said fusible section said tube and conductor will be projected by said spring from said member, said spring being anchored at one end to said shouldered portion and said member projecting into said tube a distance greater than the length of said spring when expanded, whereby to prevent said spring from expanding and entering the arcing area of said fusible section.

7. A unitary spring-tensioned fuse link for expulsion fuses, said link comprising an elongated

rigid contact member which is tubular in part and flattened in part and having a flanged contact at the end of said flattened part remote from the tubular part, said flattened part providing shoulders extending from said tubular part and said tubular part providing shoulders extending from said flattened part, a fusible section including a strain wire extending into said tubular part and anchored therein by means of deformed portions of said tubular part, a flexible conductor, a tubular anchor surrounding adjacent parts of said strain wire and conductor, said deformed portion to secure said wire and conductor together, an insulating tube surrounding said fusible section and portions of said tubular part and anchor, a coil spring on said tubular part exteriorly of said tube and having one of its end convolutions engaged with and anchored to said shoulders, said anchor being deformed in part to hold said tube in compressive relation to said spring.

8. A unitary spring-tensioned fuse link for expulsion fuses, said link comprising an elongated rigid contact member which is tubular in part and flattened in part and having a flanged contact at the end of said flattened part remote from the tubular part, said flattened part providing shoulders extending from said tubular part and said tubular part providing shoulders extending from said flattened part, a fusible section including a strain wire extending into said tubular part and anchored therein by means of deformed portions of said tubular part, a flexible conductor, a tubular anchor surrounding adjacent parts of said strain wire and conductor, said deformed portion to secure said wire and conductor together, an insulating tube surrounding said fusible section and portions of said tubular part and anchor, a coil spring on said tubular part exteriorly of said tube and having one of its end convolutions engaged with and anchored to said shoulders, said anchor being deformed in part to hold said tube in compressive relation to said spring, said tubular part extending into said tube a distance greater than the expanded length of said spring from said shoulders.

9. A unitary spring-tensioned fuse link comprising an insulating tube, a rigid contact member having a tubular portion extending into said tube and provided with a flanged contact remote from said tube, a fusible section in said tube secured to said member, a flexible conductor extending from the end of said tube remote from said member and secured to said fusible section, anchorage means on said conductor engaging said tube, and a coil spring in said tube disposed about said tubular portion of said member, said spring being secured at one end to said tubular portion adjacent said fusible section and engaged at the other end with said tube, said spring being contractible and normally held under tension, whereby said tube and conductor will be simultaneously projected from said member when the fusible section is ruptured.

10. A fuse link comprising a tubular member, a fusible section lying in said member, a stiff tubular rod extending through the top of said member connecting the top of said fusible section and being swaged at the end within the member, a coil expansion spring surrounding said rod and partially retained within said member, said spring having coils at its lower portion of lesser diameter to contact the swaged portion of said rod and having coils of greater diameter to bear on the top edge of said member, an anchored tube partially retained in the bottom of said member

and permanently securing the bottom of said fusible section.

11. A fuse link comprising a tubular element, a fusible element within and at the lower portion of said tubular element, a rigid element within and at the upper portion of said tubular element, a contact terminal in electrical contact with said rigid section and outside of said tubular element, a leader portion in electrical connection with the lower portion of said fusible section and outside of said tubular element, and a tensioned spring anchored at the lower end of said rigid section and expanded into frictional engagement with the upper inner portion of said tubular element, said spring and tubular element moving with such force as to expel the lower fusible section from the lower portion of said tubular element.

12. A spring-tensioned fuse link comprising a tubular member, a fusible section including a pair of strain wires and a solder support, a terminal contact secured to one of said wires and extending out of the top of said member and provided with a pair of anchor shoulders, an anchor tube

provided with a bore and anchor ears, said tube being attached to the other of said wires, a flexible leader secured to said tube and a coil expansion spring strained between the upper part of said member and said shoulders.

13. A unitary spring-tensioned fuse link for expulsion fuses, said link comprising an elongated rigid conducting member having a contact end, a fusible section connected to the other end of said member, a conductor including a flexible leader connected to the fusible section remote from said member, an insulating tube surrounding the fusible section and a portion of said member, a coil spring mounted on said member and interacting between said member and said tube to bias said tube for movement relative to said member, anchoring means on said conductor retaining said tube in biased relation to said spring, and means on said member preventing said spring from moving into the arcing zone when the fusible section is ruptured.

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