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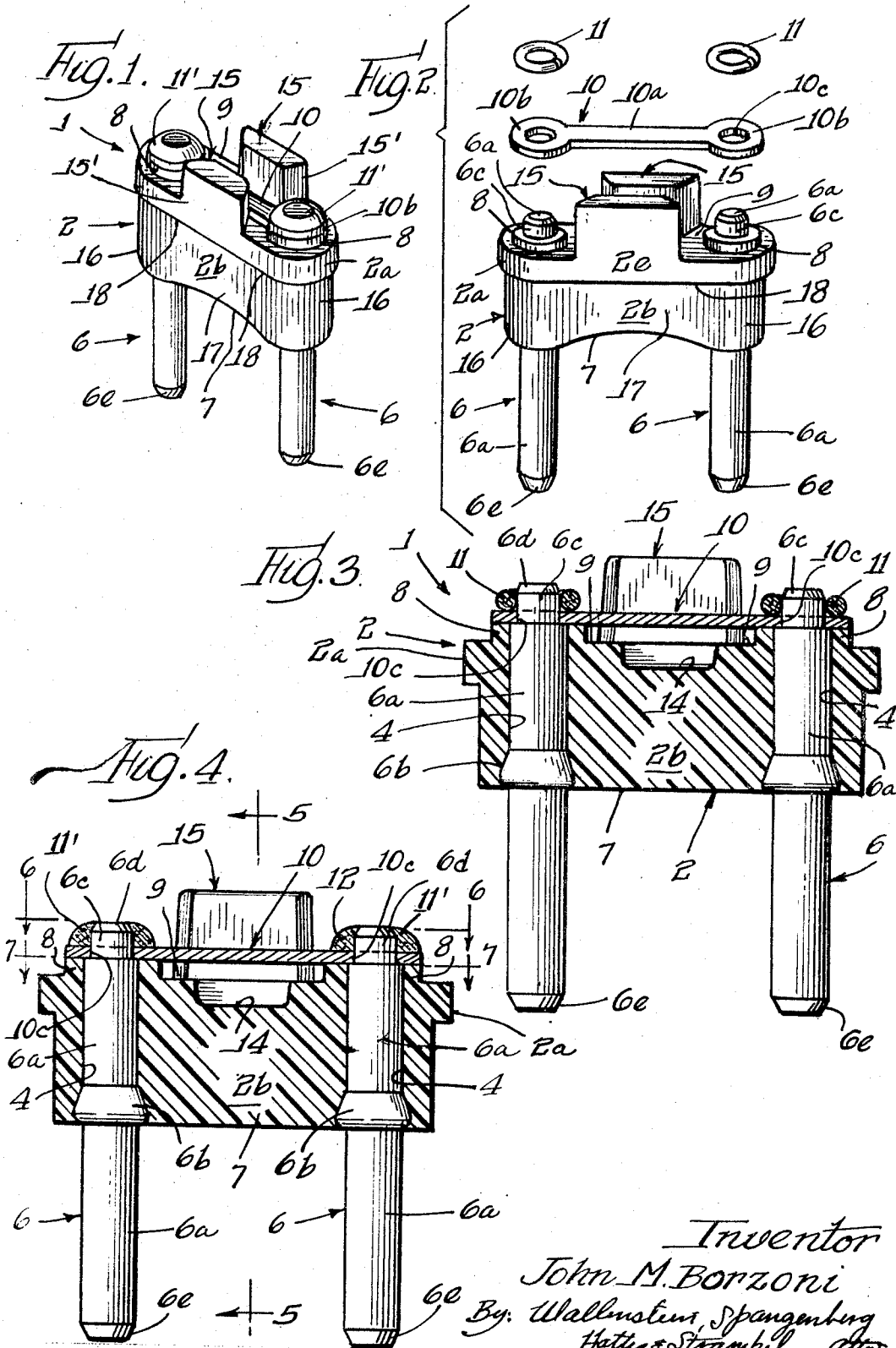
J. M. BORZONI

3,436,711

MINIATURE CURRENT OVERLOAD FUSE

Filed Nov. 20, 1967

Sheet 1 of 2



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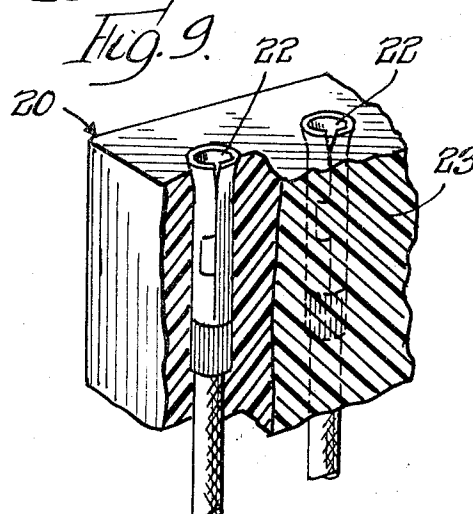
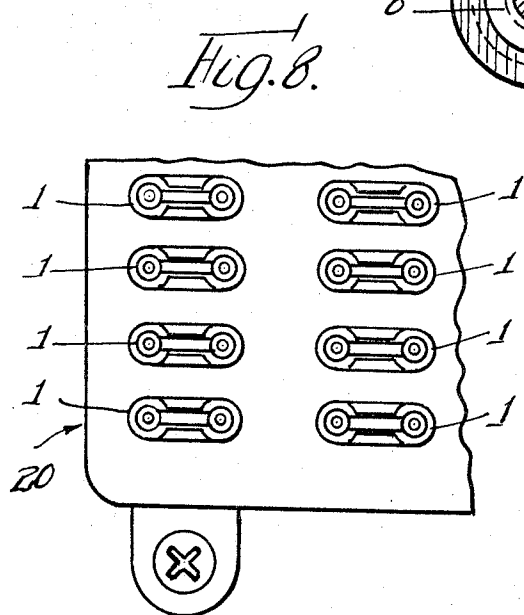
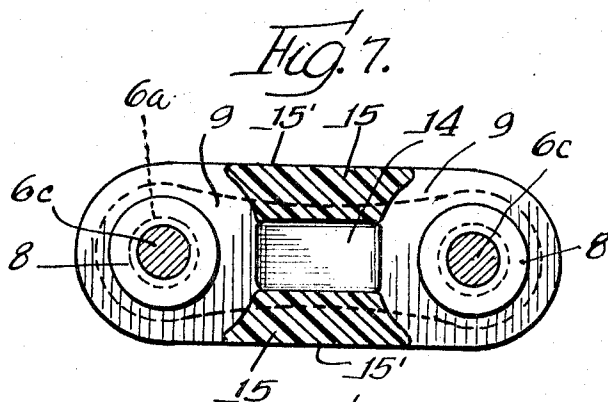
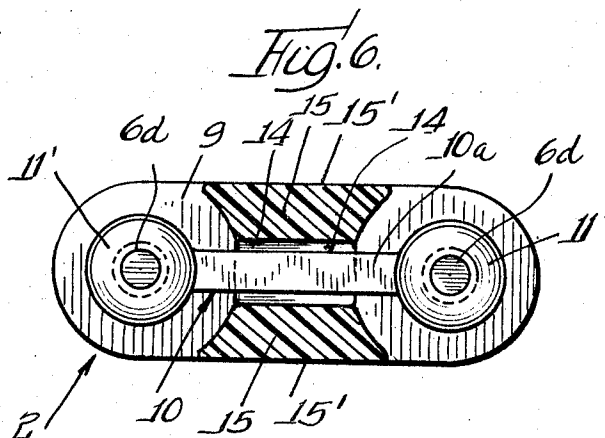
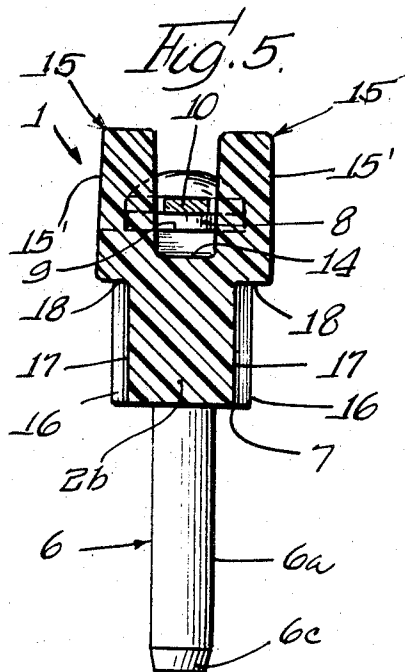
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Sheet 2 of 2



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MINIATURE CURRENT OVERLOAD FUSE
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13 Claims

ABSTRACT OF THE DISCLOSURE

A miniature current overload fuse is provided comprising an elongated body of insulating material and terminal pins extending transversely through the end portions of the insulating body, and projecting a relatively large distance beyond the inner side thereof. The opposite or outer ends of the terminal pins preferably project a small distance beyond the outer side of the insulating body. At least the outer side of the intermediate portion of the insulating body has on the opposite longitudinal margins thereof a pair of barrier-forming walls spaced apart a relatively small distance to prevent the entry therebetween of a human finger, or a barrier-forming wall or terminal pin of another similar fuse. A fuse link extends between the outer ends of the terminal pins which fuse link is sized to be dropped into place between the barrier-forming walls and soldered or welded to the terminal pins.

The present invention relates to a miniature current overload fuse capable of carrying substantial currents, such as currents as high as ten or more amperes.

An overload fuse capable of carrying currents of the above magnitude commonly comprises a sealed cylindrical glass envelope with cylindrical terminals projecting from the ends thereof and a fuse link extending between the fuse terminals within the sealed cylindrical envelope. Fuses of this type having current ratings of 10–30 amperes commonly have lengths of the order of magnitude of over one inch and, together with the mounting terminals with which they are associated, an overall width of approximately one quarter inch and higher. Some of the disadvantages of this type of fuse are the large space requirements for mounting the same and difficulty in easily determining a blown fuse by sight.

The present invention represents a marked improvement in overload current fuses of the ratings referred in that, among other reasons, a fuse having a rating as high as 30 amperes can be made having a length well under $\frac{3}{4}$ inch, that is of the order of magnitude of the thickness of an average human index finger, and a width of under $\frac{1}{4}$ inch. Also, the terminals of the fuse can plug into socket openings transversely to the length of the fuse body so the socket connector can be a much less expensive and less bulky support means than that needed for conventional high current rated fuses. Moreover, the fuse of the invention is designed so that, despite the small size of the fuse, the fuse can be easily and safely handled when installing or removing the same.

In accordance with the most preferred form of the invention, the fuse has an elongated body of insulating material, most advantageously a thermosetting material such as melamine phenolic material, which is made with a distinctive color indicating the rating of the fuse. A pair of relatively long and thick terminal pins extend transversely through the end portions of the elongated body and project a relatively large distance beyond the inner side of the end portions of the insulating body so that they are readily receivable and supportable in the sockets of an electrical connector and so that there is an appreciable heat conducting area which can contact a

correspondingly large area of the metal sockets into which they extend which carry away the heat generated in the fuse by the large currents involved. In the most preferred form of the invention, the length of the insulating body is not greater and preferably less than the distance the terminal pins project beyond the inner side of the insulating body, so that a maximum area of the terminal pins are exposed consistent with the strength requirements of the fuse. The outer ends of the terminal pins, which are referred to as fuse connecting ends, project if at all only a relatively small distance beyond the outer side of the insulating body. A fuse link of substantially contrasting color to the insulating body is provided which most preferably extends between bosses on the outer side of the insulating body between the fuse connecting ends of the terminal pins. The fuse link will thus stand out sharply from the contrasting background supplied by the insulating body. The fuse link may be a thin stamping of fuse material with eyelets on the ends thereof adapted to fit over the ends of the terminal pins where they are anchored thereto preferably by soldering the same thereto. The insulating body preferably has a depression in the center portion thereof so that the center portion of the fuse link is substantially spaced from the insulating body.

Of great importance is the provision of a pair of spaced, confronting, outwardly extending, barrier-forming walls of insulating material on the opposite longitudinal margins of the outer side of at least the intermediate portion of the insulating body. The barrier-forming walls project outwardly beyond the insulating body a distance appreciably greater than the fuse connecting ends of the terminal pins and the fuse link, so that the barrier-forming walls can be engaged by the fingers of the user on the laterally outwardly facing sides or the outer ends thereof without touching the conductive parts of the fuse on the outer side of the insulating body. The barrier-forming walls are most advantageously spaced apart a small distance so that a user's finger, a barrier-forming wall or terminal pin of another identical fuse cannot fit or become wedged between the barrier-forming walls. The spacing between these walls is sufficient to allow the widest (i.e. highest current rated) fuse to be dropped between the barrier-forming walls when applied over the fuse connecting ends of the terminal pins. The insulating body is most advantageously undercut to a substantial degree so that there are shoulders provided for conveniently grasping the fuse to pull the same from an electrical connector.

Other advantages and features of the invention will become apparent upon making reference to the specification to follow, the claims and the drawings wherein:

FIG. 1 is a perspective view of a miniature current overload fuse constituting the most preferred form of the invention;

FIG. 2 is an exploded view showing the three basic components of the fuse of FIG. 1 before the final assembly thereof;

FIG. 3 is a longitudinal sectional view, somewhat enlarged, of the component parts of the fuse shown in FIG. 2 just prior to a soldering operation which secures the parts together;

FIG. 4 is a longitudinal sectional view corresponding to FIG. 3 of the completed fuse;

FIG. 5 is a vertical sectional view through the fuse of FIG. 4, taken substantially along section line 5—5 thereof;

FIG. 6 is a horizontal sectional view through the fuse of FIG. 4, taken substantially along the line 6—6 thereof;

FIG. 7 is a horizontal sectional view through the fuse of FIG. 4, taken substantially along the line 7—7 thereof;

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FIG. 8 is a fragmentary plan view of a fuse block having a number of fuses like that shown in FIGS. 1 through 7 inserted therein; and

FIG. 9 is a fragmentary, partly broken away view of the portion of the fuse block shown in FIG. 9, showing the construction of the sockets which receive one of the fuses thereof.

Referring now more particularly to FIGS. 1-7, a miniature current overload fuse 1 of the invention is there illustrated comprising a horizontally elongated insulated body 2 having a relatively narrow upper flange-forming portion 2a and a reduced main body or skirt-forming portion 2b. In the most preferred form of the invention, both the flange-forming and main body-forming portions of the insulating body have a length at least in the neighborhood of about twice the height and width of the main body portion 2b thereof. The end portions of the insulating body 2 have vertically or transversely extending openings 4-4 within which are anchored a pair of terminal pins 6-6. The terminal pins 6-6 project a substantial distance downwardly from the bottom or inner surface 7 of the insulating body, most advantageously a distance of at least equal to and preferably a substantially greater distance than the height of the main body portion 2b of the insulating body. The upper or outer ends of the terminal pins 6 are fuse connecting ends of the pins which most advantageously extend through and project a short distance beyond the flat top surfaces of a pair of bosses 8-8 projecting upwardly or outwardly from the outer flat surface 9 of the insulating body.

Each of the terminal pins 6-6 preferably has a main cylindrical body portion, the upper section 6a thereof being located within the openings 4-4 and terminating in a downwardly flaring skirt 6b having an irregular (that is non-circular) cross section. The bottom section 6a of the main cylindrical body portion of the terminal pins have a thickness which is preferably a substantial portion of the width of the main body portion 2b of the insulating body, preferably at least in the neighborhood of one-half the width thereof. The main upper section 6a of the main cylindrical body portion of each terminal pin is most advantageously flush with upper surface of the associated insulating body boss 8 and terminates in a reduced end portion 6c which projects upwardly a relatively small distance beyond the top of the boss 8. The reduced end portion 6c of each terminal pin most advantageously terminates in an outwardly tapering or chamfered portion 6d. The bottom of each terminal pin 6 similarly terminates in a chamfered portion 6e.

The insulating body 2 which is preferably made of a thermosetting synthetic plastic material most advantageously a melamine phenolic material, which is transfer molded around the terminal pins. The melamine phenolic material gives off an arc quenching vapor under heated conditions prevailing in the fuse when the fuse blows. The terminal pins are preferably made of copper coated with a suitable coating of metal, such as a .00005 inch layer of Bright alloy plate, an alloy of tin, zinc and copper sold under the trademark "Albaloy" which protects the copper pins during the molding operation and provides for long shelf life.

Extending between the reduced end portions 6c-6c of the terminal pins 6-6 is a fuse link 10 made of a material which melts when a prolonged current greater than the fuse rating flows therein. The fuse link 10 most advantageously is a flat plate-like member having a very thin intermediate portion 10a with a width or thickness which varies with the rating of the fuse involved, and thin end portions 10b-10b which form eyelets having openings 10c-10c which fit around the reduced end portions 6c-6c of the terminal pins 6-6. The flat faces of the fuse link preferably seat upon the flat upper surfaces of the bosses 8-8. The reduced end portions 6c-6c of the terminal pins preferably extend above the upper surface of the fuse link so that rings 11-11 of solder

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(FIGS. 2 and 3) can be positioned about the pins above the fuse link and melted to form dome-shaped blobs 11'-11' of solder (FIGS. 1 and 4) extending over the chamfered portions 6d-6d of the terminal pins, firmly to secure the fuse link to the terminal pins.

The central portion of the fuse link 10 which is to melt is most advantageously spaced an appreciable distance from the insulating body 2 by a recess 14 formed in the upper surface 9 of the insulating body.

In the most preferred form of the invention, the main body portion 2b of the insulating body has rounded protuberant ends sections 16-16 which gradually merge with a reduced central section 17. The reduced central section 17 forms a relatively wide undercut or shoulder-forming portions 18-18 on the outwardly laterally facing sides of the insulating body at the bottom of the flange forming portion 2a thereof, so that the fuse may be readily grasped to insert the same into or remove the same from a fuse block 20 (FIGS. 8 and 9).

The upper or outer side of the intermediate portion of the insulating body 2 has on the opposite longitudinal marginal portions thereof a pair of confronting, transversely spaced, vertical barrier-forming walls 15-15. The barrier-forming walls 15-15 most advantageously form an outward extension of the flange-forming portion 2a of the insulating body 2. The barrier-forming walls preferably terminate short of the end portions of the fuse body, so that the upper ends of the terminal pins 6-6 can be fully exposed to receive a soldering tool for soldering the fuse and the terminal pins together. (The broadest aspect of the invention envisions the barrier-forming walls extending completely around the margin of the fuse link where a solder or welding operation is carried out by induction heating techniques.) The barrier-forming walls form a very important feature of the fuse body because they are designated to enable the fuse to be handled during insertion and removal of the fuse from the terminal block 20 without shock and burn hazards to the person handling the fuse.

The barrier-forming walls most advantageously project substantially above the uppermost or outermost portion of the adjacent conductive parts of the fuse namely, the terminal pins 6-6, the fuse link 10 and the solder 11'-11'. Also, the barrier-forming walls are spaced apart a distance much less than the average thickness of a human index finger and less than the thickness of the barrier-forming walls or the terminal pins, so that the barrier-forming walls minimize the possibility that the user can touch the current-carrying portions of the fuse by bringing his finger down against the upper end of the fuse, and the barrier-forming walls and terminal pins of other identical fuses cannot become wedged between the walls when identical fuses are stored in a large mass. Of equal significance is the fact that the laterally outwardly facing surfaces 15'-15' (FIG. 5) of the barrier-forming walls are in vertical planes which are spaced appreciably from the outer margins of the fuse link 10, the solder 11'-11' and the upper ends of the terminal pins 6-6, so that a person grasping the fuse and inserting the same into a fuse block will have his fingers spaced an appreciable distance from the current carrying portions of the fuse. (It can be appreciated that if a fuse is inserted within a fuse block where the circuit into which the fuse is being placed has a short circuit therein, substantial currents can flow momentarily which can generate appreciable amounts of heat which could burn a person inserting the fuse into the fuse block unless the current carrying portions of the fuse are spaced an appreciable distance from the portions of the fuse engaged by the user's fingers.)

The barrier-forming walls 15-15 are also preferably spaced apart a distance greater than the width of the widest fuse link to be used with the fuse body so that the fuse link 10 is spaced from all portions of the insulating body to assure consistent fuse blowing character-

istics and so that the fuse link can be readily dropped into place between the barrier-forming walls upon the terminal pins 6—6.

An especially important feature of the present invention made possible by the design of the fuse parts and their relationship is the extremely small size of the fuse for the current rating thereof. For example, a commercial form of the fuse of the invention rates at 30 amperes has an overall length of only about .625 inch, an overall width of about .225 inch and an overall height (including the barrier-forming walls but excluding the pin lengths) of about .312 inch. In application of the present invention, it is preferred to standardize all portions of the fuse except the fuse link 2 which will vary in width, thickness or material, depending upon the fuse rating. It is of great importance to provide relatively large heat conducting area for carrying heat away from the fuse without making the fuse bulky, particularly in length and width. This is made possible by the use of relatively thick terminal pins which project an appreciable distance beyond the inner surface of the insulating body and the use of metal socket terminals which engage the terminal pins over most of the projecting positions thereof. For example, in the commercial form of the invention, the projecting portion of the terminal pins have a diameter of the order of magnitude of about $\frac{1}{8}$ inch and a projecting length of about $\frac{1}{8}$ inch. To make the most efficient use of the insulating material, the pins were embedded in the insulating body for about $\frac{1}{4}$ inch of their length. The length and configuration of the insulating body tend to minimize fatigue failure due to frequent cycling of the fuse between no-load and near rated load.

FIGS. 8 and 9 illustrate the terminal block 20 into which a number of fuses like that shown in FIGS. 1 through 7 can be supported in relatively close relation. The fuse block 20 has a pair of metal sockets 22—22 (FIG. 9) into which the projecting ends of the terminal pins 6—6 of a fuse 1 can be snugly inserted. The metal sockets 22—22 make extensive physical and electrical contact with the terminal pins 6—6 of the associated fuse so they make a good low resistance high heat conducting contact therewith. The sockets 22—22 are shown embedded within a body 23 of insulating material forming the main body portion of the fuse block 20.

It should be understood that numerous modifications may be made in the most preferred form of the invention described above without deviating from the broader aspects thereof.

I claim:

1. A miniature current overload fuse comprising: an elongated body of insulating material of a length which is substantially less than $\frac{3}{4}$ inch so it is of a size not substantially greater than the thickness of an average human finger, the end portions of said insulating body having a pair of transversely extending openings passing therethrough, terminal pins anchored in said openings and projecting beyond the inner side of the end portions of the insulating body a distance where they are readily receivable and supportable in the metal sockets of an electrical connector and present a heat radiating area capable of adequately conducting heat to said metal connector sockets for prolonged currents of at least ten amperes, said pins having fuse connecting end portions positioned adjacent the outer side of said insulating body, at least the outer side of the intermediate portion of said insulating body having on the opposite longitudinal marginal portions thereof a pair of spaced confronting barrier-forming walls which project outwardly of said insulating body so the ends thereof are spaced from the fuse connecting ends of said terminal pins, and a fuse link adapted to melt when a given prolonged overload current flows therethrough and having end portions respectively connected to said fuse connecting ends of said terminal pins and a bridging intermediate portion passing between said barrier-forming walls well below the tops thereof, the

fuse link having a central portion which is first to melt which center portion is spaced from said insulating body to be completely out of contact with the heat absorbing parts of the fuse.

2. The miniature fuse of claim 1 wherein said barrier-forming walls are spaced apart a distance less than the thickness of either of said barrier-forming walls or terminal pins, so that a barrier-forming wall or terminal pin of a fuse similar to said miniature fuse cannot enter the space between said barrier-forming walls.

3. The miniature fuse of claim 1 wherein the outer longitudinal margins of said barrier-forming walls are in planes substantially spaced from the nearest margins of the fuse connecting ends of said terminal pins and said fuse link, whereby said barrier-forming walls can be grasped without touching the conductive parts of the fuse.

4. The miniature fuse of claim 1 wherein said barrier-forming walls project outwardly a substantial distance from said terminal pins and said fuse link, and said planes of the outer longitudinal margins of said barrier-forming walls are substantially spaced from said terminal pins and fuse link, the barrier-forming walls spacing the fingers of a person touching the outer ends thereof or grasping the barrier-forming walls a substantial distance from the terminal pins and the fuse link to avoid burning the user's fingers even under short circuit current conditions.

5. The miniature fuse of claim 1 wherein both longitudinal outer sides of said insulating body have substantially undercut portions forming shoulders enabling the fuse to be grasped and pulled from an electrical connector.

6. The miniature fuse of claim 1 wherein said barrier-forming walls terminate short of the fuse connecting ends of said terminal pins wherein the pins are substantially fully exposed for readily attaching the fuse link thereto.

7. A current overload fuse comprising a body of insulating material having a horizontally elongated cross section, the end portions of said insulating body having a pair of vertically extending openings passing therethrough, vertically extending terminal pins anchored in said openings which project substantially vertically from the bottom of said insulating body so that they are readily receivable and supportable in the sockets of an electrical connector, the upper ends of said terminal pins projecting a relatively small distance above the adjacent upper surface of said insulating body and forming fuse connecting ends of the pins, at least the upper side of the intermediate portion of said insulating body having on the opposite longitudinal marginal portions thereof a pair of transversely spaced confronting vertical barrier-forming walls which enable the user to grasp the fuse without touching the conductive parts of the fuse, and a fuse link extending adjacent the top of said insulating body between said barrier-forming walls and connected between the fuse connecting ends of said terminal pins, the spacing between said barrier-forming walls being greater than the corresponding width of the intermediate portion of the fuse link so the link can be dropped between the barrier-forming walls upon the fuse connecting ends of the terminal pins and being substantially less than the thickness of a human finger, and the top and outer margins of said barrier-forming walls being positioned in planes spaced from the corresponding outer portions of the fuse connecting ends of said terminal pins and said fuse link, wherein the barrier-forming walls keep the user from touching the conductive parts of the fuse when it is grasped to insert the same or remove the same from an electrical connector.

8. The fuse of claim 7 wherein said body of insulating material when heated under heavy overload conditions gives off an arc quenching gas.

9. The fuse of claim 7 wherein the portion of said body of insulating material which said fuse link overlies is made of a color which contrasts sharply with the color of the fuse link.

10. The fuse of claim 7 wherein the fuse link has eye-lets at the ends thereof which fit around the fuse connecting ends of said terminal pins at a point below the uppermost parts of said terminal pins, and said fuse link being physically and electrically connected to said terminal pins project downwardly beyond the bottom of portions of said fuse link and melted intimately to bond the fuse link to the terminal pins.

11. The fuse of claim 7 wherein the length of said insulating body is at least in the neighborhood of twice the height and width of the insulating body, and said terminal pins project downwardly beyond the bottom of the insulating body a distance at least comparable to the height of the insulating body.

12. In combination: a fuse support having at least two metal sockets therein; and a current overload fuse comprising a body of insulating material having a horizontally elongated cross section, terminal pins anchored to and extending vertically through the end portions of said insulating body, the terminal pins having a width which is at least in the neighborhood of one half the width of the main portion of the insulating body, the terminal pins projecting downwardly from the bottom of said insulating body a distance at least comparable to the height of the insulating body, said terminal pins extending into said metal sockets where they are engaged thereby for substantially the full length of the downwardly projecting portions thereof, and a fuse link extending between the upper ends of said terminal pins.

13. A current overload fuse comprising a body of insulating material having a bottom portion of reduced cross section leaving downwardly facing shoulders on the

opposite sides thereof which aid the user in grasping the insulating body to insert the same into or remove the same from a fuse block, terminal pins anchored to and extending through the end portions of said insulating body and projecting a relatively large distance from the inner side of said insulating body so they are readily receivable and supportable in sockets of an electrical connector, a pair of bosses projecting transversely from end portions of the outer side of the insulating body and through which bosses said terminal pins project outwardly a relatively short distance, a fuse link extending between the outer faces of said bosses and having eye-lets which fit around the portions of said terminal pins projecting beyond said bosses, and bodies of solder extending between the outer surfaces of said eyelet portions of said fuse link and the adjacent surfaces of said terminal pins.

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