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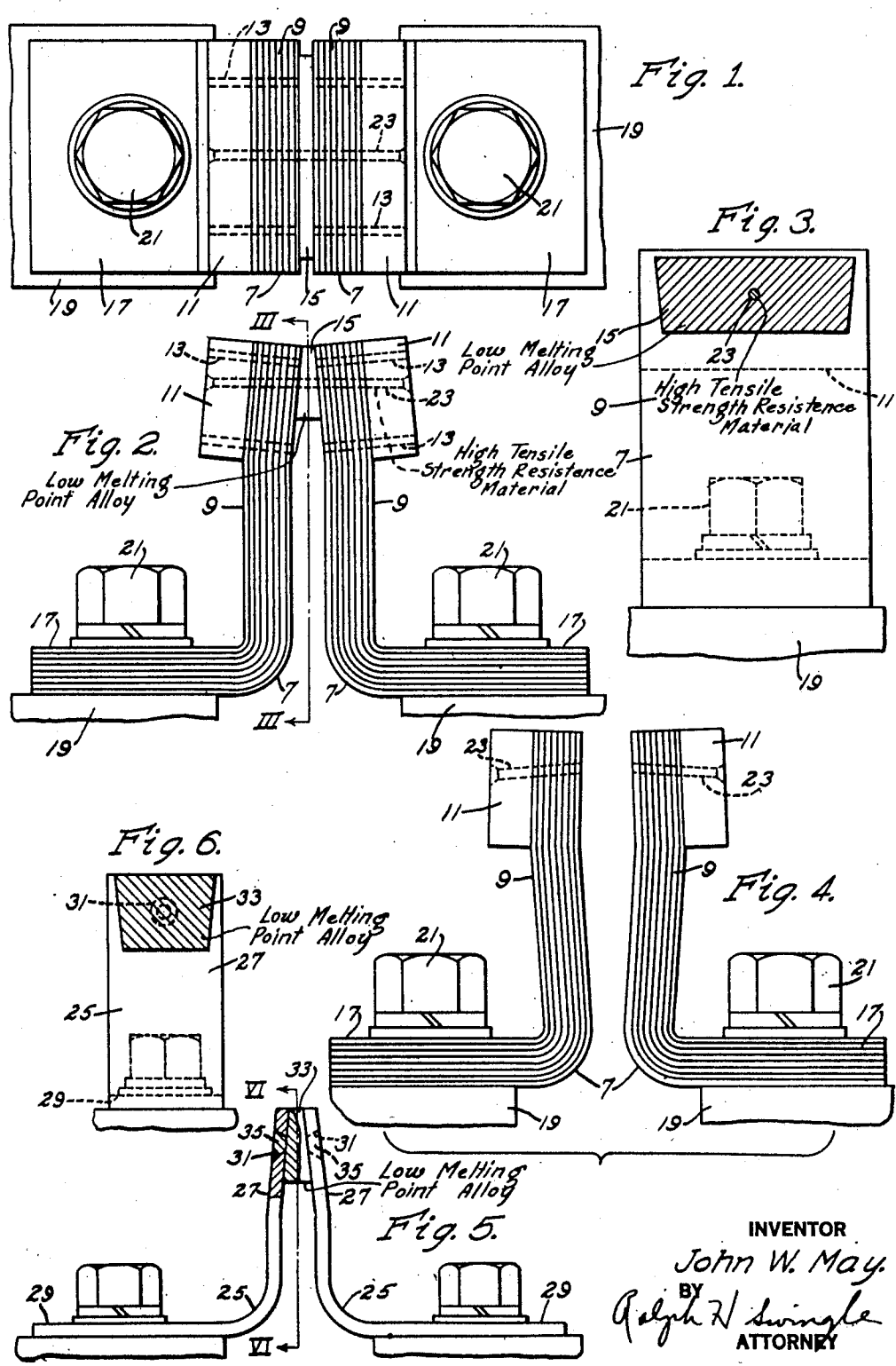
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FUSE CONSTRUCTION
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FUSE CONSTRUCTION

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This invention relates to improvements in fuse constructions, and more particularly to fuse devices adapted for service in low-voltage high-current circuits. Although the fuse construction of my invention may be used in a variety of ways, it is especially well adapted for back-up protection for circuit breakers in low-voltage electrical networks. A fuse device in this type of service must have a high current-carrying capacity and an operating characteristic which is well under the transformer short-time rating but above the relay operating time of the connected circuit breaker. In order to meet these requirements, a low melting point alloy fuse has been proposed which embodies a pair of conducting members normally held united by a low melting point alloy, preferably a eutectic combination, but biased to separate in order to insure positive operation when the alloy melts in response to overload. This structure, however, presents a serious difficulty in that the bond between the alloy and the conducting members gradually weakens with age and continued heating under normal service conditions, thereby causing the conducting members to be pulled away from the fusible alloy and thus produce a false operation.

The principal object of my invention is to provide an improved fuse device of the type above described, which is more positive in action than devices heretofore known, and which eliminates false operations under normal conditions of load.

A more specific object of my invention is the provision of means in a fuse device of the type above-mentioned for relieving the tensile load upon the low melting point alloy without impairing the operating characteristic of the fuse.

Further objects and advantages relate to the structural parts of the fuse device and the arrangement thereof, and will appear more fully in the following description when taken in connection with the accompanying drawing, in which:

Figure 1 is a plan view of the fuse device of my invention;

Fig. 2 is a side elevation view of the fuse device shown in Fig. 1;

Fig. 3 is a sectional view of the fuse device taken along the line III—III of Fig. 2;

Fig. 4 is a side elevation view of the fuse device showing the relative position of the elements following a fuse operation;

Fig. 5 is a side elevation view of a modified form of a fuse device adapted for lower current ranges; and

Fig. 6 is a sectional view of the fuse device of

Fig. 5 taken along the line VI—VI of that figure.

Referring to the drawing, the reference numeral 7 designates a pair of angular current-carrying members preferably formed of laminated resilient conducting material such as copper or phosphor bronze. The current-carrying members 7 have upstanding leg portions 9 which are normally disposed in substantially parallel relation with respect to each other. The laminations of the leg portions 9 are preferably rigidly held together and secured to blocks of conducting material 11 by a plurality of rivets 13 extending transversely therethrough.

The upper ends of the leg portions 9 are joined to each other by a block 15 of low melting point alloy, preferably a eutectic combination. By way of example, the following combinations have been found suitable:

	Per cent
20 Bismuth -----	54
Tin -----	26
Cadmium -----	20
Bismuth -----	58
25 Lead -----	42
Lead -----	32
Tin -----	50
Cadmium -----	18
30 Lead -----	37
Tin -----	63

The alloy block 15 is preferably united to the leg portions 9 in the molten state and may be cast when the current-carrying members 7 are being held in a suitable mold.

The current-carrying members 7 are also provided with laterally extending legs 17 which serve as terminals for clamping the fuse device to a suitable support or bus structure. In this particular instance, the lateral legs 17 are shown clamped to a pair of spaced bus bars 19 by means of bolts 21 passing through the leg portions 17 and making threading engagement with the bus bars 19 in a well-known manner.

The leg portions 9 and 17 of each of the current-carrying members 7 are preferably formed so that they make an angle somewhat less than 90° with respect to each other. This relationship is more clearly shown in Fig. 4. Thus when the terminal legs 17 are clamped into position with respect to the bus bars 19, the upstanding legs 9 will be biased outwardly or away from each other, placing the fusible block 15 under tension. The purpose of providing a biasing action tend-

ing to separate the leg portions 9 will appear more fully hereinafter.

In order to relieve the fusible block 15 from excess tension, the upper ends of the legs 9 are also joined by a rivet 23 of high tensile strength material. Nichrome wire, for example, has been found suitable for this purpose. The pin or rivet 23 passes transversely through the blocks 11, the ends of the legs 9, and also the fusible block 15, and may have the ends thereof burred or upset within suitable countersunk portions provided in the blocks 11. It is thus seen that the rivet 23 carries substantially the entire mechanical stress and relieves the fusible block 15 of tension which tends to cause the bond between the block and the leg members 9 to separate.

In operation, current flowing from one bus bar 19 to the other will traverse the legs 17 and 9, as well as the fusible alloy block 15. Under abnormal current conditions the alloy block 15 melts and flows away from between the upstanding legs 9, leaving only the rivet 23 to carry the current. Since the rivet 23 is of high resistance material, it immediately fuses and permits the upstanding legs 9 to separate and assume the position shown in Fig. 4. Separation of the upstanding legs 9 during operation of the fuse is desirable in that it insures a positive fuse operation when a predetermined overload current has been reached. In the absence of this feature, a current condition may exist which would soften the fusible block 15, thereby weakening the bond between the fusible material and the current-carrying members 7, and thus produce a higher resistance connection. The presence of a higher resistance connection of this type would cause a subsequent fuse operation at a materially lower current rating than that for which the fuse was designed.

It should be noted that this fuse device has a very good time lag characteristic because of the time required to heat alloy block 15 to its melting temperature, and this time is controlled by the size of conducting blocks 11.

The fuse structure shown in Figs. 5 and 6 is similar to that shown in the preceding figures with the exception that it is designed for lower current ranges. In this instance, the current-carrying members 25 are formed of solid resilient conducting material such as copper or phosphor bronze. The angular current-carrying members 25 also have upstanding legs 27 and transversely extending terminal legs 29.

The upper ends of the legs 27 are provided with countersunk holes 31, and are joined together by a block 33 of low melting point alloy which is preferably cast so that the block 33 has extension portions 35 filling the countersunk holes 31. The extensions 35 filling the openings 31 act as wedges and prevent the main body of the alloy block 33 from pulling away from the legs 27 during the normal operation of the fuse.

The construction shown in Figs. 5 and 6 is particularly effective in fuse devices having a current range insufficient to fuse a strain wire or rivet of the type shown in the preceding figures. On account of the lower current-carrying capacity, the upstanding legs 27 may be constructed of correspondingly less cross-section with a consequent lower tension being required to cause separation of the legs upon overload.

With a materially lower tension to contend with, the alloy projections 35 extending into the countersunk holes 31 have sufficient tensile strength to prevent separation of the legs 27

from the alloy block 33 under normal conditions of load.

Although I have shown and described several specific embodiments of my invention, it is to be understood that the same are for the purpose of illustration and that changes and modifications may be made by those skilled in the art without departing from the spirit and scope of the appended claims.

I claim as my invention:

1. A fuse device comprising a pair of current-carrying members, means biasing said current-carrying members apart to obtain a predetermined separation, a body of fusible metal normally joining said members and restraining the action of said biasing means, and means in addition to the adhesion of said fusible metal to said current-carrying members for holding said members against movement by said biasing means, said holding means including portions engaging the outer sides of said members.

2. A fuse device comprising a pair of current-carrying members, means biasing said current-carrying members apart to obtain a predetermined separation, a body of fusible metal normally joining said members and restraining the action of said biasing means, and a strain rivet member of higher resistance and melting point than said fusible metal passing through and joining said current-carrying members for normally preventing the separation of said fusible metal from said current-carrying members under the action of said biasing means.

3. A fuse device comprising a pair of current-carrying members, means biasing said current-carrying members apart to obtain a predetermined separation, a body of fusible metal normally joining said members and restraining the action of said biasing means, and a strain pin of high tensile strength extending through said current-carrying members and provided with means engaging the outer side of said members for holding said members in clamping engagement with said fusible metal.

4. A fuse device comprising a pair of current-carrying members, means biasing said current-carrying members apart to obtain a predetermined separation, each of said current-carrying members having an opening therethrough adjacent one end thereof, and a body of fusible metal normally joining said members at said one end and holding said members against movement by said biasing means, said fusible metal extending into said openings to form outer integral enlarged anchoring portions for preventing the separation of said current-carrying members from said fusible body during normal operation of the device.

5. A fuse device comprising a pair of resilient bars of conducting material, a body of fusible metal joining the opposed inner faces of said bars adjacent one end thereof, the remainder of said bars being disposed in spaced, substantially parallel relation with respect to each other, a support, means mounting the other ends of said bars upon said support to cause said joined ends to be biased away from each other, and means in addition to the adhesion of said body of fusible metal with said bars for normally holding said bars against separation from said body of fusible metal and including portions engaging outer sides of said bars.

6. A fuse device comprising a pair of resilient bars of conducting material, a body of fusible metal joining the opposed inner faces of said bars

123 adjacent one end thereof, the remainder of said bars being disposed in spaced relation with respect to each other, a support, means mounting the other ends of said bars upon said support to cause said joined ends to be biased away from each other, and a member of high tensile strength engaging opposite sides of the fused ends of said bars for normally holding said bars against separation from said body of fusible metal.

7. A fuse device comprising a pair of resilient bars of conducting material, at least a portion of said bars being disposed in substantially parallel relation with respect to each other, each of said bars having a countersunk hole therethrough adjacent one end thereof, a body of fusible metal joining the opposed inner faces of said bars adjacent said holes, a support, and means mounting the other ends of said bars upon said support to cause said joined ends to be biased away from each other, said body of fusible metal extending into said holes for interlocking said body of fusible metal with said bars.

8. In combination, a pair of spaced bus bars, a protective device adapted to be connected between said bus bars, said protective device including a pair angular current-carrying members of resilient conducting material, said members being disposed with two legs thereof in substantially parallel, spaced relation, a fusible metal body joining the free ends of said parallel legs, means in addition to the adhesion of said

5 fusible metal body to said members for holding said members against separation, the other legs of said members serving as terminals for connection to said bus bars, means clamping said terminal legs to said bus bars, said terminal legs being inclined with respect to said bus bars so that when clamped thereto the fused ends of said parallel legs will be biased away from each other.

9. In combination, a pair of spaced bus bars, a protective device adapted to be connected between said bus bars, said protective device including a pair of angular current-carrying members of resilient conducting material, said members being disposed with two legs thereof in substantially parallel relation, a cast low melting point alloy block joining the free ends of said parallel legs, the other legs of said members serving as terminals for connection to said bus bars, means clamping said terminal legs to said bus bars, said terminal legs being inclined with respect to said bus bars so that when clamped thereto the fixed ends of said parallel legs will be biased away from each other, the free ends of said parallel legs having a countersunk hole therethrough filled with low melting point alloy formed integrally with said cast alloy block for preventing said parallel legs from pulling away from said alloy block during normal operation of said protective device.

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