Nov. 9, 1937. O. H. JUNG ET AL 2,098,664

ELECTRICAL FUSE LINK

Filed April 16, 1934

Fig. 1.

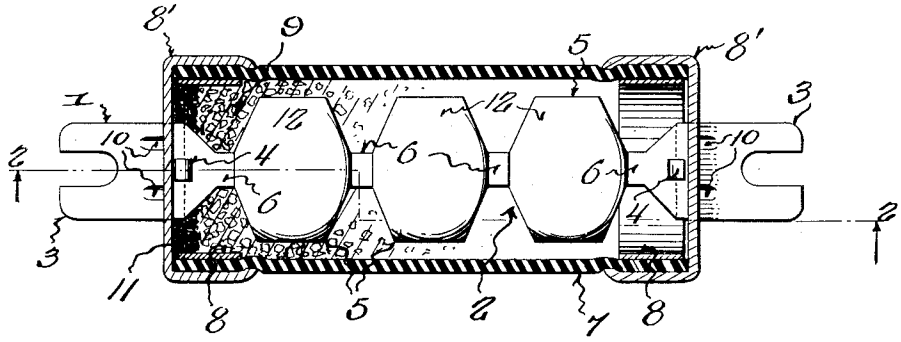


Fig. 2.

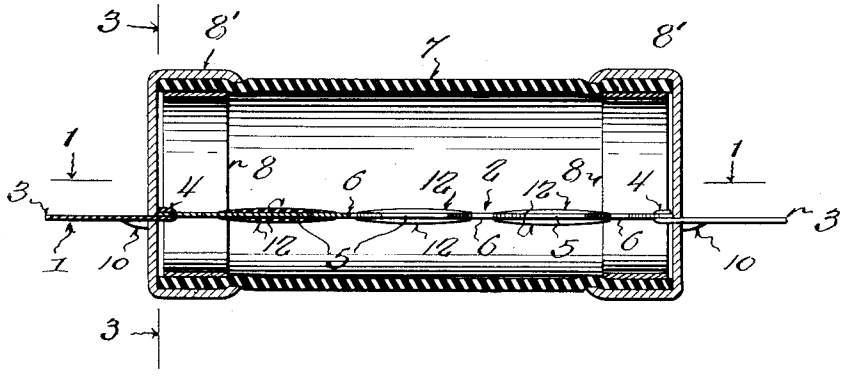
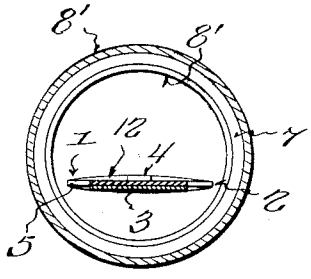


Fig. 3.



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ELECTRICAL FUSE LINK

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7 Claims. (Cl. 200—135)

This invention pertains to electrical fuse links of either the renewable or non-renewable type, and is directed particularly to links provided with a time lag for overloads of comparatively brief duration.

Links having a time lag in their fusing period are well-known in the art, and therefore it is considered unnecessary to discuss their purpose or mode of operation, other than that the links now in common use provide for a time lag by either the attachment of additional metal to certain portions of the fuse, or by increasing the metallic cross sectional area of certain portions of the fuse in various ways, with the result that a greater amount of metal is volatilized upon the blowing of the fuse links on short circuits, which is both highly detrimental to the fuse casing, and creates a serious explosive hazard.

The present invention has primarily for its object to overcome the foregoing objects by the provision of a fuse link having a practical commercial time lag, which is not detrimental to the short circuit characteristics of the link, and which reduces the explosive effect upon the fuse casing to a minimum, thus eliminating resultant hazard, and materially reducing the cost of manufacture of the casing, in that a lighter construction is permissible.

Incidental to the foregoing, a more specific object of the present invention resides in coating a fuse link with an electrical non-conducting material, but having heat-conducting properties, to increase the inherent time lag of the link without increasing the quantity of metal to be volatilized upon short circuit fusing.

A still further object is to provide a fuse link having the foregoing characteristics, in which its potential fusing portion, or portions, are packed in a suitable powdered material, which serves to both quench and de-ionize the explosive arc upon fusing, and further increase the time lag of the link.

With the above and other objects in view, which will appear as the description proceeds, the invention resides in the novel construction, combination, and arrangement of parts, substantially as hereinafter described, and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the herein disclosed invention may be made as come within the scope of the claims.

In the accompanying drawing is illustrated one complete example of the physical embodiment of the present invention constructed according to the best mode so far devised for the practical application of the principles thereof.

In the drawing:—

Figure 1 is an elevation of a fuse link constructed in accordance with one form of the present invention, the powder tube being shown in section.

Figure 2 is a longitudinal section taken on the line 2—2 of Figure 1.

Figure 3 is a transverse section taken on the line 3—3 of Figure 2.

Referring now more particularly to the accompanying drawing, the numeral 1 designates a fuse link of that type commonly known as a drop-out link, and comprising a fusible section 2 having end attaching terminals 3 secured thereto. Here it is to be understood that the end terminals 3 may be formed of the same material and integrally with the fusible section 2. However, when it is desired to reduce the resistance of the link, the separate terminals 3, formed from copper or other high conductive material of low resistance, are employed. In the present instance, the terminals 3 are provided with tongues 4, which pass through suitable openings in the ends of the fusible section 2, and are crimped over the same, the terminals being further soldered, or welded, to the ends of the fusible section 2, in order to secure the desired contact.

In a drop-out type of link, such as illustrated, the fusible section 2 is provided with one or more enlarged portions 5, having adjacent restricted potential fusing portions 6. Naturally, the greatest resistance in a fusing link occurs centrally of the ends of the link. However, in the type of link shown, the central portion 5, being of considerably greater area than the adjacent restricted portions 6, requires a greater period of time to become heated to the fusing point than the restricted portions, and hence fusing will occur at the restricted portions, causing the intermediate portion to drop out and prevent subsequent arcing, which occurs in links having only one potential fusing portion.

From the foregoing, it will be readily appreciated that a drop-out link of low capacity requires only two space restricted portions. However, in larger capacity fuses any number of restricted portions may be provided, such as illustrated in the present instance, and while a link of this type may fuse at only one point in instances of light overload and resultant slow heating of the link, in instances of a dead short the link will generally fuse at all of the restricted portions. It is further well known that a link of the foregoing type provides a time lag, inasmuch as the enlarged intermediate portions 5 absorb and conduct the heat away from the potential fusing portions, thus requiring a prolonged period of overload to effect fusing. However, the time lag thus acquired is not sufficient to be commercially practical, and, therefore, in order to increase the time lag, it is customary to attach additional metallic plates to the enlarged portions 5, with the result that the time lag is materially increased, but at the same time considerable additional metal is added to the link, and a greater amount is vola-

tilized upon fusing, thus increasing the explosive effect, which is not only detrimental to the fuse casing, but also creates a serious fire hazard. To meet this situation, commercial fuses now on the market are made of exceedingly heavy material, and require rigid attachment of the end caps to the casing, thus materially increasing the cost of manufacture.

To eliminate the foregoing objections, the present invention provides for the most practical commercial time lag by coating the intermediate portion of the link with any suitable non-metallic material 12, characterized by its ability to conduct heat, and at the same time act as an electrical non-conductor, and inasmuch as the material employed has greater conducting properties than absorption properties, the same rapidly conducts the heat from the enlarged portions 5, which in turn conduct the heat from the restricted potential fusing portion 6, and because of the relatively large area of contact between the coating and link, with resultant maximum radiating surface of the coating, a maximum time lag is obtained without affecting the short circuit characteristic of the link. While the coating 12 may be formed from various ingredients, one formula which has been found most satisfactory comprises a mixture of refractory cement, and either borax or sodium bicarbonate.

In forming the present link, a coating of plastic material is applied to the desired surfaces, leaving the edges free, inasmuch as actual tests have demonstrated that an arc shield is unnecessary in the present link. It has further been found that the amount or thickness of coating has practically little or no effect upon the time lag, inasmuch as the action that takes place is one of conducting the heat away from the link rather than absorption of the same. Therefore, little or no care or skill is required in applying the coating.

Attention is further directed to the fact that in applying coating in a plastic state, it inherently assumes the form illustrated in the drawing, in which the greatest thickness occurs at the center or hottest part of the surface coated, from which the coating tapers off to the edges of the link, with the result that a maximum desired conduction, and therefore uniform cooling of the coated areas, takes place.

In the form of the invention illustrated and described, only the intermediate enlarged areas of the link are coated, leaving the potential fusing portions free.

To further increase the time lag period, and at the same time quench the fusing arc, it is proposed to encase the intermediate fusible portion of the link in a suitable powdered material capable of breaking up and deionizing the arc, with resultant quenching of the same. Obviously, inasmuch as such powdered material must have some absorptive capacity, heat conducted away from the potential fusible portions by the enlarged coated portions will also be absorbed by the powder, resulting in further increasing the time lag inherent in the link itself.

Also, it has been found that by coating a fuse link of any type in the manner described, with material characterized by its ability to be broken up by the heat of the fusing arc, and produce a turbulent blast of neutral gases, such gases act to effectively de-ionize and quench the arc, which is desirable for reasons heretofore set forth.

One method by which the foregoing is accomplished resides in the provision of a fibrous tubular casing 7, the ends of which are reinforced by the metallic bands 8 inserted into the tube. Slotted end caps 8', which receive the terminals 3, are then crimped over the outer ends of the tube to provide a comparatively rigid and inexpensive housing for the quenching powder 9, with which the tube is filled before closing. To further obstruct the passage of gases from the cartridge thus formed, a layer of flocculent or fine comminuted material 11, such as asbestos or the like, is positioned at the ends of the tube surrounding the terminals adjacent the slots in the end caps 8'. To further secure the end caps 8' upon the tube 7, and also to prevent longitudinal shifting of the link within the cartridge, the terminals 3 may be provided with struck-out nibs 10 which engage the outer faces of the end caps.

From the foregoing explanation, considered in connection with the accompanying drawing, it will be readily seen that an exceedingly simple, inexpensive, and efficient fuse link has been provided, which affords a maximum practical time lag with a minimum quantity of metal, thus materially reducing detrimental effects of the fusing explosion upon the fuse shell, and eliminating entirely possible fire hazard.

We claim:—

1. A fuse link provided with spaced potential fusible portions and an enlarged intermediate area, the surface of the intermediate portion being coated with a material which is an electrical non-conductor, and at the same time a heat conductor, the thickness of the coating being gradually reduced to nothing toward the edges of the coated area.

2. A fuse link having a potential fusing section, a portion of which is coated with a non-conducting material, said coating being gradually reduced toward the edges of the coated area so as to expose the edge of the fusible link.

3. A fuse link having spaced intermediate portions of uniform cross section coated with a non-metallic substance, the coating being gradually reduced in thickness toward the edges of the coated area so as to expose the edges of the fusible link.

4. A fuse link comprising intermediate its terminals a series of coated areas, the coated portions being of substantially uniform cross section, and the coating being gradually reduced in thickness to nothing toward the edges of the coating.

5. A fuse link comprising spaced potential fusible portions and an enlarged intermediate section therebetween, said intermediate section being coated with a non-metallic material and being gradually reduced toward the edges of the coated area so as to expose the edges of the link.

6. A fuse link comprising spaced potential fuse sections and an enlarged intermediate section therebetween having a series of non-metallic coated areas of substantial uniform cross section intermediate its terminals, the coating being gradually reduced toward the edges of the coated area so as to expose the edges of the link.

7. A fuse link comprising a series of potential fusible sections and a plurality of enlarged intermediate sections being coated with a non-conducting material, said coating being gradually reduced toward the edges of the coated area so as to expose the edges of the fusible link.

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