March 30, 1943. C. W. BROWN 2,315,311

FUSE LINK

Filed Nov. 17, 1941

Fig. 1

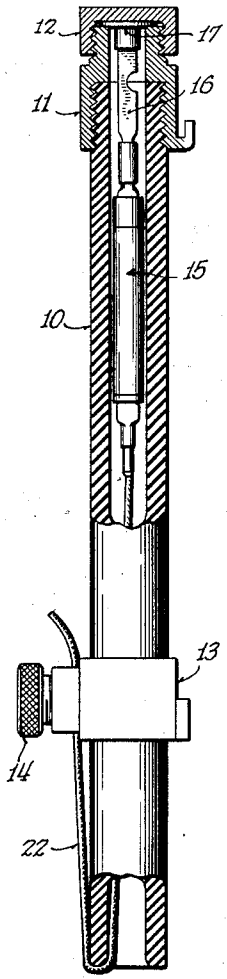


Fig. 2

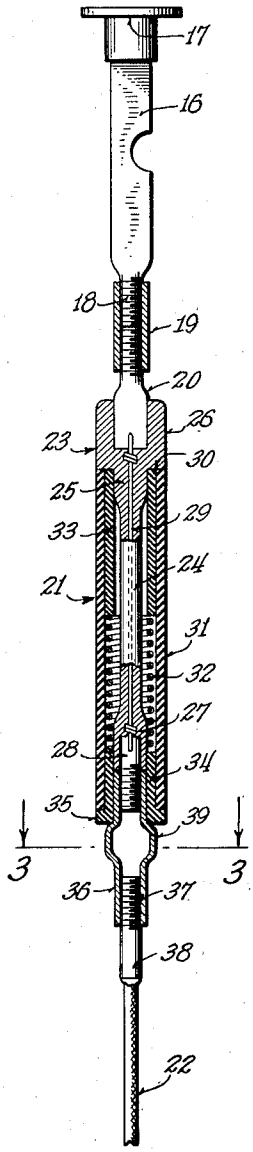


Fig. 4

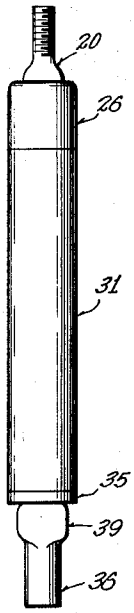


Fig. 5

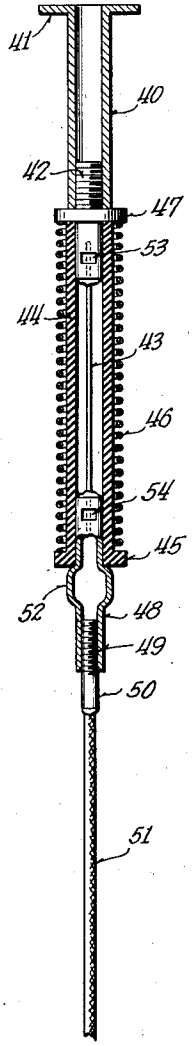
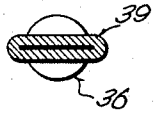


Fig. 3



INVENTOR.

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UNITED STATES PATENT OFFICE

2,315,311

FUSE LINK

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Application November 17, 1941, Serial No. 419,367

8 Claims. (Cl. 200—135)

This invention relates to fuse-links for the protection of electrical circuits and has to do more particularly with fuses of the expulsion type wherein the fuse-link includes a spring designed to effectuate or help effectuate a quick separation of conductive parts upon severance of the fusible element—thereby serving quickly to extinguish the ensuing arc.

According to the practice heretofore prevailing when a fuse of the type here dealt with blew out it was necessary to replace the entire fuse-link—thus scrapping parts which were unimpaired by the blowout and capable of being salvaged for further use if the fuse-section could economically have been replaced in the field. But, insofar as I am aware, it has not previously been thought practicable to make replaceable fuse-sections because the cost of such sections would have to nearly approach the cost of producing an entire fuse-link having a non-replaceable fuse-section.

My object is to provide a replaceable fuse-section which is entirely dependable in operation and which can be manufactured and sold so cheaply as to render it substantially more economical to replace a fuse-section than to replace an entire fuse-link when a blow-out occurs.

The novel features of this invention can be most readily pointed out by referring to the two embodiments thereof illustrated in the accompanying drawing and described in detail hereafter.

In the drawing:

Fig. 1 is an elevational view, partly sectionalized, of a fuse cartridge with a fuse-link installed therein;

Fig. 2 is an elevational view of this fuse-link with a replaceable fuse-section forming a part thereof—the latter being shown in longitudinal section;

Fig. 3 is a cross-sectional view taken along the line 3—3 of Fig. 2;

Fig. 4 is an elevational view of the fuse-section of Fig. 2; and

Fig. 5 is a longitudinal sectional view of a second embodiment of the invention.

The fuse cartridge, per se, shown in Fig. 1, comprises a tube 10 of insulating material to the upper end of which is threaded a metal ferrule 11 which, in turn, is externally threaded to receive a removable metal cap 12. Secured to the mid-portion of tube 10 is a metal contact sleeve 13 having a binding screw 14 threaded therein.

Inside the cartridge and identified as a whole by reference numeral 15 is a fuse-link, illustrated in detail in Fig. 2; but in place of which may be substituted the alternative fuse-link of Fig. 5.

The fuse-link of Fig. 2 comprises a terminal portion 16 to the upper end of which is fixed a button 17 by means of which the fuse-link is secured in the cartridge—see Fig. 1—and the lower end of which is threaded at 18 to engage an internally threaded sleeve 19.

Below sleeve 19 and removably secured thereto by virtue of the threaded terminal member 20 is a replaceable fuse-section here identified as a whole by reference numeral 21.

To the lower end of fuse-section 21 is removably connected a flexible conductive cord 22 which —see Fig. 1—is designed to be drawn taut and connected to contact terminal 13 by means of binding screw 14—a suitable aperture, not shown, being provided in contact terminal 13 for the reception of conductor cord 22.

The replaceable fuse-section 21 comprises an elongate fusible element 23 having a relatively extenuate mid-section 24, an intermediate portion 25 of enlarged diameter terminating in a head 26 of still larger diameter, and an enlarged lower end 27. The threaded terminal member 20 is embedded in the fusible metal head 26 and a second threaded terminal member 28 is embedded in the enlargement 27. Running axially through the extenuate mid-section 24 of the fusible element 23 is a taut strain wire 29 which is tied to and interconnects the terminal members 20 and 28. Strain wire 29 is usually made of chrome-nickel-iron alloy and is strong enough to withstand the tension to which it is subjected while at the same time it has, in conjunction with the fusible metal forming the extenuate mid-section 24, a current carrying capacity slightly in excess of the rated capacity of the link.

Bearing at its upper end against a shoulder 30 on the fusible element is a tube 31 of insulating material, usually fiber, which functions as a housing for the extenuate mid-section and also as a housing and guide for a helical ejector spring 32. Telescoped within tube 31 is another tube 33, also of insulating material—usually fiber—which functions as a spacer and abutment for the upper end of spring 32, which spring is normally under compression. In the lower end of tube 31 is inserted a tubular plug 34 of insulating material having a flanged head 35 at its lower end. The tubular plug forms a lower abutment for spring 32.

Threaded to the lower end of terminal member 28 is a tubular sleeve 36 which is internally threaded at 37 for the reception of a cord ter-

minal 38 to which is soldered or otherwise connected the flexible conductor cord 22.

Tubular sleeve 36 is pinched flat at 39—see enlarged detail in Fig. 3—to form an enlargement and thus a shoulder which presses against the end of plug 34, thereby serving normally to resist the expansive force of spring 32. It will be observed that the force of the spring places the extenuate mid-section of the fusible element, including strain wire 29 under tension and, as will be apparent, a rupture of this extenuate mid-section will permit spring 32 to expel plug 34 downwardly, together with the lower portion of the fusible element as well as terminal member 28, sleeve 36, cord terminal 38 and that portion of cord 22 which normally extends into the cartridge tube. The action of the ejector spring is, of course, aided by the explosive force generated by volatilization of the fusible metal when fusion occurs and explosion of the above enumerated parts takes place with considerable abruptness—thus quickly extinguishing the arc which follows severance of the fusible element.

Fuse-section 21 is, obviously, a unitary self-contained element easily detachable from sleeve 19 and cord terminal 38 and it will be apparent that no skill and little time is required to detach the separated parts of a blown out fuse-section from the remainder of the fuse-link and replace the same with a new fuse-section. But to make it worthwhile to provide replacement fuse-sections, it is essential that the entire fuse-link be substantially as cheap to manufacture as a fuse-link in which the fuse-section is not replaceable and, further, that the cost to consumers of replacement fuse-sections be materially less than the cost of entire fuse-links of conventional design. Both those requirements are met by the present invention because the parts of the replaceable fuse-section are all capable of cheap production and the assembling operations are very quickly and easily performed. The mode of assembly is thought to be self-evident.

In the alternative construction illustrated by Fig. 5 the terminal portion 40 is provided with a button head 41 which serves the same purpose as the button 17 of Fig. 2. Terminal portion 40 is internally threaded at its lower end to receive a metal terminal member 42 which forms one terminus of a fusible strain wire 43 and also as a means for centering a tube 44 of insulating material. The latter tube has a flanged lower end 45 which provides a shoulder against which the lower end of a helical ejector spring 46 abuts—said spring enveloping said tube and abutting at its upper end against an insulating washer 47 which is threaded or otherwise secured to terminal member 42.

Inserted in the lower end of the tube 44 is a second terminal member 48 which is internally threaded at 49 to receive an externally threaded cord terminal 50 which, in turn, is soldered or otherwise secured to the end of a flexible conductor cord 51. Terminal member 48 is tubular at its lower end and is pinched flat at 52 to provide a shoulder which bears against the lower end of tube 44 and secures the same against the force of spring 46 which is normally under compression.

Terminal members 42 and 48 are both drilled endwise to receive the respective ends of fusible strain wire 43 and, for the purpose of securely anchoring said strain wire to said members the latter are indented at 53 and 54 when the strain wire is in place, thereby firmly clamping down on the ends of the strain wire.

Tube 44 is preferably a free fit on terminal member 42 and since spring 46 is normally compressed it will be clear that upon fusion and severance of strain wire 43 said tube and all parts therebelow will be expelled from the fuse cartridge.

Depending upon the current-carrying capacity required, fuses are commonly made with a strain wire embedded in low melting point fusible alloy as shown in Fig. 2 or without the low melting point fusible alloy, as shown in Fig. 5, and it will be evident that in the structure of Fig. 5 the strain wire could be embedded in low melting point fusible alloy if desired, and vice-versa.

What is claimed is:

1. A replaceable fuse-section designed to function as a component part of a fuse-link, said fuse-section being a self-contained unitary structure comprising a tube of insulating material, a fusible element within said tube, an ejector spring co-axial with said tube and continuously applying tension to said fusible element, and a pair of terminal members, one at each end of said tube, said terminal members being connected individually to the respective ends of said fusible element, each said terminal member being provided with means for effecting readily detachable connection with other fuse-link portions between which said fuse-section is intended to be interposed.

2. A replaceable fuse-section designed to function as a component part of a fuse link, said fuse-section being a self-contained unitary structure comprising a tube of insulating material, an elongate fusible element within said tube and extending longitudinally thereof, a helical ejector spring co-axial with said tube and at least partially co-extensive therewith lengthwise, said spring continuously applying tension to said fusible element, and a pair of terminal members, one at each end of said tube, said terminal members being connected individually to the respective ends of said fusible element, one of said terminal members having a portion which is pinched flat to provide an abutment for securing said tube in place and for resisting the action of said spring, each said terminal member being provided with means for effecting readily detachable connection with other fuse-link portions between which said fuse-section is intended to be interposed.

3. A replaceable fuse-section designed to function as a component part of a fuse-link, said fuse-section being a self-contained unitary structure comprising a tube of insulating material, an elongate fusible element within said tube and extending longitudinally thereof, a helical ejector spring coaxial with said tube and at least partially co-extensive therewith lengthwise, said spring continuously applying tension to said fusible element, and a pair of terminal members, one at each end of said tube, said terminal members being connected individually to the respective ends of said fusible element, one of said terminal members being tubular for at least a part of its length, a portion of said tubular part being collapsed to form an abutment for securing said tube in place and for resisting the force of said spring, each said terminal member being threaded for effecting readily detachable connection with other fuse-link portions between which said fuse-section is intended to be interposed.

4. A replaceable fuse-section designed to func-

tion as a component part of a fuse-link, said fuse-section being a self-contained unitary structure comprising an elongate tube of insulating material, a helical ejector spring within said tube and co-axial therewith, an elongate fusible element within said tube and extending axially through said spring, said fusible element having a shouldered enlargement projecting from one end of said tube and against which the adjacent end of said tube abuts, a terminal member attached to and projecting from said enlargement, a second terminal member projecting from the end of said tube remote from said enlargement and connected to said fusible element, said last-mentioned terminal member having a shoulder which serves to secure said tube in place and at least indirectly as an abutment for said spring whereby said fusible element is subjected to continuous tension by said spring, each said terminal member being provided with means for effecting readily detachable connection with other fuse-link portions between which said fuse-section is intended to be interposed.

5. A replaceable fuse-section designed to function as a component part of a fuse-link, said fuse-section being a self-contained unitary structure comprising an elongate fusible element having an extenuate mid-section and an enlargement at one end having a peripheral shoulder, a tube of insulating material co-axial with and enclosing said extenuate mid-section, said tube bearing at one end against said shoulder, a compressed helical ejector spring within said tube and co-axial therewith, a tubular plug of insulating material inserted in the end of said first tube remote from said enlargement and abutting one end of said spring, a tubular terminal member inserted in said plug and connected with the end of said fusible element remote from said enlargement, said terminal member projecting axially from said tube and having a flattened mid-portion providing an abutment for the external end of said plug whereby to retain said spring in said tube under compression, and a second terminal member attached to said enlargement and projecting axially therefrom, each said terminal member being provided with means for effecting readily detachable connection with other fuse-link portions between which said fuse-section is intended to be interposed.

6. A replaceable fuse-section designed to function as a component part of a fuse-link, said fuse-section being a self-contained unitary structure comprising an elongate fusible element having an extenuate mid-section and an enlargement at one end having a peripheral shoulder, a tube of insulating material co-axial with and enclosing said extenuate mid-section, said tube bearing at one end against said shoulder, a tubular plug of insulating material inserted in the end of said tube remote from said enlargement, said plug having a peripheral shoulder bearing against the adjacent end of said tube, a compressed helical ejector spring within said tube and co-axial therewith, said spring being interposed between the inner end of said plug and the said shoulder on said enlargement, said spring tending to effect a longitudinal disruption of said fuse-section, a terminal member attached to said enlargement and projecting axially therefrom and a tubular terminal member inserted in said plug and connected with said fusible element, said tubular terminal member having a collapsed portion forming an abutment for the outer end of said plug and operating to retain said spring within said tube under compression, each said terminal member being threaded for effecting readily detachable connection with other fuse-link portions between which said fuse-section is intended to be interposed.

7. A replaceable fuse-section designed to function as a component part of a fuse-link, said fuse-section being a self-contained unitary structure comprising an elongate tube of insulating material, a terminal member inserted in one end of said tube, a washer of insulating material secured to said terminal member and forming an abutment for one end of said tube, said washer overlapping the periphery of said tube annularly, a compressed helical ejector spring enveloping said tube and substantially co-extensive therewith longitudinally, said tube having a shoulder at the end thereof remote from said washer and against which said spring abuts, a second terminal member inserted in the end of said tube remote from said first terminal member, a fusible link within said tube interconnecting said terminal members and under tension imposed by said spring, said second terminal member having a shoulder engaging the adjacent end of said tube and serving to retain said spring in place and under compression, each said terminal member projecting axially from said tube and having means for effecting readily detachable connection with other fuse-link portions between which said fuse-section is intended to be interposed.

8. A replaceable fuse-section designed to function as a component part of a fuse-link, said fuse-section being a self-contained unitary structure comprising an elongate tube of insulating material, two terminal members each projecting individually from opposite ends of said tube, a fusible element within said tube interconnecting said terminal members, a compressed helical ejector spring encircling said tube, means defining a non-conductive shoulder connected with one of said terminal members but not connected with said tube and constituting an abutment for one end of said spring, a shoulder on said tube constituting an abutment for the opposite end of said spring, one of said terminal members being tubular, at least in part, a portion of said tubular part being collapsed to form an enlargement for securing together the assembled parts of said fuse-section and for holding said spring under compression, said fuse section being disruptable by said spring upon severance of said fusible element, each said terminal member being threaded for effecting readily detachable connections with other fuse-link portions between which said fuse-section is intended to be interposed.

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