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W. T. CLARK

1,856,317

FUSIBLE ELEMENT FOR PROTECTING ELECTRICAL CIRCUITS

Filed May 22, 1930

Fig. 3

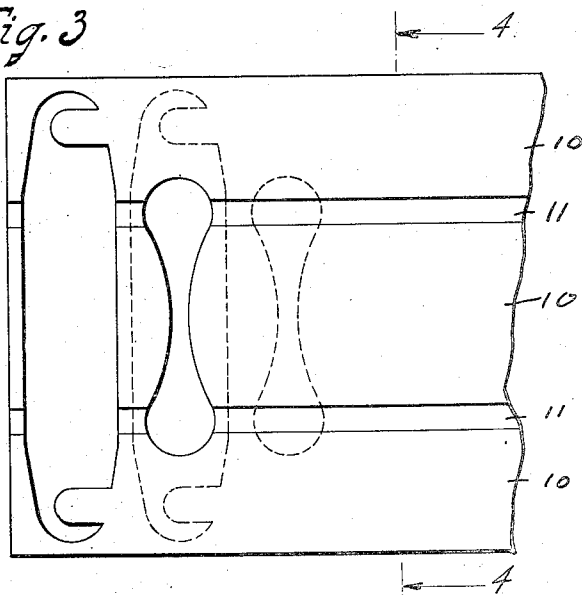


Fig. 4

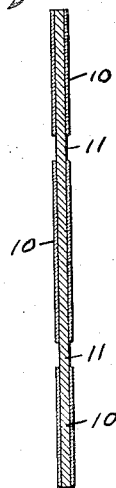


Fig. 1

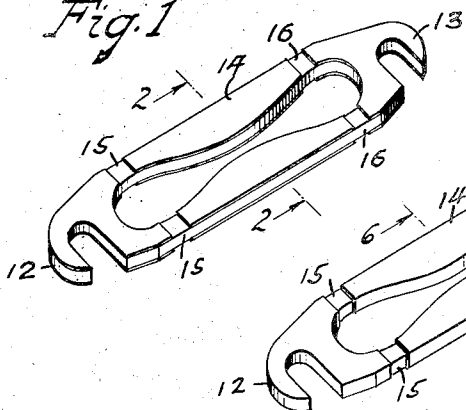


Fig. 5

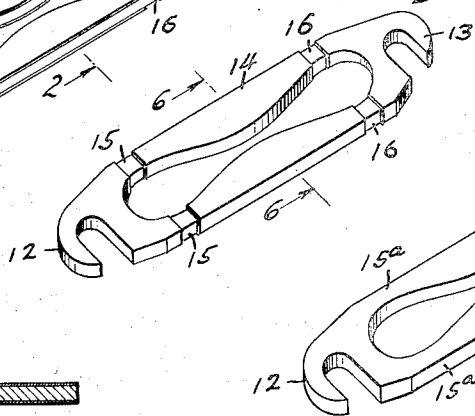


Fig. 2



Fig. 7

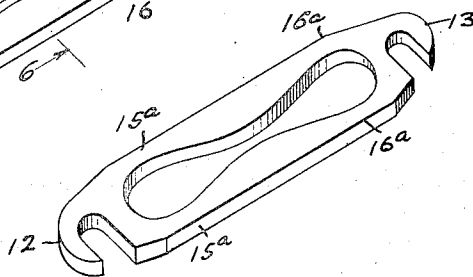


Fig. 6



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FUSIBLE ELEMENT FOR PROTECTING ELECTRICAL CIRCUITS

Application filed May 22, 1930. Serial No. 454,537.

The invention relates to fusible links or other elements adapted to conduct an electrical current, and it resides in a novel construction of fusible link by means of which a current of electricity is conducted from one point to another in a more efficient manner. A link embodying the invention is composed of a plurality of linearly extending conductors, each possessing electrical and physical properties which differ from the like properties possessed by the other, the differing conductors being bonded or otherwise united or joined together into a bi-metallic integral structure by any of the several processes available for such purpose.

value of conductance of the secondary coating in the novel link, contributes to the maintenance of a minimum temperature caused by the flow of any given quantity of electrical current through the fusible link inasmuch as the electric current always follows the path of least resistance.

In the foregoing, I have outlined the nature and purpose of my invention, and will now proceed to describe the same specifically. The novelty residing in the invention will be pointed out in the appended claims.

In the accompanying drawings:

Figure 1 is a perspective view of one form of link constructed in accordance with my invention;

Fig. 2 is a sectional view on the line 2—2, Fig. 1, of the link shown in Fig. 1.

Fig. 3 is a plan view of a sheet of metal having a low melting point characteristic, preferably zinc, having bands formed by the electro-deposition of copper on the sides thereof for the purposes of the invention as will later be described.

Fig. 4 is a sectional view on the line 4—4, Fig. 1.

Fig. 5 is a perspective view similar to Fig. 1, showing a modified form of the link.

Fig. 6 is a sectional view on the transverse line 6—6, Fig. 5.

Fig. 7 is a view similar to Figs. 1 and 5, showing a further modification.

I have illustrated my invention as composed of a strip of metal having a low melting point characteristic and low conductivity, to which is bonded one or more metallic layers having a high melting point characteristic and high conductivity, and my invention contemplates the joining or union of the metals of different electrical and physical properties by any suitable process, as by electro-deposition, welding, soldering, rolling or otherwise, by any means known in the art, to constitute a bi-metallic integral structure of fusible link, in accordance with the purposes of my invention.

Fig. 3 shows a metal sheet, preferably of zinc, on the opposite sides of which are bands of copper, placed thereon it may be by electro-deposition, and separated from each other

In constructing my improved link, a suitably contoured member having a low melting point characteristic is selected as the basic or primary element of the conductor, and with this is combined one or more secondary conductors in which the characteristics of the basic or primary conductor are so varied as to constitute the secondary conductor as one of high electrical conducting characteristics, and thus produce a fusible link having an electric path of highly conductive nature and also a path of least resistance to the passage of the electrical current, but retaining the low melting point characteristic through which the fuse may function in disrupting an electric circuit due to an excess current above that at which the element is rated, to avoid damage.

In a simple form, and as an instance of practical construction, the invention may be embodied in a strip of zinc reduced in width intermediate its ends as the basic or primary element, to which may be applied an electro-deposit or coating of copper as a secondary element. In all of its forms, added mechanical strength is imparted to the link by the shell-like coating of metal of higher tensile strength, and there results a reduction in resistance losses inherent to all electric circuits having low conductive paths.

The electro-deposit or coating of copper insures a copper-to-copper contact with the copper knife blades or other terminals to which the ends of the fusible link are connected in its practical application. The high

by exposed or bare lines 11 of the zinc sheet, so as to provide marginal bands and an intermediate band or a plurality of intermediate bands.

The sheet thus prepared is passed between the dies of a blanking press, the action of which is to punch out the links from the sheet, preferably in the novel form shown.

The blanking die is composed of two punches, one for the purpose of producing the elongated perforation having an outline resembling somewhat a flattened ellipse. When the sheet is fed into the press, the first operation makes the perforation referred to, at the leading end of the sheet. The second punch is for the purpose of imparting the desired exterior contour to the link, and completes the blanking of the latter and its detachment from the sheet. The first operation in which only the perforation of a link is effected, is followed by a joint operation in which the elongated perforation of the next or second link is effected at the time that the leading or first link is contoured and separated from the sheet. The full lines in Fig. 3 show the results of the first complete operation, while the dotted lines show what will be the result of the second complete operation. From this, the succession which follows the step-by-step feeding movement of the sheet into the blanking press will be apparent.

In effecting the electro-deposit of the copper bands 10 upon the metal sheet, as shown in Fig. 3, in the production of the link shown in Figs. 1 and 7, suitable dams will be applied to the sheet in such positions as will serve to completely cover the lines 11 of the plate which are not to receive the deposited coating, and so form the bare spaces separating the bands.

The complete link is shown in Fig. 1, it having ends 12 and 13, an intermediate portion 14 composed of two parts separated by the elongated perforation, and contracted or narrowed in the direction of its width to form neck portions 15 and 16 at each longitudinal edge of the link, connecting respectively the said ends and the longitudinally divided intermediate portion. The ends 12 and 13 and the intermediate portion 14, are coated upon their sides with an electro-deposit of copper, while the necks 15 and 16 are uncoated.

The copper coated ends of the fusible link provide for a copper-to-copper contact with the terminals of the circuit in which the link is used, and thus a good electrical connection is insured. The high electrical conducting characteristic of the copper creates a path of lesser resistance for the flow of the current in traversing the link, and this action decreases the resistance losses and tends to the maintenance of a lower temperature in the restricted current passages of the link. The uncoated necks 15 and 16 of the fusible link,

by reason of their low melting point characteristic, are immediately responsive to a rush of current above that for which they are rated, and by reason of their reduced cross-sectional areas will create a minimum volume of gases, when blown.

Figs. 5 and 6 show a link blanked from an uncoated sheet of zinc, in the manner before described, and then completely coated with an electro-deposit of copper, except as to the narrowed or contracted and reduced widthwise neck portions 15 and 16, which will be dammed to prevent such deposit. The complete coating forms an enclosing copper shell, which has a greater tensile strength than the zinc body which it entirely surrounds except for the contracted or reduced neck portions 15 and 16.

Fig. 7 illustrates a further modification of my invention, in a manner which I have found imparts to it some important adaptations when used in connection with electric currents carrying momentary overloads, which are attendant upon industrial power circuits. In this construction, the fusible link element is blanked from an uncoated sheet of low melting point characteristic, as before described, and is then completely and entirely surfaced with an electro-deposit of copper, or metallic layer otherwise applied, having a relatively higher electrical conductivity and a higher melting point characteristic. This layer forms a shell which completely encloses the basic element. Whenever in use a momentary rush of current in excess of that for which the link is rated occurs, the temperature at the narrowed or contracted and restricted widthwise portions 15^a and 15^b of the link, is raised to and above a point which is necessary to liquefy the basic element at such restricted widthwise portions, the latter become fluid momentarily. The enclosing shell of copper, being of a higher melting point characteristic than that at which the basic element liquefies, serves to confine and maintain the form of such element, notwithstanding its molten condition. In the restoration of the circuit to its normal operating condition, the temperature in the link decreases, and the molten metal at the restricted portions quickly solidifies, and again assumes its normal state, unimpaired, and in condition for further service. If the excess of current be maintained for a period of longer duration than that attending a momentary overload, the fusible link will flow at the reduced portions and function in a normal manner to open the circuit.

Having thus described my invention, what I claim and desire to secure by Letters Patent of the United States, is:

1. A fusible link comprising a flat strip of low melting point characteristic and narrowed between its ends, and having upon its

sides, except at the narrowed portion, a coating of copper to provide high electrical conductivity and afford a copper-to-copper contact with the terminals of the circuit in which the link is disposed.

5 2. A fusible link comprising a flat strip of low melting point characteristic, the said strip being provided with a perforation contracted at points and then widened to form
10 narrowed portions in the link, the said link having upon its sides, except at the narrowed portions, a coating of copper to provide high electrical conductivity and afford a copper-to-copper contact with the terminals of an
15 electric circuit.

3. A fusible link comprising a flat strip of low melting point characteristic, the said strip being provided with an elongated perforation contracted at points intermediate its
20 length and then widened to form narrowed portions in the link, the said link having upon its sides, except at the narrowed portions, a coating of copper to provide high electrical conductivity and afford a copper-to-copper
25 contact with the terminals of an electric circuit.

In testimony whereof, I have signed my name at Milwaukee, this 17th day of May, 1930.

WM. T. CLARK.

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