Feb. 15, 1955 E. DIETZ, JR., ET AL 2,702,329

INDICATOR FUSE PLUG

Filed Dec. 1, 1951

FIG. 3

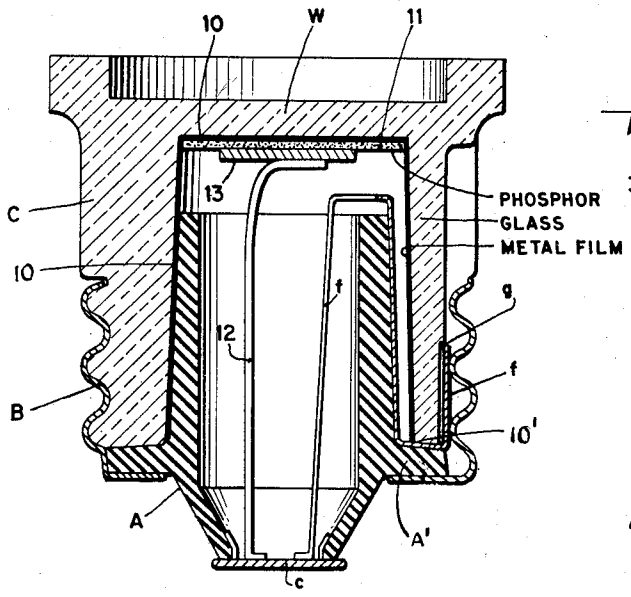


FIG. 2

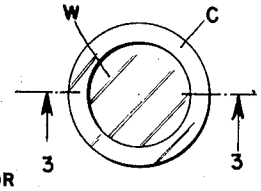


FIG. 1

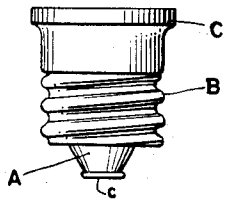
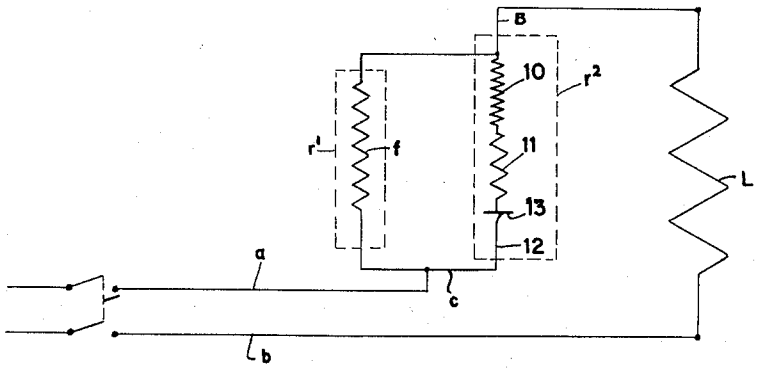


FIG. 4



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United States Patent Office 2,702,329
Patented Feb. 15, 1955

2,702,329

INDICATOR FUSE PLUG

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Application December 1, 1951, Serial No. 259,448

6 Claims. (Cl. 200—121)

This invention relates to electrical fuse plugs and more particularly to indicator fuse plugs and has for its object the provision of a fuse plug in which means is provided to indicate visually when the fuse element therein has been destroyed.

Another object is to provide a fuse plug having a luminescent means for indicating fuse element failure therein.

Still another object is to provide a fuse plug having a shunt electrical circuit including a phosphor conductor for luminescently indicating failure of the fuse element therein.

A further object is to provide an improved indicator electrical fuse plug.

Other objects will be apparent as the invention is more fully hereinafter disclosed.

In accordance with these objects we have devised an improved type of indicator fuse plug in which a high resistance luminescent phosphor indicator element is electrically connected in parallel with the low resistance fuse element in series connection in the load circuit so that on fuse element failure the load circuit passes through the high resistance luminescent phosphor element to activate the same, thereby visually indicating fuse element failure.

The present invention is adapted for reduction to practice in many different forms but in view of the wider field of utility afforded by the conventional screw-type fuse plug we have adapted the invention to this type of fuse plug as one specific embodiment of the invention.

Before further disclosing the invention, reference should be made to the accompanying drawings, wherein:

Fig. 1 is a side elevational view of a screw-type fuse plug improved in accordance with the present invention;

Fig. 2 is a top view of same;

Fig. 3 is an enlarged sectional view of same taken along plane 3—3 of Fig. 1; and

Fig. 4 is a schematic wiring diagram illustrating the present invention.

Referring to the drawings, it will be noted in the enlarged cross-sectional view shown in Fig. 3 of the screw-type fuse plug of Figs. 1 and 2, that the present invention is adapted for use without essential modification or change in the conventional elements of this type of fuse plug.

These conventional elements consist of the centrally located dielectric core A, threaded metallic shell B and dielectric cup member C enclosing the upper open end of core A from the atmosphere. These elements and the manner in which they are interlockingly engaged to form the completed fuse plug are substantially the same as those heretofore employed in the art except as elements A and C are modified, as hereinafter described, to introduce in the fuse plug the high resistance luminescent shunt circuit of the present invention.

In the normal manufacture of the screw-type fuse plug illustrated, the core element A is comprised of a suitable molded dielectric material such as one of the synthetic resins known in the art under the trade-name "Bakelite." There are a number of equivalent dielectric insulating materials known in the art and common in the art and as the specific composition of core A forms no part of the present invention and may consist of any suitable dielectric insulating material, the composition, per se, of core A need not be further described or disclosed. The particular size, shape and configuration of core A also may be widely varied without essential departure from the invention.

Common to such core elements A, however, as are employed in the art is the disc contact member *c* secured on the bottom, and preferably tapered, end of the element. This contact member *c* is provided to make electrical contact with one of the lead in wires in the screw-type socket receiving the screw-type fuse plug. One end of the fuse wire *f* is secured to the inner surface of contact *c* and the length of the fuse wire *f* is carried upwardly and outwardly across the inner edge of the core A and thence downwardly in a groove provided in the outer surface of the core A to the ledge A′ of the core A and outwardly between the upper surface of the ledge and the lower edge of the cup C a sufficient distance adapting the outer end of the fuse wire *f* to extend upwardly and seat within a groove *g* in the outer threaded face of cup element C wherein it is brought into electrical contact with the inner surface of the shell B when the elements A, B and C are assembled together into a fuse plug. Shell B when it is threaded into the usual type of screw socket, engages a threaded shell contact which is electrically connected to the load circuit, thereby electrically connecting the fuse wire *f* in series in the load circuit. On failure of the fuse wire *f* the flow of current to the load circuit is broken.

Element C of the fuse plug in this specific embodiment consists of glass molded to the specific size, shape and configuration shown in the drawings. This type of element C provides a clear view window *w* through which heretofore the condition of fuse wire *f* normally may be viewed.

In accordance with the present invention, elements A and C of this conventional type of screw-type fuse plug are modified to introduce into the fuse plug a high resistance luminescent circuit electrically in parallel with the fuse wire *f* which in normal operation carries an insufficient part of the load circuit to energize the luminescent element of the circuit but which on failure of the fuse wire *f* is adapted to carry the full current of the load circuit thereby to energize the luminescent element of the circuit and to indicate fuse failure.

To achieve this result the inner surface of the element C is made electrically conductive with a thin film coating **10** of metal covering the under surface of the window *w* and extending from the window to the lower edge of the cup where it makes contact at **10′** with the portion of the fuse wire *f* passing between the ledge A′ and the cup. This provides a high resistance path for the electric current normally in the load circuit. Over this metal film in the area encompassed by the window *w* is deposited a layer of electrically conductive luminescent phosphor material **11**. The particular thickness of this phosphor material as well as its composition may be varied widely without essential departure from the invention. There are a number of different phosphor materials available in the art but we prefer to employ the phosphor material of the type described in U. S. Patent No. 2,566,349 to Mager issued September 4, 1951. Our experiments have indicated that this phosphor material is well adapted for use in the present invention.

Element A is provided with an electrically conductive spring contact arm **12**, secured at one end to the inner surface of contact disc *c* in spaced relation to fuse wire *f*, the opposite end of the contact for carrying a disc contact **13** adapted to spring engage in electrical contact the deposit of phosphor material **11** overlying the metal film **10** on the inner surface of window *w* of element C, when the element C is in assembled position in the fuse plug. As the metal film deposit **10** on the inner surface of element C makes electrical contact with the fuse wire *f* at **10′**, where a portion of the fuse wire is gripped between elements C and A′ in assembled position, a high resistance electrical circuit is completed between disc *c* and element B that is electrically in parallel with the fuse wire circuit including fuse wire *f*.

The electrical characteristics of the fuse plug of the instant invention is diagrammatically illustrated in Fig. 4, wherein wires *a*—*b* indicate a supply line carrying an electric current to a load circuit L with the fuse plug of the instant invention electrically connected in series there-

in. As indicated, contact disc *c* is connected to wire *a* and the current passes from the disc *c* through two resistances r' and r^2 that are electrically connected in parallel to B and thence through the load circuit L back to wire *b*. The resistance r' is the low resistance fuse wire *f* and the resistance r^2 includes elements **12**, **13**, **11** and **10** (as indicated) and is the high resistance luminescent path or fuse failure indicating means of the present invention described above.

It is believed apparent that the particular resistance ratio between resistances r' and r^2 may be widely varied without essential departure from the invention and will depend mainly on the particular characteristics of the material comprising resistances **11** and **10** of resistance r^2. This resistance ratio, however, should be that which effectively limits the amount of current flowing through resistance r^2 to substantially less than that which will cause the phosphor composition of **11** to luminesce when the resistance r' is connected and to cause the phosphor composition of **11** to luminesce brightly when the resistance r' fails.

In the specific embodiment given above, and for the purposes of illustration and not as a limitation, **10** consists of a relatively thin film of aluminum approximating 0.50 micron in thickness and **11** consists of a layer of the activated zinc sulfide and zinc oxide phosphor composition of the specific example given in said U. S. Patent No. 2,566,349 on page 1, column 2, lines 10–13, inclusive, having a thickness of about .005 inch. This combination of materials has been found to produce excellent results in the indicator fuse plug of the present invention. Other combinations of conductive metal film and phosphor compositions, however, are equally as effective for the purposes of the present invention.

The specific method of forming the relatively thin film of conductive metal on the inner surface of the cup C forms no part of the invention and there are a plurality of methods to form such a metal film layer now known in the art, any one of which may be utilized in the instant invention.

Having hereinabove described the present invention generically and specifically and described and illustrated one specific embodiment thereof, it is believed apparent that the invention may be widely modified without essential departure therefrom and all such modifications and departures are contemplated as may fall within the scope of the following claims.

What we claim is:

1. An indicator fuse plug having two electrical resistance circuits electrically connected in parallel between two spaced contacts, each of which contacts is adapted to be electrically connected in series in one side of a load circuit, one said resistance circuit being a low resistance circuit and including a low melting fuse element and the other said resistance circuit being a high resistance circuit and including a phosphor luminescent element with the electrical resistance of said high resistance circuit being that preventing the luminescence of the said phosphor luminescent element while the low melting fuse element is carrying the load current of the load circuit.

2. The fuse plug of claim 1, and a radiation permeable housing enclosing the two said resistance circuits from the atmosphere.

3. An indicator fuse plug for electrical circuits, said fuse plug consisting essentially of two spaced contacts adapted for series connection into one side of a load circuit, a low resistance circuit including a low melting fuse element to carry the load circuit from one contact to the other, a high resistance circuit including a phosphor luminescent element electrically connecting the two said contacts in parallel with the low resistance circuit, the electrical resistance of said high resistance circuit being at least sufficient to prevent the passage of sufficient current through the phosphor luminescent element to luminesce the same while the low melting fuse element is in current carrying position in said low resistance circuit, the two said circuits being enclosed from the atmosphere by a radiation permeable enclosure providing for the visual observance of the luminescence of the phosphor luminescent element.

4. An indicator fuse plug comprising interlocking shell, core and cup members, the said shell member consisting of a metallic tubular body having interior and exterior threads extending from one end thereof to the other end with an interiorly extending flange on said other end, said core member consisting of a substantially tubular dielectric body having an outwardly extending flange adapting the core member to be seated upon the said inwardly extending flange of the said shell with one end thereof extending exteriorly beyond the said inwardly extending flange, and said cup member consisting of substantially transparent dielectric material having a threaded exterior adapted to engage the interior threads of said shell member a distance bringing the peripheral edge of the cup member into engagement with the upper face of said outwardly extending flange on said core member thereby to secure the members together into a unitary structure, a metallic disc member closing the open extending end of said core member, a low resistance electric circuit including a low melting fuse element electrically connecting the inner face of said disc to said shell and a high resistance electric circuit including a phosphor luminescent element electrically connecting the inner face of said disc separately to said shell, the two said resistance circuits being electrically connected in parallel between said disc and shell with the resistance of the high resistance circuit being at least sufficient to prevent the passage of sufficient current therethrough to luminesce the said phosphor luminescent element while the low melting fuse element remains in current carrying position in the said low resistance circuit.

5. An indicator fuse plug for electrical circuits, said plug consisting of interlocking shell, core and cup elements, said shell member being an exteriorly and interiorly threaded metallic member having an interiorly extending annular flange providing a seat for the core member, the said core member being a substantially tubular dielectric body provided with an annular flange on the exterior thereof substantially above the bottom end thereof and adapted to seat within and upon the annular flange of said shell, and said cup element consisting of a substantially transparent dielectric body having a threaded exterior adapted to engage the interior threads on said metallic shell and to be threaded therein to a position engaging the peripheral edge thereof with the flange of the core member thereby to assemble the elements together as a unitary structure, a metallic disc member closing the open extending end of said core, an elongated low melting fuse element secured at one end to the inner face of said disc member and extending over the upper edge of the said core member and downwardly to the flange thereof and under the peripheral edge of the cup member into electrical contact with the said shell forming thereby a low resistance electric circuit to conduct electric current through the said plug, a spring contact having one end secured to the inner face of said disc contact at a spaced distance from said fuse element and with the opposite end thereof in spring contact engagement with the inner surface of the bottom of said cup member, a metallic disc contact interposed between said spring contact and the inner face of said bottom of said cup member, a deposit of a phosphor luminescent material interposed between said disc contact and the inner face of said bottom of said cup, and an electrically conductive film deposit of a metal on the inner face of said cup member and extending into electrical contact with the fuse element adjacent its point of contact with said shell, thereby to form a high resistance circuit to carry the electric current passing through the said plug with the two said circuits connected electrically in parallel and with the electrical resistance of the high resistance circuit at least sufficient to prevent the passage of an electric current therethrough of a magnitude inducing luminescence in said phosphor luminescent material while the fuse element of the low resistance circuit is carrying the current.

6. The indicator fuse plug of claim 3, wherein the said phosphor luminescent material consists of an activated mixture of zinc sulfide and zinc oxide.

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