

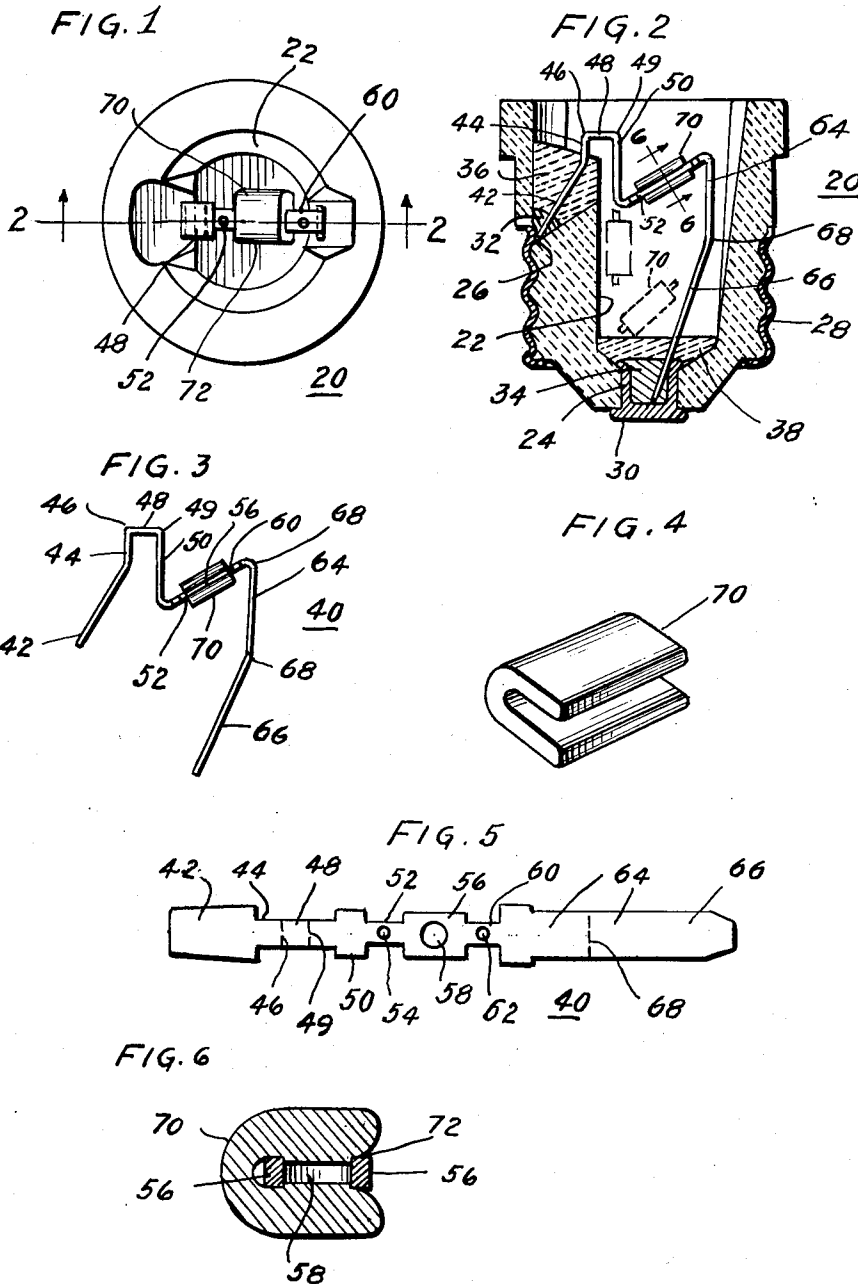
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PROTECTORS FOR ELECTRIC CIRCUITS

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PROTECTORS FOR ELECTRIC CIRCUITS

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This invention relates to improvements in protectors for electric circuits. More particularly, this invention relates to improvements in electric fuses.

It is therefore an object of the present invention to provide an improved electric fuse.

It is highly desirable, in the manufacture of electric fuses, to make those fuses so they clearly indicate when they have opened the circuit. Where electric fuses of the plug type are so made, the users of those fuses are able, upon even casual inspection, to determine when those fuses have opened the circuit. The present invention provides such a plug type fuse; and it does so by mounting a weight on the fusible element of that fuse and by causing that weight to move relative to the window of that fuse whenever that fuse opens the circuit. That weight is mounted closely adjacent the window of the fuse; and, consequently, when that weight moves relative to that window, its movement is readily detected. In this simple and automatic manner, the fuse of the present invention provides a readily detectable indication that it has opened the circuit. It is therefore an object of the present invention to provide a fuse with a fusible element that holds a weight closely adjacent the window of that fuse and that causes that weight to move relative to that window when that fuse opens the circuit.

The weight that is provided for the fuse of the present invention is supported wholly by the fusible element of that fuse. Further, that weight is mounted on a portion of the fusible element which is inclined to the axis of the fuse. This inclination of the weight-carrying portion of the fusible element is important because it enables the weight, in almost all positions of the fuse, to apply both a downward and a sideward component of force to the fusible element. The sideward component of force will coact with the downward component of force to cause the weight to move relative to the window of the fuse. The combination of the sideward and downward components of force makes the movement of the weight more certain than could just a sideward component of force or just a downward component of force. It is therefore an object of the present invention to provide a fuse with a weight that is supported wholly by the fusible element and that mounts that weight on a portion of the fusible element which is inclined to the axis of the fuse.

In the operation of fuses, it is desirable that large arcing gaps be formed, and further that the arcing gaps be formed as quickly as possible. The present invention forms large arcing gaps and forms them quickly by mounting the weight on a portion of the fusible element of the fuse which is intermediate two portions of reduced cross-section. Both of those reduced cross-section portions are designed to fuse on heavy overloads or on short circuits; and when both of those portions fuse, the weight will fall away and promptly form a large arcing gap. It is therefore an object of the present invention to provide a fuse with a weight that is mounted on a portion of the fusible element intermediate two reduced cross-section portions of that fusible element.

The weight for the fusible element of the fuse provided by the present invention is made of a material that is form-retaining in the presence of heat but that is softer than the material of the fusible element. Further, that weight is made so it is U-shaped in configuration; and it is mounted adjacent an opening in the fusible element.

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The arms of the U-shaped weight are squeezed against the fusible element with such force that portions of the confronting faces of those arms move, by cold flow, into the opening in that fusible element. In doing so, those portions of those confronting faces lock the weight in position on the fusible element. This locking is important because it holds the weight intermediate the two portions of the fusible element which are of reduced cross-section, and thereby enables that weight to absorb substantially equal amounts of heat from those reduced cross-section portions. Furthermore, the locking of the weight keeps that weight from sliding downwardly toward one, and from sliding downwardly away from the other, of those portions of reduced cross-section. It is therefore an object of the present invention to make the weight for the fusible element of a fuse of a material that is form-retaining in the presence of heat but that is softer than the metal of the fusible element, and to lock that weight to that fusible element.

To mount the weight closely adjacent the window of the fuse requires the portion of the fusible element, intermediate one end of the weight and one terminal of the fuse, to be longer than the portion of the fusible element intermediate the other end of the weight and the other terminal of the fuse. That difference in the lengths of the two portions of the fusible element is undesirable because it fosters unequal conduction of heat from the portions of reduced cross-section, at the opposite ends of the weight, to the terminals. The present invention compensates for the difference in the lengths of the portions of the fusible element intermediate the terminals and the opposite ends of the weight by forming those portions with individually different widths which render the overall thermal resistance of those portions substantially the same. It is therefore an object of the present invention to provide a fusible element which has a weight thereon that is closer to one end of that fusible element than it is to the other and which has the portions, intermediate that weight and those ends, formed to have substantially the same overall thermal resistance.

Other and further objects and advantages of the present invention should become apparent from an examination of the drawing and accompanying description.

In the drawing and accompanying description a preferred embodiment of the present invention is shown and described but it is to be understood that the drawing and accompanying description are for the purpose of illustration only and do not limit the invention and that the invention will be defined by the appended claims.

In the drawing,

FIG. 1 is a plan view of a fuse that is made in accordance with the principles and teachings of the present invention, and it shows the body of that fuse before the window and retaining cap have been assembled with it,

FIG. 2 is a sectional view in elevation through the fuse of FIG. 1, and it is taken along the plane indicated by the line 2-2 in FIG. 1,

FIG. 3 is a front elevational view of the weighted fusible element of the fuse of FIGS. 1 and 2,

FIG. 4 is a perspective view, on a greatly enlarged scale, of the weight mounted on the fusible element of FIGS. 1-3,

FIG. 5 is a plan view of the fusible element of the fuse of FIGS. 1 and 2 before the weight is associated with that element and before that element is bent, and

FIG. 6 is a sectional view on said greatly enlarged scale, through the weighted fusible element of FIGS. 1 and 2, and it is taken along the plane indicated by the line 6-6 in FIG. 2.

Referring to the drawing in detail, the numeral 20 generally denotes the body of an electric fuse of the plug type. That body is of standard design and construction; and it

will preferably be made of porcelain or some other good insulating material. That body has a central cavity 22, has an opening 24 at the bottom thereof, and has an opening 26 at one side thereof. The exterior of the body 20 is provided with a rounded screw thread, and that screw thread accommodates a screw shell terminal 28 which fits standard Edison base sockets. If desired, the body 20 could be made with type-S threads.

The opening 24 in the fuse body 20 receives a center terminal 30. That terminal preferably has the form of a hollow rivet which has its head at the bottom face of the fuse body 20 and has its cylindrical end riveted over inside the fuse body 20. Solder 32 is used to connect one end of a fusible element 40 to the screw shell terminal 28, and solder 34 is used to connect the other end of that fusible element to the terminal 30. After the solder 32 and the solder 34 have hardened, cement 36 is used to overlie and protect the solder 32 and cement 38 is used to overlie and protect the solder 34.

The fusible element 40 has a spade-like end 42, shown particularly in FIG. 5, and that end is secured to the screw shell 28 by the solder 32. That spade-like end is inclined to the vertical, as shown particularly in FIG. 2; and it extends upwardly and inwardly of the cavity 22 from the point where it is soldered to the screw shell 28. The fusible element 40 has a portion 44 of reduced cross-section which is contiguous to the spade-like end 42; and the portion 44 is vertically directed, thereby forming a bend intermediate the end 42 and the portion 44. A bend 46 is provided intermediate the vertical portion 44 and a horizontal portion 48 of the fusible element 40; and, as shown by FIG. 5, the portions 44 and 48 are of the same cross-section. A bend 49 is intermediate the horizontal portion 48 and a vertical portion 50. The portion 50 has one end thereof of the same cross-section as the portion 48, and has the other end thereof of a larger cross-section. As a result, the portion 50 is T-shaped in configuration. The T-shaped portion 50 has its largest cross-section adjacent the bottom thereof. Contiguous to the lower end of the T-shaped portion 50 is a reduced cross-section portion 52; and the cross-section of that portion is smaller than the cross-section of any of the portions 44, 48 and 50. An opening 54 is provided in the reduced cross-section portion 52, and that opening provides a further decrease in the cross-section of the portion 52, thereby providing a readily fusible weak spot for the fusible element 40.

Contiguous with the other end of the portion 52 of reduced cross section is an intermediate portion 56. That portion has the same cross-section as the large cross-section of the T-shaped portion 50. A large opening 58 is provided at the center of the intermediate portion 56, but that opening is sufficiently smaller than the portion 56 to provide conducting paths which are materially larger than the conducting paths defined in the reduced cross-section portion 52 by the opening 54. Contiguous to the other end of the intermediate portion 56 is a second reduced cross-section portion 60; and that portion has an opening 62 therein to form a further reduction in cross-section, thereby providing a second readily fusible weak spot for the fusible element 40. The cross-sections of the portions 52 and 60 are the same, and the diameters of the openings 54 and 62 are the same. Furthermore, the lengths of the portions 52 and 60 are the same; and therefore the portions 52 and 60 will generate the same amount of heat. Because both of those reduced cross-section portions are contiguous with the intermediate portions 56, they will both supply substantial quantities of heat to that portion.

Contiguous with the other end of the reduced cross-section portion 60 is a T-shaped portion 64. The wide cross-section of the T-shaped portion 64 is larger than the wide cross-section of the T-shaped portion section 50; and the narrow cross-section of the T-shaped portion 64 is also larger than the wide cross-section of the T-shaped portion 50.

The reduced cross-section 52 is bent abruptly immediately adjacent the T-shaped section 50, and the reduced cross-section portion 60 is bent abruptly immediately adjacent the T-shaped section 64, as shown particularly by FIGS. 2 and 3. As a result, the T-shaped portion 50 is vertical, the portions 52, 56 and 60 define a straight line that is inclined to the vertical, and the T-shaped portion 64 is substantially vertical. A bend 68 is provided at the lower end of the T-shaped portion 64, and the portion 66 extends downwardly and inwardly toward the terminal 30. The fusible conductor 40 is preferably formed by punching it from a strip of metal, and that metal is preferably cuprous.

A weight 70, of a metal that is form-retaining in the presence of heat but that is softer than the metal of the fusible element 40, is formed in the shape of a U, as shown particularly in FIGS. 4 and 6. One such metal is a zincy metal. As initially formed, the weight 70 has a space between the confronting faces of the arms thereof and the thickness of that space is greater than the thickness of the portion 56 of the fusible element 40. This difference in the thicknesses enables the weight 70 to be set in position over the portion 56 of the fusible element 40. Thereafter, the U-shaped weight 70 is deformed by pressure to cause it to lock itself in position on that portion 56. As shown particularly in FIG. 6, portions of the confronting faces of the arms of the U-shaped weight 70 will flow part-way into the opening 58; and those portions of those confronting faces will fixedly and permanently lock that weight to the intermediate portion 56. Thereafter, a small quantity of bonding material 72, such as alloy or solder, will be applied to the ends of the arms of the weight 70 to bond that weight to the intermediate portion 56. The bonding material 72 is an additional safeguard to insure full thermal interchange between the intermediate portion 56 and the weight 70.

In the drawing, the arms of the weight 70 completely overlies the opening 58, but they need not do so. By increasing the thicknesses of the arms of the weight 70, it is possible to reduce the lengths or widths of those arms. Hence it is possible to attain the required mass for the weight 70 and still have parts of the opening 58 not completely overlain by that weight.

The fusible element 40 has the weight 70 secured to it mechanically and also has that weight bonded to it; and hence a full interchange of heat will be attained between the portion 56 and the weight 70. That weight performs the function of a heat-absorber in addition to performing its function as a weight.

Once the weight 70 has been fixedly secured to the fusible element 40, that fusible element is bent to have the configuration shown in FIGS. 2 and 3. Thereafter, the portion 66 of that fusible element is disposed within the hollow center of the terminal 30, and the spade-like end 42 is set adjacent the upper part of the screw shell 28. Heat is then applied to enable the solder 32 and the solder 34 to permanently secure the fusible element 40 to the screw shell 28 and to the terminal 30, respectively. The cement 36 and 38 is subsequently inserted within the appropriate portions of the fuse body 20 to overlies the solder 32 and 34.

In normal use, when the current through the circuit protected by the fuse does not exceed the rating of that fuse, the heat generated at the two weak spots is absorbed by the weight 70 and by the terminals 28 and 30 at a rate which is rapid enough to keep those weak spots from reaching their fusing points. That part of the fusible element constituted by the portions 64 and 66 is appreciably longer than that part of that element which is constituted by the portions 42, 44, 48 and 50; and hence the latter part would tend to transmit heat more rapidly to terminal 28 than could the former part transmit heat to the terminal 30. However, the present invention makes the two parts of the fusible element 40, intermediate the weak spots and the terminals of the

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fuse body 20, of substantially the same overall thermal resistance by making the T-shaped portion 50 smaller in cross-section than the T-shaped section 64, and also by making the portions 44 and 48 of smaller cross-section than the portion 66. The overall result is that the amount of heat which flows outwardly from each of the two weak spots to the terminals 28 and 30 is approximately the same; and, therefore, the amount of heat added by each of those weak spots to the intermediate portion 56 and to the weight 70 will be approximately the same. This relationship remains substantially unchanged throughout the overall operation of the fuse because the dominant part of the heat generated by the fusible element 40 is generated at the two weak spots.

The size of the two weak spots is such that they generate considerable amounts of heat as heavy currents flow through them, but the weight 70 absorbs enough of that heat to prevent fusing of those weak spots throughout the specified current range of the fuse. Not until a predetermined overload is applied will the heat generated by the weak spots be great enough to fuse those weak spots.

When overloads at or above a predetermined value are applied to the fuse for a prescribed period of time, one or both of the weak spots will fuse. Usually, both of the weak spots will fuse; but it is possible in some instances for just one of those weak spots to fuse. Whether just one of the weak spots fuses or whether both of the weak spots fuse, the weight 70 will move relative to the window of the fuse. The position of the weight 70 prior to the breaking of the circuit is shown by solid lines in FIG. 2; and the position of that weight when both weak spots have fused is shown by dotted lines at the bottom of FIG. 2, and the position of that weight when the upper of the two weak spots has fused is shown by dotted lines intermediate the top and bottom of FIG. 2. These positions of the weight are premised on the assumption that the fuse is set in the position shown in FIG. 2; and if that fuse is set with its axis horizontal or in any other position, the weight will move toward other parts of the cavity 22. However, no matter how the fuse is set, the weight 70 will respond to the fusing of one or both of the weak spots to move relative to the window of the fuse. In doing so, it will clearly indicate that the fuse has opened the circuit.

As the weight 70 moves, it not only gives an obvious indication of the condition of the fuse but it also forms a large arc gap which quickly quenches any arc that might tend to form. The overall result is a fuse that provides a clear and unmistakable indication of its condition, provides immediate and full quenching of any arc that might tend to form, and provides a complete certainty of operation.

The pressing of the U-shaped weight 70 onto the fusible element 40 is far more desirable than any riveting of a weight onto that element could be. As the two arms of the weight 70 are pressed together they dominantly apply compressive forces to those areas of portion 56 which bound the opening 58; but those portions can withstand compressive forces better than any other fuses. If a weight were to be riveted to the element 40, the riveting operation would apply tensile forces to the areas of portion 56 that bound the opening 58; and those portions are far less able to withstand tensile forces than they are able to withstand compressive forces. Such tensile forces could easily break the areas of portion 56 that bound opening 58 where, as in one preferred embodiment of the present invention, the fusible element is only five thousandths of an inch thick, the intermediate portion 56 is only fifteen hundredths of an inch wide, and the diameter of opening 58 is one hundred and two thousandths of an inch.

The drawings have shown the weighted fusible element of the present invention mounted in a fuse of the plug type, but that weighted fusible element can also be

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mounted in a fuse of the cartridge type. Where that weighted fusible element is mounted in a fuse of the cartridge type, the portion 56 and preferably the portions 52 and 60 will be inclined to the axis of the fuse but the rest of the portions of that weighted fusible element can be generally parallel to that axis.

Whereas the drawing and accompanying description have shown and described a preferred embodiment of the present invention, it should be apparent that various changes may be made in the form of the invention without affecting the scope thereof.

What I claim is:

1. An electric fuse of the plug type that comprises a plug-type housing with a plurality of terminals, one of said terminals being at the bottom of said housing and another of said terminals being at one side of said housing, and an elongated fusible link that is disposed within said housing and is electrically connected to said terminals, said fusible link having a plurality of bends intermediate the ends thereof to define a first portion that extends upwardly in said housing from said one terminal and inclines toward that side of said housing which is opposite to said one side of said housing, a second portion that is contiguous to and extends generally vertically upwardly from the first said portion, a third portion that is contiguous to and inclines downwardly from said second portion toward said one side of said housing, a fourth portion that is contiguous to and extends generally vertically upwardly from said third portion and is adjacent said one side of said housing, a fifth portion that is contiguous to and extends generally horizontally from said fourth portion toward said one side of said housing, and a sixth portion that is contiguous to and extends generally vertically downwardly from said fifth portion toward said other terminal, the bends between said second and third portions and said third and fourth portions of said fusible link being abrupt, said third portion of said fusible link having a central wide section intermediate two narrow sections, said central wide section having a large opening therein, said narrow sections of said third portion having weak spots therein, each of said second and fourth portions having a wide section and a narrow section, said wide sections of said second and fourth portions of said fusible link being adjacent and contiguous to said third portion, said third portion having a generally U-shaped slug of zinc mechanically secured to and overlying substantially all of said central wide section except one edge of said central wide section, said slug overlying and underlying said large opening in said central wide section and having portions thereof extending into said large opening to permanently lock said slug to said central wide section, said slug being soldered to said central wide section at said edge of said central wide section.

2. An electric fuse of the plug-type that comprises a plug-type housing with a plurality of terminals, and an elongated fusible link that is disposed within said housing and is electrically connected to said terminals, said fusible link having a plurality of bends intermediate the ends thereof to define a portion that is inclined to the axis of said plug-type housing and two portions that are contiguous to the first said portion, the bends between the first said portion and the said two portions being abrupt, the first said portion of said fusible link having a central wide section intermediate two narrow sections, said central wide section having a large opening therein, said narrow sections of the first said portion having weak spots therein, each of the said two sections having a wide section and a narrow section, said wide sections of the said two sections being adjacent and contiguous to the first said portion of said fusible link, the first said portion of said fusible link having a generally U-shaped slug of zinc mechanically secured to and overlying and underlying substantially all of said central wide section except one edge of said central wide section, said slug overlying and underlying said large opening in said central wide section and having portions thereof extending into said large

opening to permanently lock said lug to said central wide section, said slug being soldered to said central wide section at said edge of said central wide section.

3. An electric fuse of the plug-type that comprises a plug-type housing with a plurality of terminals and an elongated fusible link that is disposed within said housing and is electrically connected to said terminals, said fusible link having a plurality of bends intermediate the ends thereof to define a portion that is inclined to the axis of said plug-type housing and two portions that are contiguous to the first said portion, the bends between the first said portion and the said two portions being abrupt, the first said portion of said fusible link having a central wide section intermediate two narrow sections, said central wide section having a large opening therein, said narrow sections of the first said portion having weak spots therein, each of the said two sections having a wide section and a narrow section, said wide sections of the said two sections being adjacent and contiguous to the first said portion of said fusible link, the first said portion of said fusible link having a mass of heat absorbing material mounted on and carried by said central wide section, said mass of heat absorbing material overlying at least part of said opening in said central wide section, and a bonding material engaging said central wide section and said mass of heat absorbing material to assure full heat interchange between said central wide section and said mass of heat absorbing material.

4. An electric fuse of the plug-type that comprises a plug-type housing with a plurality of terminals and an elongated fusible link that is disposed within said housing and is electrically connected to said terminals, said fusible link having a plurality of bends intermediate the ends thereof to define a portion that is inclined to the axis of said plug-type housing and two portions that are contiguous to the first said portion, the bends between the first said portion and the said two portions being abrupt, the first said portion of said fusible link having a central wide section intermediate two narrow sections, said narrow sections of the first said portion having weak spots therein, each of the said two sections having a wide section and a narrow section, said wide sections of the said two sections being adjacent and contiguous to the first said portion of said fusible link, the first said portion of said fusible link having a mass of heat absorbing material mounted on and carried by said central wide section.

5. An electric fuse of the plug-type that comprises a plug-type housing with a plurality of terminals and an elongated fusible link that is disposed within said housing and is electrically connected to said terminals, said fusible link having a plurality of bends intermediate the ends thereof to define a first portion and two portions that are contiguous to said first portion, the first said portion of said fusible link having a central wide section intermediate two narrow sections, each of the said two sections having a wide section and a narrow section, said wide sections of the said two sections being adjacent and contiguous to the first said portion of said fusible link, the first said portion of said fusible link having a mass of heat absorbing material mounted on and carried by said central wide section.

6. An electric fuse of the plug-type that comprises a plug-type housing with a plurality of terminals and a transparent portion and an elongated fusible link that is disposed within said housing and is electrically connected to said terminals, a portion of said fusible link being immediately adjacent said transparent portion of said plug-type housing, said portion of said fusible link having a mass of heat absorbing material mounted thereon and carried thereby and normally holding said mass of heat absorbing material adjacent to and in register with said transparent portion of said plug-type housing whereby said mass of heat absorbing material is normally readily visible through said transparent portion of said plug-type housing to indicate the unblown condition of said electric fuse,

said portion of said fusible link having weak spots at the opposite sides of said mass of heat absorbing material, said weak spots being dimensioned to fully support said portion of said fusible link and said mass of heat absorbing material as long as said fusible link remains unblown but being dimensioned so either of said weak spots will bend under the weight of said portion of said fusible link and said mass of heat absorbing material when both of said weak spots are heated and the other of said weak spots blows, either or both of said weak spots responding to long continued lower overloads to fuse and open the circuit and to permit said mass to fall away and thereby provide an indication visible through said transparent portion of said plug-type housing, said weak spots responding to short circuit to fuse and permit said mass of heat absorbing material to fall away and thereby provide an indication visible through said transparent portion of said plug-type housing, said mass of heat absorbing material responding to the fusing of one of said weak spots to bend the portion of said fusible link that defines the other of said weak spots and thereby move away from said transparent portion to provide an indication visible through said transparent portion.

7. A protector for electric circuits that comprises terminals and a fusible conductor electrically connecting said terminals, said fusible conductor having a generally U-shaped mass of heat absorbing material mounted on and carried thereby, said mass having the arms thereof overlying and underlying a portion of said fusible conductor and being permanently and fixedly secured thereto, said fusible conductor having weak spots spaced from said mass of heat absorbing material, and solder that is spaced from said weak spots and that engages said mass of heat absorbing material and said fusible conductor and assures full interchange of heat between said fusible conductor and said mass of heat absorbing material, said mass of heat absorbing material keeping said solder from reaching its melting point during the operation of said protector and thereby making certain that the portion of said fusible conductor which blows must rise to the melting temperature of the metal of said fusible conductor.

8. A protector for electric circuits that comprises terminals and a fusible conductor electrically connecting said terminals, said fusible conductor having two portions of limited cross section oppositely disposed of an intermediate portion of larger cross section, each of said portions of limited cross section having a further reduction in cross section intermediate the ends thereof and adjacent the center thereof, and a mass of heat absorbing material mounted on and carried by said intermediate portion, said portions of limited cross section substantially providing spot generation of heat adjacent the centers thereof and providing rapid conduction of heat to said intermediate portion and to said mass of heat absorbing material, said further reductions in cross section enabling either of said portions of limited cross section to bend in response to the weight of said mass of heat absorbing material when both of said portions of limited cross section are hot and the other of said portions of limited cross section blows.

9. A protector for electric circuits that comprises terminals and a fusible conductor electrically connecting said terminals, said fusible conductor having an opening intermediate the ends thereof, said fusible conductor having a readily fusible portion spaced from said opening, and a generally U-shaped mass of heat absorbing material mounted on and carried by said fusible conductor, said mass having the arms thereof overlying and underlying part of said opening and having said arms spaced from said readily fusible portion, said mass of heat absorbing material absorbing heat from those portions of said fusible conductor which define said opening and thereby preventing melting of said opening-defining portions of said fusible conductor, said readily fusible portion of said fusible conductor having to rise to the melting point of the metal of said fusible conductor to blow and open the circuit.

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10. A protector for electric circuits that comprises terminals and a fusible conductor electrically connecting said terminals, said fusible conductor having an opening intermediate the ends thereof, and a generally U-shaped mass of heat absorbing material mounted on and carried by said fusible conductor, said mass having the arms thereof overlying and underlying part of said opening and partially extending toward each other and into said opening to lock said mass of heat absorbing material in position on said fusible conductor, said mass of heat absorbing material absorbing heat from those portions of said fusible conductor which define said opening and thereby preventing melting of said opening-defining portions of said fusible conductor.

11. A protector for electric circuits that comprises a housing, a fusible conductor that is disposed within said housing and has the ends thereof embedded and having the rest thereof freely and openly exposed to the atmosphere within said housing, a pair of weak spots in said fusible conductor that define an intermediate portion of said fusible conductor, said intermediate portion being spaced from one of said embedded ends by a freely and openly exposed portion of said fusible conductor which is longer than the freely and openly exposed portion which spaces said intermediate portion from said other embedded end, said freely and openly exposed portions of said fusible conductor being formed to provide approximately the same resistance to the flow of heat outwardly from said weak spots toward said embedded ends of said fusible conductor.

12. A protector for electric circuits that comprises a housing, a fusible conductor that is disposed within said housing and has the ends thereof embedded and having the rest thereof freely and openly exposed to the atmosphere within said housing, a pair of weak spots in said fusible conductor that define an intermediate portion of said fusible conductor, said intermediate portion being spaced from one of said embedded ends by a freely and openly exposed portion of said fusible conductor which is longer than the freely and openly exposed portion which spaces said intermediate portion from said other embedded end, said freely and openly exposed portion of said fusible conductor which spaces said intermediate portion from said other embedded end being of smaller cross section than said freely and openly exposed portion of said fusible conductor which spaces said intermediate portion from said one embedded end, whereby the thermal resistance of said freely and openly exposed portions is approximately the same and whereby said freely and openly exposed portions of said fusible conductor provide approximately the same resistance to the flow of heat outwardly from said weak spots toward said embedded ends of said fusible conductor.

13. A protector for electric circuits that comprises terminals and a fusible conductor electrically connecting said terminals, said fusible conductor having a large opening therein and having two smaller openings therein oppositely disposed of said large opening and having a heat absorbing mass mounted thereon and overlying at least part of said large opening, those portions of said fusible conductor that define said smaller openings constituting the smallest cross section portions of said fusible conductor and constituting the hottest portions of said fusible conductor whenever current passes through said protector for electric circuits, whereby said portions that define said smaller openings always constitute the circuit-opening portions of said protector for electric circuits irrespective of the magnitude of the overload causing said protector for electric circuit to open the circuit, said heat absorbing mass remaining substantially unfused throughout the operation of said protector for electric circuits, said portions of said fusible conductor that define said smaller openings rising to the melting point of the metal of said fusible conductor to open said circuit.

14. A protector for electric circuits that comprises

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terminals and a fusible conductor electrically connecting said terminals, said fusible conductor having two portions of reduced cross section that are oppositely disposed of an intermediate portion, a heavy mass mounted on and carried by said intermediate portion, said reduced cross section portions being dimensioned to fully support said intermediate portion and said heavy mass as long as said fusible conductor remains unblown but being dimensioned so either of said reduced cross section portions will respond to temperatures adjacent their fusing temperatures to bend under the weight of said heavy mass and provide an increased arc gap when the other of said reduced cross section portions fuses.

15. A protector for electric circuits that comprises a housing, terminals and a fusible conductor electrically connecting said terminals, said fusible conductor having a pair of weak spots therein and having a mass of heat absorbing material mounted on and carried thereby, said mass of heat absorbing material being permanently and mechanically secured to said fusible conductor, whereby said mass of heat absorbing material can not shift along the length of said fusible conductor and thereby absorb an undue amount of heat from one of said weak spots and absorb an insufficient amount of heat from the other of said weak spots, said weak spots being dimensioned to fully support said mass of heat absorbing material as long as said fusible conductor remains unblown but being dimensioned so either of said weak spots will bend under the weight of said mass of heat absorbing material when both of said weak spots are heated and the other of said weak spots blows, said fusible conductor having bends intermediate its ends and said weak spots that incline, said mass of heat absorbing material and the portion of said fusible conductor on which it is mounted relative to the axis of said protector for electric circuits, said fusible conductor holding said mass of heat absorbing material spaced from the interior surface of said housing but responding to the fusing thereof adjacent one or the other of said weak spots to free said mass of heat absorbing material for movement relative to said interior surface of said housing.

16. A protector for electric circuits that comprises terminals and a fusible conductor electrically connecting said terminals, said fusible conductor having a mass of heat absorbing material mounted on and carried thereby, said mass of heat absorbing material being permanently and mechanically secured to said fusible conductor, solder engaging and bonded to said fusible conductor and to said mass of heat absorbing material to assure full interchange of heat between said fusible conductor and said mass of heat absorbing material, and a weak spot in said fusible conductor, said solder remaining substantially unfused throughout the operation of said protector for electric circuits, whereby said fusible conductor will blow in said weak spot and whereby said weak spot must rise to the melting point of the metal of said fusible conductor to blow.

17. A protector for electric circuits that comprises terminals, a fusible conductor, and a mass of heat absorbing material, said fusible conductor normally electrically connecting said terminals, said fusible conductor having a wide portion intermediate the ends thereof, said mass of heat absorbing material being fixedly secured to said wide portion of said fusible conductor, said mass of heat absorbing material remaining substantially unfused when said fusible conductor fuses, said fusible conductor having a second wide portion intermediate one end thereof and the first said wide portion, said fusible conductor having a third wide portion intermediate the other end thereof and the first said wide portion, said fusible conductor having a narrow portion intermediate the first said and said second wide portions, said fusible conductor having a second narrow portion intermediate the first said and said third wide portions, each of said narrow portions being further narrowed intermediate the ends thereof to form

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weak spots that can provide spot generation of heat, the first said and said second narrow portions being longer than said weak spots and having the outermost ends thereof spacing said weak spots away from said second and said third wide portions, whereby heat flowing from said weak spots toward said second and said third wide portions must pass through and be limited by said outermost ends of the first said and said second narrow portions, the first said wide portion of said fusible conductor absorbing heat which has been generated by said weak spots and has passed through the innermost ends of the first said and said second narrow portions, the first said wide portion subsequently transferring much of that heat to said heat absorbing mass whereby said heat absorbing mass can delay the fusing of said weak spots.

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