Jan. 21, 1936. F. C. LA MAR 2,028,721

FUSIBLE LINK

Filed July 2, 1934

Fig. 1.

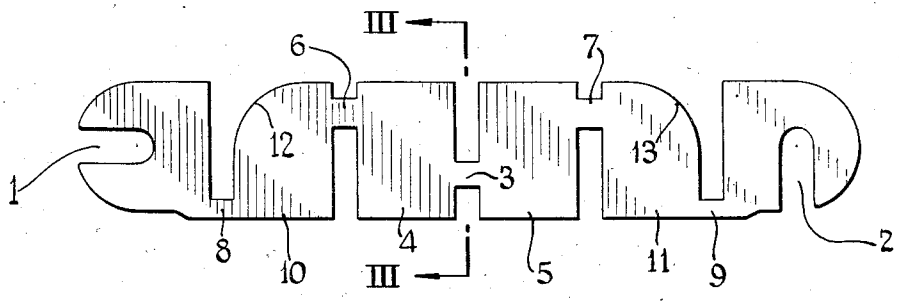


Fig. 2.

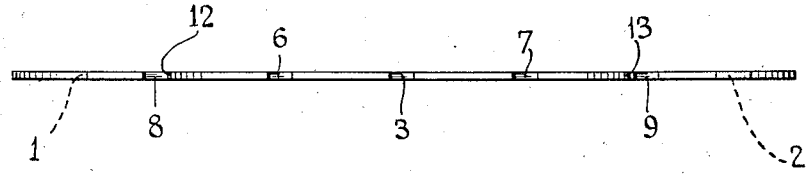
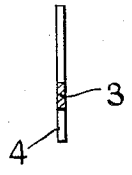


Fig. 3.



INVENTOR
Frank C. La Mar
BY
Lyman E. Dodge
ATTORNEY

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FUSIBLE LINK

Frank C. La Mar, New York, N. Y., assignor to Great Western Fuse Company, New York, N. Y., a corporation of Delaware

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7 Claims. (Cl. 200—135)

This invention relates to electrical devices, especially to those electrical devices used for interrupting an electric circuit upon an abnormal flow of current therein, commonly known as cartridge fuses, and more particularly to the fusible link employed therein.

It is well known to those skilled in the fuse art that the fusible links commonly used as fuses are defective in that they will not endure for a short time without melting, a flow of current substantially above their rated capacity. This is objectionable because the apparatus and conductors which the fusible link protects are not injured by the flow for a short time of current substantially above the rated capacity of the fuse.

It is also well known to those skilled in the fuse art that if the well known type of so called "drop out" links are used which are formed with a reduced cross-section at either end thereof, the link will melt upon a flow for a short time of a substantial overload, but will be melted not at the portions of reduced cross-section but at the very center of the link where the cross-section is generally greatest.

In my prior application, Serial No. 708,025, filed January 24, 1934, I have illustrated, described and claimed a fusible link so constructed that it melts at mid-point upon the flow of current amounting to a 50% overload or normal rated capacity, that is, upon the flow of 150% current, but when a flow of current amounting to 150% overload, that is a 250% current flows, the link will fuse at both ends and act exactly like a drop out link, that is, the intermediate portion will drop out and not be volatilized.

The fusible link of the present application embodies several novel features of the fusible link of the prior application referred to, and in addition has as a principal object the production of a fusible link which will melt at the center thereof upon flow of 150% current; melt at two points intermediate the ends and act as a drop out link upon the flow of 250% current; and melt at the two ends adjacent the usual contacts and act as a drop out link upon a dead short circuit.

A further object of the invention is a construction such that upon a dead short circuit the drop out section will not be likely to again form a complete circuit between the two ends after it has once been severed.

Other objects and advantages will appear as the description of the particular physical embodiment selected to illustrate the invention progresses, and the novel features will be particularly pointed out in the appended claims.

In describing the invention in detail and the particular physical embodiment selected to illustrate the invention, reference will be had to the accompanying drawing and the several views thereon, in which like characters of reference designate like parts throughout the several views, and in which:

Figure 1 is a plan view of a fusible link embodying applicant's invention; Fig. 2 is an edge view of the device as shown by Fig. 1; Fig. 3 is a vertical cross-sectional view of the device as shown by Fig. 1 on the plane indicated by the line III—III of Fig. 1, viewed in the direction of the arrows at the ends of the line.

The fusible link, illustrated by Fig. 1, is preferably constructed of a metal having a melting point rather low as the heavy metals go. It is preferably constructed of zinc, although at times it well may be constructed of aluminium.

The thickness of the fusible link depends both upon the material thereof and the normal rated capacity in amperes of the fuse link. The fuse link illustrated in Fig. 1 is what is known in the trade as a 200 ampere 600 volt fuse link, that is, it is designed to be used in a circuit with a difference of potential of 600 volts and is rated to indefinitely carry 200 amperes of current. This particular link if made of zinc would have a thickness of about 0.1 of an inch.

The link, as usual, is formed with slots as 1 and 2 to facilitate the attachment in the circuit which is to be protected.

In order to have the link function as desired applicant makes a reduced section 3 at mid-point of the link. This reduced section 3 is made of such width that it will melt upon a flow of current through the link from the contact at 1 to the contact at 2 of 150% of rated capacity, that is, 300 amperes. The width of the reduced cross-section 3 must be arrived at by experiment as it depends upon a multitude of factors, chief of which are the size and heat storage capacity of the rectangular sections 4 and 5 adjacent the reduced section 3.

Applicant also forms the reduced cross-sections 6 and 7. These cross-sections are of equal width and are so designed that upon the flow of 250% current, that is, upon the flow of 500 amperes the sections 6 and 7 will both melt and the rectangular portions 4 and 5 will drop out thereby functioning exactly like the well known drop out link.

Applicant also forms the reduced cross-sec-

tions 8 and 9 adjacent the ends or terminal portions. These reduced cross-sections are of such width that they will melt upon the occurrence of a dead short circuit and the entire intermediate portion including the somewhat rectangular members 10 and 11 and the rectangular portions 4 and 5 will drop out.

The widths of both the reduced sections 6 and 7 and the reduced sections 8 and 9 will be found by experiment just as the width of the reduced section 3 is found because there seems to be no general rule by which these may be precisely calculated beforehand although those familiar with a fusible link of this construction, by cutting and trying, very soon arrive at the proper dimensions.

When a dead short circuit occurs and the reduced sections 8 and 9 are melted the entire intermediate section falls out, but as it may be thrown somewhat by the violence of the current it is likely to get positioned diagonally between the ends and so form a path from end to end which would result in a great deal more metal being volatilized and the circuit continued for an undesirable time. In order to obviate this, applicant rounds the sections 10 and 11 as at 12 and 13 respectively thereby greatly lessening the likelihood of the intermediate portion of the link getting positioned diagonally between the ends and completing a circuit after once having been severed at the points 8 and 9.

It is to be further understood that applicant's end blowing points or reduced sections 8 and 9 are both positioned adjacent the same edge of the fusible link so that the intermediate portion comprising the rectangular members 10 and 11 and the rectangular members 4 and 5 is in fact eccentrically pivoted so that practically the full weight of the intermediate section acts as a lever to twist the material of the sections 8 and 9 as they are being heated by the current and thereby causes the intermediate section to be as great a distance as possible outside of the plane of the ends when the final severance at 8 and 9 takes place so that there is still less likelihood for the intermediate section to re-establish the circuit between the ends.

The eccentric pivoting of tht drop out section is also applied to the drop out section which is displaced upon the flow of 250% current, that is, the section composed of rectangles 4 and 5 is eccentrically supported by the reduced sections 6 and 7 so that when these sections are softened the intermediate members 4 and 5 twist the material of the reduced sections 6 and 7 so that at the time the actual melting takes place the drop out portion has moved somewhat out of the main plane of the link so that there is less likelihood for it to get diagonally positioned between the somewhat rectangular members 10 and 11 and so again complete the circuit which has been broken.

It is to be understood that the fusible link of applicant's invention is also useful when used independently of a containing cartridge.

Although I have particularly described one particular physical embodiment of my invention and explained the operation, construction and principal thereof, nevertheless, I desire to have it understood that the form selected is merely illustrative, but does not exhaust the possible physical embodiments of the idea of means underlying my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A fusible link formed of metal, in thickness varying with the normal rated capacity; and provided with means for attachment in an electric circuit to be protected; substantially rectangular in general form; and formed with a first substantially reduced section about midway of the length; second reduced sections, one on each side of the first reduced section, and separated therefrom by substantially rectangular sections of comparatively much greater cross-section; third reduced sections, one on each side of each of the second reduced sections, and separated therefrom by substantially rectangular sections of comparatively much greater cross-section, said last named sections each having one corner substantially rounded whereby it is prevented from coming in contact with the adjacent end, and the second and third reduced sections being out of alignment with each other and with the first reduced section.

2. A fusible link formed of metal, in thickness varying with the normal rated capacity; and provided with means for attachment in an electric circuit to be protected; substantially rectangular in general form; and formed with a first substantially reduced section about midway of the length; second reduced sections, one on each side of the first reduced section, and separated therefrom by substantially rectangular sections of comparateively much greater cross-section; third reduced sections, one on each side of each of the second reduced sections, and separated therefrom by substantially rectangular sections of comparatively much greater cross-section, said last named sections each having one corner substantially rounded whereby it is prevented from coming in contact with the adjacent end; the size of the reduced cross-section being in the order from smallest to largest of third, first, and second.

3. A fusible link formed of metal, in thickness varying with the normal rated capacity; and provided with means for attachment in an electric circuit to be protected; substantially rectangular in general form; a plurality of reduced cross-sections formed along the length of the link, separated by substantially rectangular plates of comparatively much greater cross-section than the reduced sections, said reduced sections being of such cross-section and length that upon the flow of a dead short circuit current through the link the end reduced cross-sections are melted and the entire intermediate portion between drops out, and upon a flow of current of 250 percentum of the value of the rated capacity of the link two separated intermediate reduced sections are melted and the section therebetween drops out, and upon a flow of current of 150 percentum of the value of the rated capacity of the link a single reduced section substantially midway of the ends of the link melts, runs, and interrupts current flow.

4. A fusible link formed of metal, in thickness varying with the normal rated capacity; and provided with means at each end for attachment in an electric circuit to be protected; substantially rectangular in general form; two reduced cross-sections, one adjacent one of the means for attachment, and the other adjacent the other means for attachment, each reduced cross-sections, being positioned to one side of the longitudinal axis whereby when the reduced cross-sections are softened by excessive current the portion intermediate thereof by its weight tends

to pivot upon the cross-section to move out of the general plane of the link.

5. A fusible link formed of metal, in thickness varying with the normal rated capacity; and provided with means at each end for attachment in an electric circuit to be protected; substantially rectangular in general form; two reduced cross-sections, one adjacent one of the means for attachment, and the other adjacent the other means for attachment, each reduced cross-section being positioned to one side of the longitudinal axis whereby when the reduced cross-sections are softened by excessive current the portion intermediate thereof by its weight tends to pivot upon the cross-sections to move out of the general plane of the link; and a second set, comprising two, of reduced cross-sections, each positioned a substantial distance from the longitudinal center of the link, and each positioned to the same one side of the longitudinal center, but on the other side therefrom from the first mentioned reduced cross-sections whereby upon the flow of a predetermined excessive current the second set of reduced cross-sections will soften and the section intermediate thereof will turn upon them as a pivot and move out of the general plane of the link.

6. A fusible link formed of metal, in thickness varying with the normal rated capacity; and provided with means at each end for attachment in an electric circuit to be protected; substantially rectangular in form; a plurality of reduced cross-sections between the ends, one pair having one positioned adjacent one end and the other positioned adjacent the other end, being positioned on one side of the longitudinal axis; another pair, each positioned between the longitudinal center and an end reduced section, and both positioned on the other side of the longitudinal axis from the first mentioned pair; and a single reduced cross-section substantially at the longitudinal center of the link but positioned to one side of the longitudinal center and on the same side as the first mentioned pair such reduced sections being of such cross-section and length that a flow of current of 150 percentum of the value of the rated capacity will cause the single central section to fuse, a flow of current of 250 percentum of the value of rated capacity will cause the pair on the other side of the longitudinal axis from the first mentioned pair to melt, and a flow of current caused by the dead short circuit will cause the first mentioned pair of reduced sections to melt, and whereby when either the first or the second pair of reduced cross-sections melts, the section intermediate thereto will pivot thereon so as to move out of the general plane of the link.

7. A fusible link formed of metal, in thickness varying with the normal rated capacity; and provided with means for attachment in an electric circuit to be protected; substantially rectangular in general form; and formed with a first substantially reduced section about midway of the length; second reduced sections, one on each side of the first reduced section, and separated therefrom by substantially rectangular sections of comparatively much greater cross-section; third reduced sections, one on each side of each of the second reduced sections, and separated therefrom by substantially rectangular sections of comparatively much greater cross-section, said last named sections each having one corner substantially rounded whereby it is prevented from coming in contact with the adjacent end, and the second and third reduced sections being out of alignment with each other and with the first reduced section and the second section toward one side edge and the third toward the other side edge of the link.

FRANK C. LA MAR.