June 22, 1965 A. J. FISTER 3,190,987

PROTECTORS FOR ELECTRIC CIRCUITS

Filed March 29, 1961 2 Sheets-Sheet 1

FIG. 1

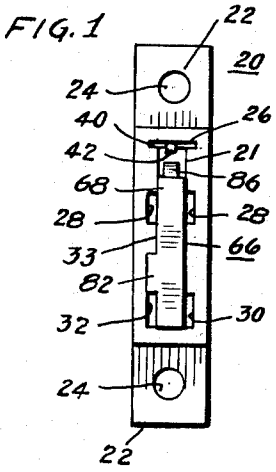


FIG. 2

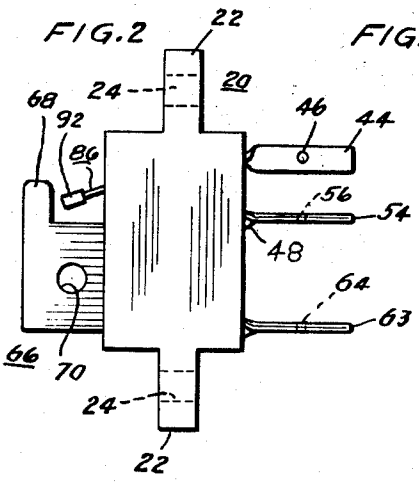


FIG. 3

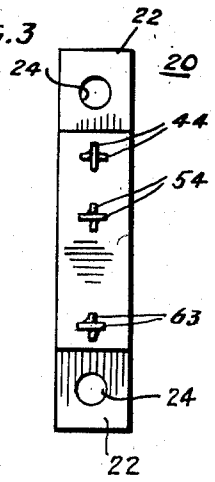


FIG. 4

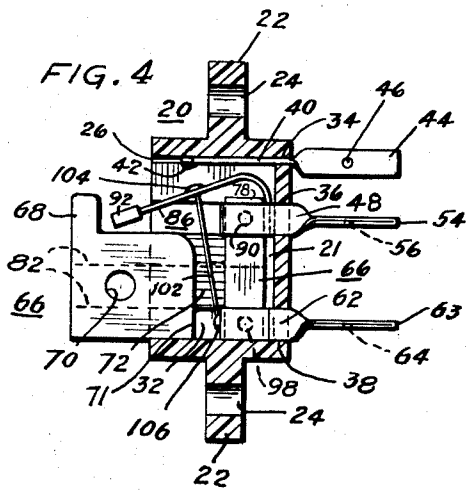


FIG. 5

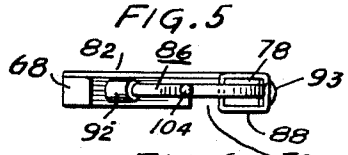


FIG. 6

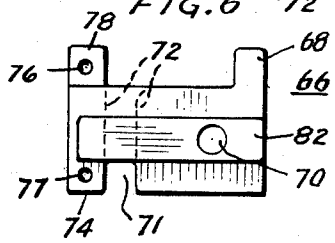


FIG. 7

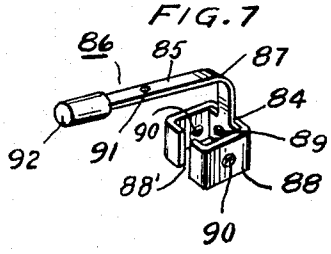
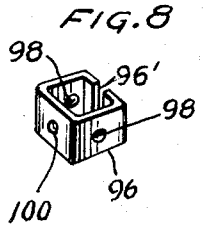


FIG. 8



INVENTOR.
ALOYSIUS J. FISTER
BY
Ray Eilers
ATT'Y.

June 22, 1965 A. J. FISTER 3,190,987

PROTECTORS FOR ELECTRIC CIRCUITS

Filed March 29, 1961 2 Sheets-Sheet 2

FIG. 9

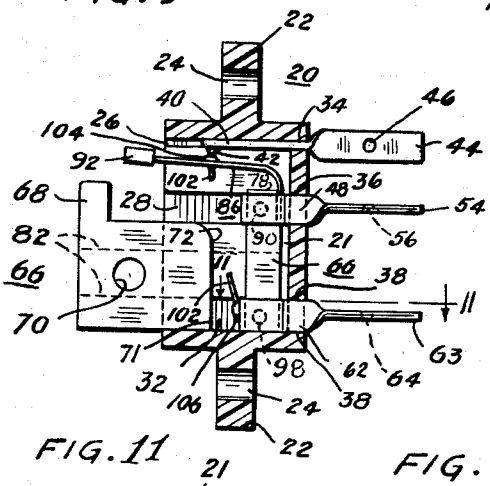


FIG. 10

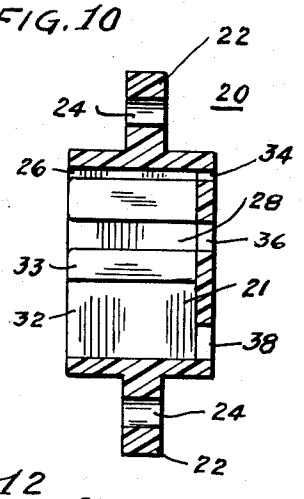


FIG. 11

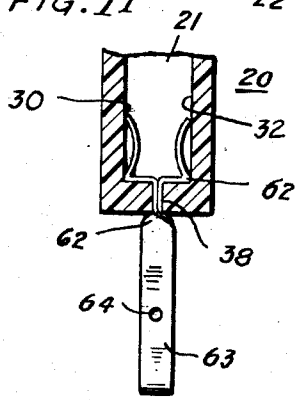


FIG. 12

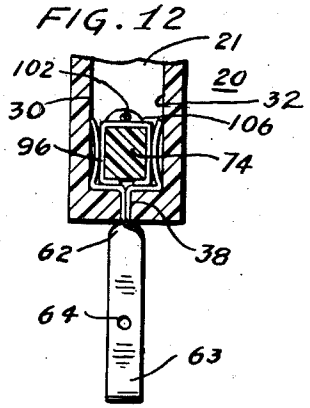
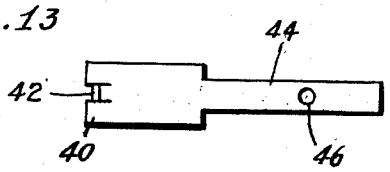


FIG. 13



INVENTOR.
ALOYSIUS J. FISTER
BY
Roy Eckert
ATT'Y.

United States Patent Office 3,190,987 Patented June 22, 1965

3,190,987

PROTECTORS FOR ELECTRIC CIRCUITS

Aloysius J. Fister, Overland, Mo., assignor to McGraw-Edison Company, Elgin, Ill., a corporation of Delaware

Filed Mar. 29, 1961, Ser. No. 99,086
9 Claims. (Cl. 200—121)

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 desirable, in some electrical installations, to use a fuse which has a resilient contact that is normally held out of engagement with an adjacent alarm contact by the fusible element of that fuse and that will move into engagement with that alarm contact when that fusible element "blows." Such a fuse was developed a number of years ago, is shown and described in Rorty and Thompson Patent No. 761,916 for Protective Device for Telephone-Circuits, which was granted June 7, 1904, and is known as a "grasshopper fuse"; and it is an open-type fuse, it has only a limited number of parts, and it is relatively inexpensive. The present invention provides an improved grasshopper fuse; and it is, therefore, an object of the present invention to provide an improved grasshopper fuse.

The open nature of grasshopper fuses is desirable, because it makes certain that light can reach and high-light the resilient contacts of those fuses. However, most grasshopper fuses are difficult to store and to ship economically, because those fuses tend to be irregular in configuration. The present invention provides a grasshopper fuse which is open in nature but which is easily and economically stored and shipped. That grasshopper fuse is regular in configuration, it is sturdy and rugged, and it protects the fusible element thereof by disposing that fusible element in a recess. It is therefore an object of the present invention to provide a grasshopper fuse which is regular in configuration, is sturdy and rugged, and protects the fusible element thereof by disposing that fusible element in a recess.

The grasshopper fuse provided by the present invention is made so light can reach and high-light the resilient contact of that fuse, and yet is made so it fully protects that resilient contact from injury. Specifically, that grasshopper fuse is made so part of the resilient contact thereof projects outwardly from the holder for that fuse, and is fully exposed to light, but is also made so that part of that resilient contact is normally disposed behind, and is thus protected by, an ear on that fuse. In this way, that resilient contact is protected from injury until the fusible element blows, and will thereafter be exposed to view and high-lighted. It is, therefore, an object of the present invention to provide a grasshopper fuse that is made so part of the resilient contact thereof projects outwardly from the holder for that fuse, and is also made so that part of that resilient contact is normally disposed behind, and is thus protected by, an ear on that fuse.

The part of the resilient contact, of the grasshopper fuse provided by the present invention, that projects outwardly from the holder for that fuse will serve as an indicator; and that part is normally hidden from view by an ear on that fuse when that fuse is viewed from the front thereof. As a result, when a person checking on the condition of a number of fuses in a fuse bank runs his eye along the fronts of those various fuses, the indicator of a "blown" fuse will stand out in bold relief and will thus be readily visible. Yet, the indicators of those various fuses can be seen, even when the fusible elements of those fuses are intact, if that person will shift his position so he can view the fuses in prespective. Such an arrangement is

desirable because it makes it possible for a person to quickly check the fuses to determine whether the indicators of those fuses have, in some way, been broken off or gotten stuck. Absent this arrangement, a person could readily assume that the various fuses were intact, and yet one or more of those fuses might have had their fusible elements blow and have had their indicators broken off or stuck. It is, therefore, an object of the present invention to provide a grasshopper fuse which has an indicator that is hidden from view when that fuse is viewed from the front thereof but that is visible when that fuse is viewed in perspective.

The grasshopper fuse provided by the present invention includes a fuse carrier which is made so it is rugged and strong and so it can be grasped to facilitate its insertion into, and to facilitate its removal from, a recess within the holder for that fuse. A portion of that fuse carrier projects outwardly beyond the recess in that fuse holder and constitutes a finger-receiving surface that can be gripped to facilitate the removal of the fuse for inspection or replacement. Further, that portion of the fuse is provided with an opening which can accommodate a tool, such as a rod with a hook in the end thereof, to facilitate the removal of that fuse from a group of closely adjacent fuse holders in a fuse bank. It is, therefore, an object of the present invention to provide a fuse with a fuse carrier which is made so it is rugged and strong and which has a portion with a finger-receiving surface that can be gripped to facilitate the removal of the fuse for inspection or replacement.

The fuse carrier, of the fuse provided by the present invention, has terminals secured thereto; and those terminals are physically spaced apart, and are electrically connected only through the medium of the fusible element of that fuse. When that fusible element blows, those terminals must be electrically isolated to interrupt the circuit protected by that fuse. To prevent the creation of any leakage paths on that fuse carrier, due to the deposition of dust on that fuse carrier or to the condensing of moisture on that fuse carrier, the present invention spaces those terminals at the opposite ends of that fuse carrier. This means that a maximal distance is provided between those terminals, and that maximal distance will preclude the establishment of leakage paths on that fuse carrier between those terminals. It is, therefore, an object of the present invention to mount terminals on a fuse carrier, and to dispose those terminals at the opposite ends of that fuse carrier.

The terminals on the fuse carrier of the fuse provided by the present invention are adapted to be received and held by terminals in the holder for that fuse carrier. The terminals in that fuse holder are generally U-shaped in elevation, and the confronting faces on the arms of those terminals are convex. Further, the upper and lower ends of those terminals abut, and are held against outward movement by, portions of the inner faces of that fuse holder. The overall result is that the confronting faces of the arms of the terminals in the fuse holder will be resistant to bending and will thus firmly grip and hold the terminals on the fuse carrier of the fuse. It is, therefore, an object of the present invention to make the terminals within a fuse holder U-shaped in elevation, to make the confronting faces on the arms of those terminals convex, and to make the upper and lower ends of those terminals abut, and be held against outward movement by, portions of the inner faces of that fuse holder.

The fuse holder, for the fuse provided by the present invention, has a recess in which part of the fuse carrier can extend; and the walls of that recess have guiding recesses which accommodate the arms of the U-shaped terminals of that fuse holder. Those guiding recesses extend all the way to the outer face of the fuse holder,

and thus serve as guides for those terminals during the assembling of those terminals with the fuse holder. Furthermore, those guiding recesses prevent displacement of the arms of those terminals during the assembling and disassembling of the fuse carrier with the fuse holder. It is, therefore, an object of the present invention to provide a fuse holder with a recess that can accommodate part of a fuse carrier and to provide guiding recesses in the walls of that recess which are contiguous with that recess and which extend to the surface of the fuse holder and which hold and guide the U-shaped arms of the terminals held by that fuse holder.

The terminals which are held by the fuse holder, for the fuse provided by the present invention, have securing portions that extend through openings in the closed end of that fuse holder and are then twisted to prevent separation of those terminals from that fuse holder. That twisting is important because it automatically and fully compensates for any manufacturing tolerances in the lengths of those terminals and in the thickness of the closed end of that fuse holder—that twisting extending directly to the outer face of the closed end of that fuse holder. It is, therefore, an object of the present invention to provide the terminals for a fuse holder with securing portions that extend through openings in the closed end of that fuse holder and which are then twisted to maintain those terminals in assembled relation with that fuse holder.

The fuse carrier of the fuse provided by the present invention has small recesses therein adjacent the opposite ends thereof. Those recesses accommodate dimples on the generally U-shaped terminals for that fuse carrier. Those terminals are made resilient so they can be spread apart to telescope them over the said opposite ends of the fuse carrier and can, upon release of the forces used to spread them, force the dimples thereof into the recesses adjacent the opposite ends of that fuse carrier. The restoring forces of those U-shaped terminals will thereafter hold those dimples within those recesses with sufficient force to prevent accidental separation of those terminals from the fuse carrier. It is, therefore, an object of the present invention to provide a fuse carrier with recesses adjacent the opposite ends thereof and to provide resilient U-shaped terminals with dimples that can coact with those recesses to prevent accidental separation of those terminals from that fuse carrier.

Because the fuse provided by the present invention is a grasshopper fuse, it has the advantages of grasshopper fuses; but that fuse is made so it is free from the objectional frailties of the usual grasshopper fuses. Specifically, the fuse provided by the present invention has a resilient, leaf-type contact that has a portion thereof which is disposed outwardly of a recess in the fuse holder, and has a fusible element which normally holds that resilient, leaf-type contact in retracted position but which is completely protected from injury. The present invention makes it possible for the fusible element to normally hold the resilient, leaf-type contact in retracted position and yet makes it possible for that fusible element to be protected from injury by providing a recess in the fuse carrier which accommodates the greatest part of the fusible element and by telescoping that fusible element wholly within a recess in the fuse holder whenever the fuse carrier is assembled with that fuse holder. The portions of the fuse carrier which define the recess in that fuse carrier will act to protect the fusible element at all times, and the portions of the fuse holder which define the recess in that fuse holder will act to protect that fusible element whenever the fuse carrier is assembled with that fuse holder. As a result, the present invention fully protects the fusible element of the fuse while enabling that fusible element to normally hold the resilient, leaf-type contact of that fuse in retracted position. It is, therefore, an object of the present invention to provide a grasshopper fuse which has a resilient, leaf-type contact and which has a fusible element that normally holds that resilient, leaf-type contact in retracted position but that frees that resilient, leaf-type contact for movement to extended position whenever it blows, and which disposes that fusible element in a recess in a fuse carrier and then disposes that recess in a recess in the fuse holder whenever that fuse carrier is assembled with that fuse holder.

Because the fuse provided by the present invention is a grasshopper fuse, and thus must close an indicating circuit when the fusible element blows, the fuse carrier of that fuse must be disposable in the fuse holder therefor in just one position. That position must be such that the resilient, leaf-type contact confronts the third terminal of the fuse holder. The present invention provides orienting surfaces on the fuse carrier and on one of the inner walls of the recess in the fuse holder to force that fuse carrier to enter that recess in just one position. It is, therefore, an object of the present invention to provide a grasshopper fuse with orienting surfaces on the fuse carrier and on one of the inner walls of the recess in the fuse holder which force that fuse carrier to enter that recess in just one position.

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 front elevational view of a fuse and of a fuse holder therefor which are made in accordance with the principles and teachings of the present invention,

FIG. 2 is a side elevational view of the fuse and fuse holder of FIG. 1,

FIG. 3 is a rear view of the fuse holder of FIG. 1,

FIG. 4 is a vertical section through the fuse holder of FIG. 1, and it shows the fuse in side elevation,

FIG. 5 is a plan view of the fuse of FIG. 1,

FIG. 6 is an elevational view of the rear face of the fuse carrier of the fuse before the terminals, the resilient, leaf-type contact, and the fusible element have been assembled with that fuse carrier,

FIG. 7 is a perspective view, on a larger scale, of the resilient, leaf-type contact and of the U-shaped terminal which is associated with that resilient, leaf-type contact in the fuse of FIG. 1,

FIG. 8 is a perspective view, on the scale of FIG. 7, of the other U-shaped terminal in the fuse of FIG. 1,

FIG. 9 is a vertical section that is similar to the vertical section in FIG. 4, but it shows the fuse after the fusible element thereof has blown,

FIG. 10 is a vertical section through the fuse holder of FIG. 1,

FIG. 11 is a sectional view, on a still larger scale, through the fuse holder of FIG. 1, and it is taken along the plane indicated by the line 11—11 in FIG. 9,

FIG. 12 is a sectional view on the scale of FIG. 11, through the fuse and fuse holder of FIG. 1, and it is taken along the plane indicated by the line 11—11 in FIG. 9, and

FIG. 13 is a plan view of the lower face of the third terminal of the fuse holder of FIG. 1.

Referring to the drawing in detail, the numeral 20 generally denotes a fuse holder that is made in accordance with the principles and teachings of the present invention. That fuse holder is generally prismatic in configuration and it has a generally prismatic recess 21 therein. That fuse holder has ears 22 extending upwardly and downwardly from the upper and lower ends thereof, and those ears have openings 24 therein. Fasteners, not shown, can pass through the openings 24 and

seat in a suitable support to maintain the fuse holder 20 in assembled relation with that support. Where desired, that support can be elongated and can accommodate a large number of fuse holders 20 in side-by-side relation.

The recess 21 in the fuse holder 20 is elongated and deep, as shown particularly by FIGS. 1 and 10. Oppositely-disposed, narrow recesses or grooves 26 are formed in the inner faces of the walls which define the recess 21 in the fuse holder 20, and those recesses or grooves extend all the way from the front face of that fuse holder to the bottom of the recess 21. An opening 34 is formed in the closed end of the fuse holder 20, and that opening is generally in register with the recesses or grooves 26. Recesses or grooves 28 are formed in the inner faces of the walls which define the recess 21 in the fuse holder 20, and those recesses or grooves extend all the way from the front face of that fuse holder to the bottom of the recess 21. An opening 36 is provided in the closed end of the fuse holder 20, and that opening is generally in register with the recesses or grooves 28. As indicated particularly by FIG. 10, the grooves 28 are wider than the grooves 26.

A recess or groove 30 is formed in the inner face of one of the walls which defines the recess 21 in the fuse holder 20, and that recess or groove is adjacent one end of the recess 21. The recess or groove 30 extends all the way from the front face of the fuse holder 20 to the bottom of the recess 21. An opening 38 is provided in the closed end of the fuse holder 20, and that opening is generally in register with the recess or groove 30. A wide recess 32 is formed in that inner face of the fuse holder 20 which is opposite to the inner face in which the recess or groove 30 is formed. Part of the recess 32 is in register with the recess or groove 30, but the recess 32 extends an appreciable distance beyond the recess or groove 30. The recess 32 extends all the way from the front face of the fuse holder 20 to the bottom of the recess 21. The recess 32 coacts with one of the recesses or grooves 28 to define a confining and guiding rib 33.

The numeral 40 denotes a metal terminal which has a wide portion and a reduced-width shank 44. A tang 42 is struck out of the wide portion of the terminal 40; and that tang inclines inwardly of the recess 21 in the fuse holder 20, as indicated particularly by FIG. 4. An opening 46 is provided in the reduced-width shank 44 of the terminal 40, as shown by FIGS. 2, 4, 9 and 13. The shank 44 initially lies in the plane defined by the wide portion of the terminal 40, as indicated by FIG. 13; but that shank will be twisted to a position where it is at a right angle to that plane after that shank has been passed through the opening 34 in the closed end of the fuse holder 20.

In assembling the terminal 40 with the fuse holder 20, the edges of the wide portion of that terminal will be alined with the recesses or grooves 26 and the shank 44 will be directed toward the opening 34. That terminal will then be moved toward the closed end of the fuse holder 20; and as that terminal is so moved, the shank 44 will pass through the opening 34 and the edges of the wide portion of that terminal will telescope within and will be guided and confined by the recesses or grooves 26. Once the shoulder between the reduced-width shank 44 and the wide portion of the terminal 40 solidly abuts the closed end of the fuse holder 20, the shank 44 will be twisted until it is at a right angle to the plane defined by the wide portion of the terminal 40. The twisting will extend to the outer face of the closed end of the fuse holder 20, and will thus coact with the recesses or grooves 26 to fixedly hold the terminal 40 against any shifting relative to the fuse holder 20.

The numeral 48 generally denotes another metal terminal for the fuse holder 20; and that terminal is preferably formed by folding an elongated, narrow piece of metal back on itself, and by forcing the portions of that piece which are adjacent the free ends of that folded piece of metal to assume a U-shaped configuration. The portions of the folded piece of metal which are adjacent the fold in that piece of metal serve as a shank 54. The confronting faces of the U-shaped portion of the terminal 48 are convex and are spaced apart by offsets. An opening 56 is provided in the shank 54 of the terminal 48. The shank 54 initially lies in a plane which is substantially co-planar with the arms of the U-shaped portion of the terminal 48; but that shank will be twisted to a position where it is at a right angle to the planes defined by the U-shaped portion of that terminal after that shank has been passed through the opening 36 in the closed end of the fuse holder 20.

In assembling the terminal 48 with the fuse holder 20, the arms of the U-shaped portion of that terminal will be alined with the recesses or grooves 28 and the shank 54 will be directed toward the opening 36. That terminal will then be moved toward the closed end of the fuse holder 20; and as that terminal is so moved, the shank 54 will pass through the opening 36 and the arms of the U-shaped portion of that terminal will telescope within and will be guided and confined by the recesses or grooves 28. Once the offsets that help define the U-shaped portion of the terminal 48 solidly abut the closed end of the fuse holder 20, the shank 54 will be twisted until it is at a right angle to the planes defined by the arms of the U-shaped portion of the terminal 48. The twisting will extend to the outer face of the closed end of the fuse holder 20, and will thus coact with the recesses or grooves 28 to fixedly hold the terminal 48 against any shifting relative to the fuse holder 20.

When the arms of the U-shaped portion of the terminal 48 are disposed within the recesses or grooves 28, the upper and lower ends of those arms will abut, and will be held against outward movement by, the outer faces of those recesses or grooves. As a result, those arms will act as convex beams which are supported at the ends thereof, and are thus strongly resistant to bending.

The numeral 62 denotes a terminal that is substantially identical to the terminal 48. The terminal 62 has a shank 63, and that shank has an opening 64 in it. The shank 63 will telescope through the opening 38 in the closed end of the fuse holder 20; and one of the arms of the U-shaped portion of that terminal will be disposed within the recess 32 while the other of those arms will be disposed within the recess or groove 30. The engagement between that other arm and the recess or groove 30 will coact with the twisting of the shank 63 to fixedly hold the terminal 62 against any shifting relative to the fuse holder 20. As indicated particularly by FIG. 11, the confronting faces of the U-shaped portion of the terminal 62 are convex and are spaced apart by offsets. The terminal 48 has a similar arrangement.

The numeral 66 generally denotes the fuse carrier of the fuse that is provided by the present invention. That fuse carrier is generally flat, and it is elongated in a direction which is perpendicular to the plane of the front face of the fuse holder 20, as indicated particularly by FIGS. 4 and 9. That fuse carrier has an ear 68; and that ear extends upwardly from that fuse carrier whenever that fuse carrier is assembled with the fuse holder 20. An opening 70 is provided in the fuse carrier 66 below and to the right of the ear 68, as that opening and ear are viewed in FIGS. 4 and 9; and that opening is adjacent the outer end of that fuse carrier. A notch 71 is provided adjacent the inner end of the fuse carrier 66; and that notch helps define an ear 74. That ear coacts with a second ear 73, adjacent the inner end of the fuse carrier 66, and with the notch 71 to provide a generally T-shaped configuration for the inner end of the fuse carrier 66. A recess 72 is formed in one face of the fuse carrier 66, and that recess extends transversely of the stem of the T-shaped portion of that fuse carrier. Generally circular concave recesses

76 and 77 are provided, respectively, in the opposite faces of the ears 78 and 74 of the fuse carrier 66. A shallow rib 82 is formed on that face of the fuse carrier 66 which is opposite to the face in which the recess 72 is formed, as indicated particularly by FIG. 6. That rib is dimensioned so it can preclude the insertion of the fuse carrier 66 within the fuse holder 20 in any position other than the position shown by FIG. 1.

The numeral 86 generally denotes a resilient, leaf-type contact which is carried by the fuse carrier 66. That contact has a wide, short, straight portion 84, a long, straight portion 85, and a bend 87 therebetween. An opening 91 is provided in the long, straight portion 85, and an indicator 92 is mounted on the free end of that long, straight portion. Preferably, that indicator is a sleeve of insulation; and that indicator will be given a color which will enable it to be readily visible. A dimple 89 is formed in the wide, short, straight portion 84 of the contact 86.

The numeral 88 denotes a generally U-shaped terminal essentially in the shape of an annulus that is made of metal and that is made so it is resilient. The arms of the U-shaped terminal 88 are provided with generally spherical protuberances or dimples 90 that extend inwardly from the confronting faces of those arms. Those dimples can be disposed in register with, and can extend into, the recesses 76 in the ear 78 of the fuse carrier 66. The U-shaped terminal 88 is resilient enough to permit the arms thereof to be spread far enough apart to enable those arms to be set in register with the recessed faces of the ear 78; but that terminal is stiff enough to force the dimples 90 on the arms thereof into, and to normally hold those dimples within, the recesses 76 in the ear 78. The free ends of the arms of the U-shaped terminal 88 are provided with short flanges, and those flanges extend toward, but terminate short of, each other to form slit 88'. Those flanges coact with the dimples 90 and the recesses 76 to prevent accidental separation of the U-shaped terminal 88 from the ear 78 of the fuse carrier 66. The closed end of the U-shaped terminal 88 has an opening, not shown, therein; and that opening is adjacent the center of that closed end. That opening accommodates the dimple 89 on the wide, short, straight portion 84 of the contact 86.

The short, straight portion 84 of the resilient, leaf-type contact 86 is inserted between the closed end of the U-shaped terminal 88 and the right-hand face of the ear 78, as that ear is viewed in FIGS. 4, 5 and 9. That short, straight portion is permanently secured to the closed end of the U-shaped terminal 88 by a mass of solder 93; and that short, straight portion and that U-shaped terminal will be held against accidental separation from the ear 78. The opening, not shown, in the closed end of the U-shaped terminal 88 facilitates the alinement and soldering of the wide, short, straight portion 84 of and to that terminal.

The numeral 96 denotes a U-shaped terminal that is similar to terminal 88—having protuberances or dimples 98 at the inner faces of the arms thereof, having short flanges at the free ends of those arms, and having an opening 100 adjacent the center of the closed end thereof. The dimples 98 are dimensioned and disposed so they can extend into the notches 77 of ear 74. U-shaped terminal 96 is sufficiently resilient to permit the arms thereof to be spread far enough apart to enable those arms to be set in register with the recessed faces of ear 74; but that terminal is stiff enough to force the dimples on the arms thereof into, and to normally hold those dimples within, the recesses 77 in ear 74. The flanges on the free ends of the arms of the terminal 96 will coact with the dimples 98 and the recesses 77 to prevent accidental separation of that U-shaped terminal from the ear 74 on the fuse carrier 66. The flanges terminate short of each other to form slit 96'.

It will be noted that the terminals 88 and 96 are spaced apart the full length of the T-shaped inner end of fuse carrier 66. This is desirable because it prevents the establishment of leakage paths between those terminals, despite the deposition of dust or moisture on that inner end.

The numeral 102 denotes a fusible element; and that fusible element is shown as a fine wire. One end of that fusible element extends through the opening 91 in the long, straight portion 85 of the resilient, leaf-type contact 86; and that end is secured within that opening by a mass of solder 104. The other end of that fusible element extends through the opening 100 in the closed end of the U-shaped terminal 96; and that other end is held within that opening by a mass of solder 106. Prior to the time that other end of the fusible element 102 is soldered to the closed end of the terminal 96, that fusible element will be pulled far enough through the opening 100 to bend the resilient, leaf-type contact 86 to the position shown by FIG. 4. While that resiilent, leaf-type contact is held in that position, the solder 106 will be applied. Subsequently, until it blows, the fusible element 102 will hold the resilient, leaf-type contact 86 in the bent position shown by FIG. 4. In that position, that resilient, leaf-type contact 86 will have the indicator 92 thereof disposed behind the ear 68 on the fuse carrier. As a result, that indicator will not be visible to a person standing squarely in front of the fuse carrier 66; but that indicator will be visible to a person standing to one side and viewing that fuse carrier in perspective.

The fusible element 102 will be disposed within the recess 72 of the fuse carrier 66, and it will be held under tension by the restorative forces in the resilient, leaf-type contact 86. That fusible element will be protected from injury by being disposed within the recess 72, and also by being disposed wholly within the recess 21 of the fuse holder 20.

The fuse carrier 66 can be inserted within the recess 21 in the fuse holder 20 whenever the rib 82 on that fuse carrier is placed in register with the recess 32 in that fuse holder. At such time, the U-shaped terminal 88 will be in register with the U-shaped end of the terminal 48, and the U-shaped terminal 96 will be in register with the U-shaped end of the terminal 62. As the T-shaped end of the fuse carrier 66 is moved into the recess 21 in the fuse holder 20, the rib 82 on that fuse carrier will coact with the rib 33 of the fuse holder 20 to guide and confine that fuse carrier. As the terminals 88 and 96 engage, and move between, the convex confronting faces of the arms of the U-shaped portions of the terminals 48 and 62, those arms will be forced to assume a less convex configuration. Because the upper and lower ends of those arms abut, and are held against outward movement by the outer faces of the recesses 28, 30 and 32, those arms will apply powerful forces to the terminals 88 and 96. Such forces are very desirable because they assure low-resistance engagements between the terminals 88 and 96 on the fuse carrier 66 and the terminals 48 and 62 in the fuse holder 20.

As long as the fuse carrier 66 is held in position within the fuse holder 20, and as long as the fusible conductor 102 is intact, current will be able to flow through the terminal 48, through the terminal 88, through the resilient, leaf-type contact 86, through the fusible element 102, through the terminal 96, and through the terminal 62. However, when the fusible element 102 blows, it will permit the resilient, leaf-type contact 86 to move into the position shown by FIG. 9; and in that position that resilient, leaf-type contact 86 will abut the tang 42 on the terminal 40. Thereupon, current will flow through the terminal 48, through the terminal 88, through the resilient, leaf-type contact 86, through the tang 42, and then through the terminal 40. Since the terminal 40 can be part of an indicator circuit, the blowing of the fusible element 102 will complete that indicator circuit and enable the fuse to provide an electrical indication that it has blown. A visual indication of the blown condition of the fuse will be given by the indicator 92; because that indicator will be in the position shown by FIG. 9, and will thus be above the level of the ear 68 on the fuse carrier 66.

Preferably, the opening **91** in the resilient, leaf-type contact **86** will be close enough to the free end of that contact to move into register with the tang **42** when the fusible element **102** blows. This means that the solder **104** will engage the tang **42** when the fusible element **102** blows, and this is desirable because that solder will assure good electrical contact between that tang and the resilient, leaf-type contact **86**.

The portion of the fuse carrier **66** which surrounds the opening **70** serves as a finger-gripping surface. That portion can be gripped to facilitate insertion of the fuse into, and to facilitate removal of that fuse from, the recess **21** in the fuse holder **20**.

Where a number of fuse holders are set immediately adjacent each other, it may be difficult for a person's fingers to reach in between the fuses held by those fuse holders. In such cases, a hooked rod can have the hook therein inserted in the openings **70** of the fuses that are to be removed. In this way, removal of the fuses is readily effected even though those fuses may be closely adjacent each other.

The openings **46**, **56** and **64** in the shanks of the terminals **40**, **48** and **62** facilitate the securement of conductors to those shanks. Specifically, those openings can accommodate the ends of conductors, and then those ends can be soldered to those shanks. Also, the shanks of those terminals are proportioned and formed to facilitate the securement of conductors to those shanks by the wire-wrapping method.

The short flanges on the free ends of the U-shaped terminals **88** and **96** make those terminals resemble split loops. As a result, those terminals are virtually wrap-around terminals.

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

What I claim is:

1. The combination of a fuse holder that has a recess therein, electrically-conductive terminals that are mounted on said fuse holder and that have portions thereof disposed within said recess, an electric fuse that comprises a fuse carrier which has a portion thereof disposed in said recess and which has a second portion thereof disposed outwardly of said recess, said fuse carrier being selectively separable from said fuse holder, the first said portion of said fuse carrier having a recess therein, further terminals that are mounted on the first said portion of said fuse carrier and that are engageable with the first said terminals when the first said portion of said fuse carrier is telescoped into said recess in said fuse holder, a fusible element that is largely disposed within said recess in said fuse carrier, whereby said recess in said fuse carrier provides protection for said fusible element and whereby said recess in said fuse holder also provides protection for said fusible element, a resilient contact that is mounted on the first said portion of said fuse carrier, said resilient contact being a leaf-type contact, an additional terminal that is mounted on said fuse holder and that has a portion thereof disposed within said recess, said resilient contact being biased toward said additional terminal whenever the first said portion of said fuse carrier is disposed within said recess, said fusible element normally holding said resilient contact out of engagement with said additional terminal but permitting said resilient contact to move toward said additional terminal whenever it blows, an indicator on the free end of said resilient contact, an ear on said second portion of said fuse carrier that normally conceals said indicator when said fuse carrier is viewed from the front thereof but permits said indicator to be seen when said fuse carrier is viewed in perspective, said indicator being disposed outwardly of said recess in said fuse holder, said further terminals on said fuse carrier being disposed at the opposite ends of the first said portion of said fuse carrier, whereby leakage between said further terminals is prevented, said portions of the first said terminals being U-shaped, the first said terminals having portions that project outwardly from the closed end of said fuse holder and that are twisted to hold the first said terminals against separation from said fuse holder, and interacting surfaces on said fuse carrier and on said fuse holder that require said fuse holder to dispose said resilient contact in register with said additional terminal whenever the first said portion of said fuse carrier is disposed within said recess in said fuse holder.

2. The combination of a fuse holder that has a recess therein, electrically-conductive terminals that are mounted on said fuse holder and that have portions thereof disposed within said recess, an electric fuse that comprises an open-type fuse carrier which has a portion thereof disposed in said recess, said fuse carrier being selectively separable from said fuse holder, said portion of said fuse carrier having spaced walls that define the top and bottom and one side of an open recess therein, further terminals that are mounted on said portion of said fuse carrier and that are engageable with the first said terminals when said portion of said fuse carrier is telescoped into said recess in said fuse holder, a conductor that is mounted on and carried by said fuse carrier and that extends across one of the ends of said recess in said fuse carrier to largely close said one end of said recess, one end of said fusible element being secured to said conductor intermediate the ends of said conductor so said ends of said conductor can project beyond said one end of said fusible element to protect said fusible element, and a fusible element that is largely disposed within said recess in said fuse carrier and that is largely surrounded and protected by said spaced walls, whereby said recess in said fuse carrier and said conductor provide protection for said fusible element and whereby said recess in said fuse holder also provides protection for said fusible element whenever said portion of said fuse carrier is disposed in said recess in said fuse holder.

3. The combination of a fuse holder that has a recess therein, electrically-conductive terminals that are mounted on said fuse holder and that have portions thereof disposed within said recess, an electric fuse that comprises a fuse carrier which has a portion thereof disposed in said recess, said fuse carrier being selectively separable from said fuse holder, and further terminals that are mounted on the first said portion of said fuse carrier and that are engageable with the first said terminals when the first said portion of said fuse carrier is telescoped into said recess in said fuse holder, said portions of the first said terminals being U-shaped, the arms of said U-shaped portions having the upper and lower ends thereof normally abutting the inner faces of said recess in said fuse holder and having inwardly bent confronting faces so said arms act as inwardly bowed beams that have both ends thereof supported, said further terminals extending into the spaces between and bending said arms of said U-shaped portions of the first said terminals intermediate the upper and lower ends of said arms when the first said portion of said fuse carrier is telescoped into said recess, said further terminals responding to the forces exerted thereon by said arms of said U-shaped portions of the first said terminals to bend into tighter engagement with said first portion of said fuse carrier.

4. A fuse that comprises an open-type fuse carrier, a fusible element that is mounted on said fuse carrier, a resilient contact that is mounted on said fuse carrier, an indicator on the free end of said resilient contact, and an ear on said fuse carrier, said fusible element normally holding said indicator on said resilient contact behind said ear on said fuse carrier so said ear normally conceals said indicator when said fuse carrier is viewed from the front thereof, said ear on said fuse carrier being dimensioned so it permits said indicator to be seen when said fuse carrier is viewed in perspective, said resilient

contact responding to "blowing" of said fusible element to move said indicator out from behind said ear on said fuse carrier and thereby permit direct and unobstructed viewing of said indicator.

5. The combination of a fuse holder that has a recess therein, electrically-conductive terminals that are mounted on said fuse holder and that have portions thereof disposed within said recess, an electric fuse that comprises a fuse carrier which has a portion thereof disposed in said recess, said fuse carrier being selectively separable from said fuse holder, further terminals that are mounted on said portion of said fuse carrier and that are engageable with the first said terminals when the first said portion of said fuse carrier is telescoped into said recess in said fuse holder, a finger-receiving portion on said fuse carrier that serves as a gripping portion, an opening in said finger-receiving portion of said fuse carrier that can receive a fuse-removing tool, and interacting guiding surfaces on said fuse holder and on said fuse carrier that will guide said fuse carrier as it is removed from said fuse holder by the insertion of a tool in said opening in said finger-receiving portion of said fuse carrier, said interacting guiding surfaces including a recess and a rib that extends into and is guided by said recess.

6. A fuse that comprises a fuse carrier with spaced-apart terminal receiving portions, terminals that are mounted on said terminal-receiving portions of said fuse carrier, and interacting surfaces on said terminals and on said terminal-receiving portions of said fuse carrier that hold said terminals against accidental separation from said fuse carrier, said terminals essentially being annuli with slits therein and being dimensioned to telescope snugly onto said terminal-receiving portions of said fuse carrier, said interacting surfaces on said terminals and on said terminal-receiving portions of said fuse carrier being recesses and complementary protuberances.

7. The combination of a fuse holder that has a recess therein, electrically-conductive terminals that are mounted on said fuse holder and that have portions thereof disposed within said recess, an electric fuse that comprises a fuse carrier which has a portion thereof disposed in said recess and a fusible element that is mounted on said fuse carrier, said fuse carrier being of the open type and being smaller than said recess in said fuse holder so an open and unobstructed view of part of the interior of said recess in said fuseholder is available although said portion of said fuse carrier is disposed in said recess in said fuse holder, said fusible element being disposed wholly within said recess in said fuse holder and having a portion thereof visible whenever said portion of said fuse carrier is disposed in said recess in said fuse holder, whereby said fuse holder protects said fusible element from injury while permitting a view of a portion of said fusible element whenever said portion of said fuse carrier is disposed in said recess in said fuse holder.

8. The combination of a fuse holder that has a recess therein, electrically-conductive terminals that are mounted on said fuse holder and that have portions thereof disposed within said recess, an electric fuse that comprises a fuse carrier which has a portion thereof disposed in said recess, further terminals that are mounted on said portion of said fuse carrier and that are engageable with the first said terminals when said portion of said fuse carrier is telescoped into said recess in said fuse holder, a resilient contact that is mounted on said fuse carrier, a portion of said resilient contact being disposed within said recess in said fuse holder, another portion of said resilient contact always being disposed outwardly of said recess and serving as an indicator, and an ear on said fuse carrier that normally conceals said other portion of said resilient contact when said fuse carrier is viewed from the front thereof, said fuse carrier being of the open type, said other portion moving outwardly of said ear to permit direct and unobstructed viewing thereof when said fuse "blows."

9. The combination of a fuse holder that has a recess therein, an electrically-conductive terminal that is mounted on said fuse holder and that has a portion thereof disposed within said recess, a second electrically-conductive terminal that is mounted on said fuse holder and that has a portion thereof disposed within said recess, an electric fuse that comprises a fuse carrier which has a portion thereof disposed in said recess, said fuse carrier being selectively separable from said fuse holder, a resilient contact that is mounted on said portion of said fuse carrier and that is biased toward the first said terminal whenever said portion of said fuse carrier is disposed in said recess, and a fusible element that is mounted on said fuse carrier and that is connected to said resilient contact by a mass of solder, said fusible element normally holding said resilient contact out of engagement with the first said terminal but permitting said resilient contact to move toward the first said terminal whenever it blows, said mass of solder engaging the first said terminal and thereby placing said resilient contact in electrically-conductive engagement with the first said terminal when said resilient contact moves toward the first said terminal, said second terminal being in electrically-conductive engagement with said resilient contact whenever said portion of said fuse carrier is disposed in said recess, the first said terminal and said second terminal being connectable in an indicator circuit whereby the blowing of said fusible element will provide an electrical indication of the condition of said fusible element.

References Cited by the Examiner

UNITED STATES PATENTS

745,694	12/03	Utley et al.	200—117
817,959	4/06	Craft	200—118
905,905	12/08	Murray	200—129
2,023,517	12/35	Creager et al.	200—166
2,477,571	8/49	Billman	116—114
2,496,759	2/50	Warsher	200—121
2,530,228	11/50	Cihlar et al.	200—117
2,565,643	8/51	Baddour	200—15
2,615,963	10/52	Millen	200—121
2,923,796	2/60	Davis	200—117
2,949,511	8/60	Glueckstein et al.	200—166

BERNARD A. GILHEANY, *Primary Examiner.*

WALTER STOLWEIN, *Examiner.*