May 17, 1927. 1,629,266

F. A. FELDKAMP

FUSE MEDIUM

Filed April 4, 1923

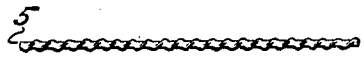


Fig. 1

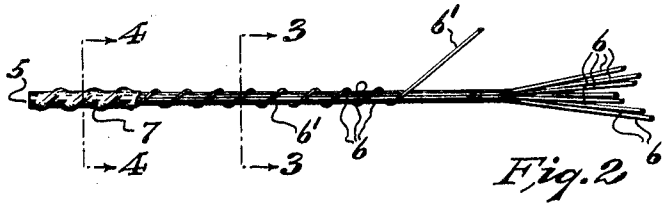


Fig. 2

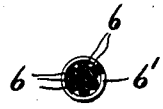


Fig. 3

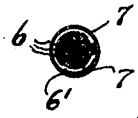


Fig. 4

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UNITED STATES PATENT OFFICE.

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FUSE MEDIUM.

Application filed April 4, 1923. Serial No. 629,808.

This invention relates to improvements in electrical fuse mediums; and the invention has reference, more particularly, to further improvements in fuse mediums of the general kind or type disclosed in my prior United States Letters Patent No. 1,473,284, dated Nov. 6th, 1923.

In said above referred to patent, I described a fuse element consisting of a main body of high conductivity but also of high melting point (e. g. copper), surrounded at intervals by portions of another fusible metal or metallic alloy possessing a comparatively low melting point (e. g. cadmium, tin, antimony or other suitable easily fusible metal or alloys thereof), the latter being adapted under heat to form with the main body a new alloy at comparatively low temperature effecting a lowering of the melting point of the main body, whereby the latter would "blow" at a considerably lower temperature than would be the case if its normal comparatively high melting point was maintained. Experience has shown that this type or kind of fuse medium works satisfactorily in all sizes, provided the quantity of the applied easily fusible metal or metallic alloy is in proper proportion to the mass of main fuse body to be acted upon. All fuse elements of this type or kind possess a very pronounced ability to sustain considerable overloads without "blowing" within an undesirable time limit, and at the same time they respond well to the rules, regulations and requirements of the Board of Fire Underwriters. While fuse elements of this kind under a one hundred and ten per cent load are permitted a temperature rise, under underwriters' rules not to exceed 70 degrees C., above a normal temperature of 24 degrees C., it is nevertheless desirable to dimension the fuse element for as low a temperature rise as possible; and this may be accomplished by increasing the cross sectional area of the same if it can be done, without entailing undue increase over the required "blowing" time limit for fifty per cent overloads. Ordinarily the larger the cross sectional area of the main body or high conductive member of the fuse element, the slower will be the temperature rise, and the higher will be the overload capacity, but, on the other hand, the longer it will take to reach the "blowing" point under a fifty per cent overload. Since, however, the required maximum time for "blowing" is fixed by the regulation of the Board of Fire Underwriters, it might occur that an otherwise excellent fuse, possessing a maximum desired cross-sectional area, would be likely to exceed the allowed maximum time limit for "blowing" under fifty per cent overloads; and if the apparent remedy of decreasing the cross sectional area of the main body or high conductive member of the fuse was employed, the result would be a return to a higher and quicker temperature rise to "blowing" point, and a consequent lowering of the desired overload capacity. Another factor which militates against increasing the cross sectional area of the single main body or high conductive member of composite fuse mediums of the kind herein considered is the fact that if such increase is made, the active or easily fusible metal or metallic alloy must penetrate the main body or high conductive member for a greater distance in order to produce the resultant alloy of lower melting point, which is again a time consuming factor.

It is the object of this invention therefore to provide a composite fuse medium, of the general kind above discussed, which will permit of a considerable variation in the rating thereof, while permitting the employment of a maximum cross sectional area in the main high conductive member thereof, without delaying the "blowing" time beyond the time limit allowed under a fifty per cent overload. In attaining this object I have discovered that a very efficient main body or high conductive member of maximum cross sectional area is provided by a plurality of unit wires or strands (e. g. of copper, brass or combinations thereof) of individually comparatively small diameters (e. g. .006 of an inch more or less), which may be twisted together or held together in substantially parallel longitudinal relation by a binding wire engaged around the same. The main body or high conductive member thus formed is coated with the easily fusible metal or metallic alloy (e. g. cadmium, tin, antimony or alloys thereof), such coating penetrating the interstices intermediate the wires or strands so as to intimately unite with the surfaces thereof,

and to be thus so related to the latter as to combine therewith under heat, to form the resultant alloy of lower melting point, and to thus permit a comparatively low "blowing" temperature to be effective upon the fuse element in operation. Another advantage of my improved fuse element, employing a main element comprising a plurality of fine wires or strands as compared with a solid integral main element of comparatively large cross-sectional diameter, is that the applied coating of low melting point metal when applied to the latter type of main element tends to produce a quantity ratio between high melting point metal and low melting point metal which is too low as to the latter, and consequently is unfavorable in obtaining the alloying action desired, whereas when the former type of main element consisting of the plurality of fine wires or strands are bulked together and each of which is coated by said low melting point metal, to say nothing of the additional amount of the latter metal filling the interstices therebetween, it follows that the quantity ratio between the high melting point metal and the low melting point metal is increased as to the latter, and therefore a more efficient and uniform alloying action is obtained.

Another advantage of the novel fuse element, in which the main element of high melting point metal consists of a plurality of fine wires or strands, is that the rating or amperage thereof may be easily varied as desired by merely reducing or increasing the number of such wires or strands employed, or by increasing or decreasing within reasonable limits the size of the base wire. For example, a base wire (i. e. a wire of selected gauge or cross sectional diameter) may be employed for all types and sizes of fuses, the variation of rating or amperage being obtained by using a greater or lesser number of the same in making up the main element of the fuse; or a base wire of one gauge or cross sectional diameter may be used in plurality to make up one rating or amperage and another base wire of greater or lesser gauge or cross sectional diameter may be used in plurality to produce another rating or amperage; in either case, however, always employing a plurality of comparatively fine wires or strands.

Referring now to the accompanying drawings, the novel fuse element made according to and embodying the principles of the present invention is clearly illustrated therein. In said drawings, Figure 1 is a side elevation of the complete composite fuse element ready for use; Figure 2 is a similar view drawn on an enlarged scale, but with portions shown broken away to illustrate the different elements of the composite fuse and the manner of assembling the same together; Figure 3 is a cross section, taken on line 3—3 in said Figure 2, but drawn on an enlarged scale; and Figure 4 is another cross section, taken on line 4—4 in said Figure 2, and also drawn on an enlarged scale.

Similar characters of reference are employed in all of the above described views, to indicate corresponding parts.

Referring now to the drawings, the reference character 5 indicates the complete composite fuse made according to and embodying the principles of this invention. Said novel composite fuse comprises a main element consisting of a plurality of comparatively fine metallic wires or strands 6, which are of a metal possessing high specific conductivity but of comparatively high melting point; metals such as copper, brass or combinations thereof serve the purpose effectively. Said wires or strands 6 are bunched together so as to group themselves longitudinally, and the same may be held together in such grouped relation by twisting the same together, or by binding the same together by convolving one of the group about the rest, in the manner illustrated by the convolved wire 6′ in Figure 2. After the plurality of wires or strands 6 are thus grouped together, the same are dipped or otherwise coated with a mass of low melting point metal 7 having the property of readily alloying with the copper or brass wires or strands 6 and 6′ of the main element at comparatively low temperatures when intimately united with the surfaces of the latter; low melting point metals such as cadmium, tin, antimony or alloys thereof will serve the purpose effectively.

It will be observed that the coating of low melting point metal 7 will not only penetrate the interstices of the group of wires or strands 6 so as to coat and unite with the surfaces of the individual wires or strands, but will also fill such interstices so as to produce a comparatively larger quantity ratio between the low melting point and high melting point metals than is practical to produce by coating a single wire of the latter metal with the former metal.

When the binding wire or strand 6′ is employed, the spaced convolutions thereof surrounding the outer surfaces of the group of wires or strands 6 form pockets, which tend to hold the low melting point metal by surface tension, when the latter metal is fluxed during the operation of the fuse, and consequently the risk of losing the alloying effect of the low melting point metal by the dropping away of fluxed portions thereof is practically eliminated.

The composite fuse made according to this invention operates substantially in the same manner as set forth in connection with the generic type of fuse described in my above mentioned prior Letters Patent, and pro-

duces a time lag fuse possessing all the advantages of said generic type of fuse, with the additional advantages that the rating and amperage of the same may be easily varied when making up the same.

Other advantages incident to the construction of composite fuse made according to the present invention are that the necessity of providing many different sizes of drawing dies for drawing different sizes of single main wire elements to correspond to the various ratings or amperages required is abolished, since the number of such dies required may be reduced to correspond to the base wire or wires employed; and, furthermore, the construction of the main element in the form of a plurality of wires or strands permits of passing the element through molten low melting point metal by practically a dipping method, thus saving considerable time and labor, while nevertheless producing a very uniform product easily cut into desired lengths required for individual fuses; all of which advantages tend to permit the most efficient production methods when manufacturing the fuses in quantity.

I claim:—

An electric fuse medium comprising a main element consisting of a plurality of comparatively fine metallic wires of high specific conductivity and comparatively high melting point disposed in longitudinally grouped arrangement, said main element having in enveloping relationship therewith a body of metallic material which under normal temperature is inactive and under higher temperature combines with the metal of said wires to form therewith an alloy of lower melting point, said wires being arranged to form pockets for said body of metallic material, whereby the net effect of surface tension under conditions of fusion is relatively great, said coating being so intimately associated with said fine metallic wires that upon the attainment of said higher temperature a comparatively high proportion of said enveloping metal combines with said metallic wires to form said alloy.

In testimony, that I claim the invention set forth above I have hereunto set my hand this 29th day of March, 1923.

FREDERICK A. FELDKAMP.