April 2, 1935. A. MILLER ET AL 1,996,432

PLUG FUSE

Filed Jan. 3, 1933

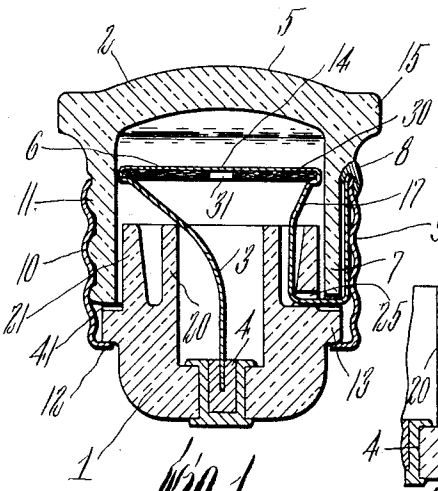


Fig. 1.

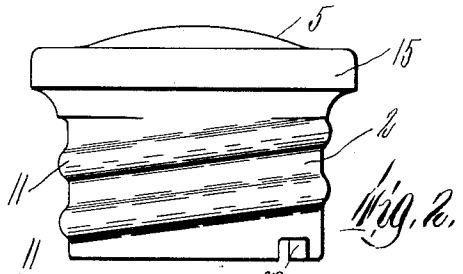


Fig. 2.

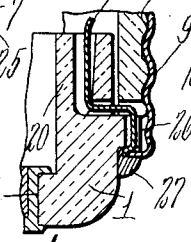


Fig. 7.

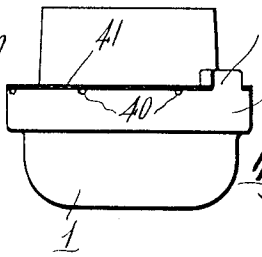


Fig. 3.

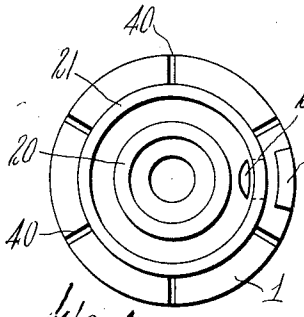


Fig. 4.

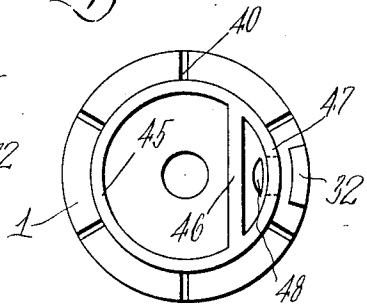


Fig. 5.

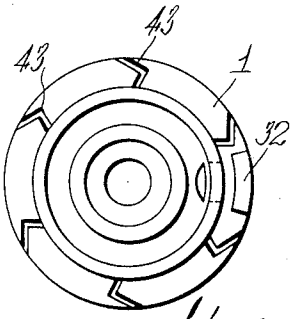


Fig. 6.

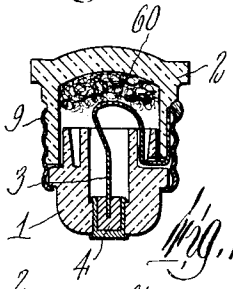


Fig. 12.

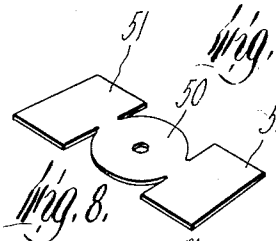


Fig. 8.

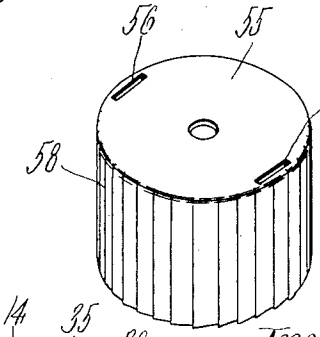


Fig. 10.

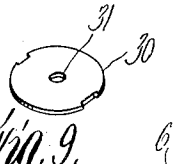


Fig. 9.

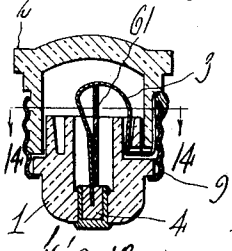


Fig. 13.

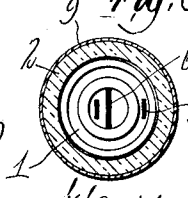


Fig. 14.

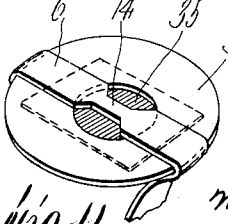


Fig. 11.

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UNITED STATES PATENT OFFICE

1,996,432

PLUG FUSE

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Application January 3, 1933, Serial No. 649,756

10 Claims. (Cl. 200—130)

This invention relates to electrical fuses more particularly of the plug type, although certain features of the invention are not limited to any particular type.

One of the objects of the invention is to increase the ease of detecting whether or not a fuse element has blown.

A further object is to provide improved means for preventing breakage of a glass top portion of the fuse by the impingement of hot materials thereon when the fuse element blows.

A still further object is to control the venting of gases from the interior of the fuse when the fuse element blows and to cool such gases before they are permitted to escape to the atmosphere.

Further objects and advantageous constructions will appear from a more complete description of certain embodiments of the invention shown in the accompanying drawing in which

Figure 1 is a central longitudinal section through a plug fuse embodying certain forms of the invention.

Figures 2 and 3 are side elevations of certain of the parts shown in Figure 1.

Figure 4 is a plan view of the chamber shown in Figure 3.

Figures 5 and 6 are views similar to Figure 4, but illustrating modifications.

Figure 7 is a fragmentary view similar to a portion of Figure 1, but showing a modification.

Figure 9 is a perspective of a disk shown in Figure 1.

Figures 8, 10 and 11 are perspectives showing further modifications.

Figure 12 is a view similar to Figure 1 but drawn to a smaller scale and showing another manner of indicating when the fuse element has blown.

Figure 13 is a similar view showing another method of decreasing the amount of hot gases when the fuse blows.

Figure 14 is a section on line 14—14 of Figure 13.

Referring first more particularly to Figures 1 to 4, at 1 is indicated a base of non-conducting material such as porcelain, which, together with a top 2 of glass forms a non-conductive enclosure within which is positioned a fuse element 3. This fuse element is secured at one end to a contact 4 which extends through the base 1, from which contact it extends upwardly from the base 1 toward a window portion 5 in a closed end of the top 2. It extends across the receptacle back of the window portion 5, as shown at 6, and then is bent backwardly as at 17 toward the base 1 and passes out between the base 1 and a tubular side wall portion 7 of the top 2 where its end, as at 8, is secured as by soldering to a conductive shell 9 which secures the base and top together. This shell has screw threads 10 formed therein for engaging mating portions 11 of the tubular side wall 2 and through its flange 12, which engages beneath a rib 13 on the base 1, which holds the base 1 and the top together. The contact 4, which extends through the base 1, and the conductive shell 9 form two terminals between which the fuse element extends as in the usual fuse of the plug type. The fuse element portion 6 is provided as is customary with a portion 14 of reduced cross section to localize the point at which rupture occurs when this element blows, and this is positioned directly back of and adjacent to the window portion 5.

It will be noted that the top 2 is provided with a marginal thickened rim portion 15, which provides means by which the plug fuse may be grasped and turned to screw it into or out of the usual threaded socket formed to receive fuses of this type. The window portion 5 is domed outwardly so that its outer face is brought outwardly beyond the plane of the outer face of the rim 15 and the inner face of the window portion 5 is formed substantially concentric to the outer face in order that the thickness of the window portion may be substantially uniform throughout. By thus extending the window portion outwardly from the rim, it is in position to catch the light and increase the illumination on the fuse element within the receptacle so that it may be more clearly visible. By forming the window portion of substantially uniform thickness throughout, no distortion of the fuse element as viewed through the window occurs. Where it is attempted to form the window portion thicker at the center to produce a magnification of the fuse element, difficulties are experienced, due to the fact that accurate positioning of the fuse is necessary in order to position it in the focus of the lens thus formed, as if it is not correctly positioned it is out of focus and its visibility is decreased rather than increased by the lens formation of the window. No such distortion occurs where the window is of substantially uniform thickness throughout and no exceptional care in placing the fuse element is then necessary.

Moreover, a concave inner face for the window portion facilitates the molding of the glass top, a rounded end to the core member which shapes the inner face of the top facilitating the molding

operation and also tending to relieve the top itself from shrinkage stresses as the glass cools.

In this embodiment of the invention, it will be noted that the base 1 is provided with a pair of upwardly extending concentric radially spaced wall portions 20 and 21 between which the portion 17 of the fuse element passes, and the outer portion 21 having a perforation 25 therethrough substantially opposite to the lower edge of the top side wall portion 7 for the passage of this element. This wall portion 21 thus acts to protect the lower end portion of the side wall 7 from contact with hot material, such as molten metal or hot gases produced when the fuse element blows, the free end portion of the side wall member being liable to breakage when not thus protected. That portion of the top adjacent to the rim 15 and the window portion 5 is found not liable to breakage from this cause. The inner wall 20 serves to prevent accidental contact between the end portions of the fuse element.

In place of attaching the outer end of the fuse element to the conductive shell 9 at its upper end as shown in Figure 1, the base may be provided with a groove as shown at 26 in Figure 7 through which the fuse element may be passed and secured as by solder at 27 to the lower edge of the shell 9.

If desired, also, the top and base may be provided with mating tongue and groove portions 32 and 33, as shown in Figures 2 and 3, which will prevent relative turning of these two parts after they are assembled.

In order that detection of a blown fuse may be rendered easier, it is desirable to place a background of sheet material immediately back of the intermediate fuse portion 6, which may be seen through the window portion 5. To this end a piece of non-conductive sheet material, such as paper, may be used as shown at 30 in Figures 1 and 9, and in order that a distinctively different appearance may be produced after the fuse blows, this disk 30 may be provided with a central opening 31 immediately back of the reduced cross section portion 14 of the fuse element so that when the fuse element blows the opening 31 will be disclosed, this appearing as a dark spot at the center of the disk 30. Or, if desired, this difference of appearance may be further enhanced by use of a larger opening through the disk, which is normally covered on its under face, as shown best in Figure 11, by sheet material 35 presenting a different color from the disk 30 and across which the fuse element portion 6 extends. Thus before the fuse is blown the material 35 presents a different color adjacent to the reduced cross section portion 14 of the fuse element. This material 35 may be secured lightly in position, as by an adhesive secured directly to the reduced portion 14, or to the under face of the disk 36, so that when the fuse blows this portion 35 is blown away from the disk 36, back into the fuse receptacle and is no longer visible through the window 5.

As considerable heat is generated when the fuse element blows, the pressure of gases within the fuse receptacle is increased and the gases vent out between the top and base and between these parts and the shell 9. In order to control this venting, the confronting faces of the top and base may be provided with channels for the escape of the hot gases. As it is easier to form these channels in the base 1, which may be of porcelain, than in the top of the glass, the upper face of the base may be provided with such grooves or channels as shown at 40 in Figures 3, 4 and 5, and in order to effect a better seat between the top and base, a gasket 41 may be placed therebetween. If desired, these grooves 40 may be made more or less tortuous to increase the surface exposed thereto and thus to produce an additional cooling effect on these gases during their escape, as shown in Figure 6 where the grooves are made angular as shown at 43.

Other means may be used to protect the side wall of the glass top from breakage because of the impingement of hot material thereon when the fuse element blows. For example, as shown in Figure 5, instead of forming a pair of concentric wall portions such as 20 and 21, as shown in Figures 1, 4 and 6, a single wall portion 45 may be employed similar to the wall portion 21, and at the side where the fuse element portion 17 passes backwardly from the window portion, this wall 45 may be bridged by a wall portion 46 so as to form with the adjacent wall portion 47 a partial enclosure for the fuse element portion 17 through which it passes on its way to the perforation 48 and its passage between the top and the base and its securement to the shell 9. This wall portion 46 prevents accidental contact between opposite end portions of the fuse element.

In place of forming this protective element integral with the base 1, it may be formed as a portion of the sheet material forming a background for the fuse as viewed through the window. For example, as shown in Figure 8, this sheet material piece may comprise a disk portion 50 having one or more integral wing portions 51 which may be bent downwardly at their juncture with the disk portion 50 and conformed to the contour of the interior of the side wall 7, the fuse element portion 17 of the fuse element being brought downwardly and inwardly of the wing portion 51 which extends between it and the side wall of the glass top.

Another construction is illustrated in Figure 10 in which the sheet material background member is formed cup-shape with a circular base portion 55 perforated at 56 and 57 for the passage of the fuse element and having an integral skirt portion 58 formed by plaiting together the sheet material, this skirt portion 58 extending between the side wall of the fuse top and the fuse element. While these elements 50 and 55 are each shown as provided with a relatively small perforation, it is of course evident that this perforation may be made larger as shown in Figure 11, and a supplementary background element removed by blowing of the fuse element may be used if desired.

In Figure 12 is shown another construction particularly intended to increase the facility with which a blown fuse may be detected. The space within the plug receptacle immediately back of the window is shown as occupied by cotton or other fibrous material 60 impregnated with suitable materials effective to cause a color change therein when the fuse blows. Such impregnating materials may comprise easily oxidizable agents such as sodium or potassium chlorate either with or without manganese dioxide, the fibrous material being ignited and blackened when the fuse blows, or the fibrous material or the back face of the window or other appropriate part visible therethrough such as the disk shown in Figures 1 and 9 and 11 inclusive may be treated with organic dies including vegetable dies which undergo color changes or become blackened when

heated, or with inorganic pigments which may decompose or discolor when heated. In the latter group may be mentioned metallic iodine which vaporizes when heated, mercurous carbonate which is normally yellow but becomes discolored when heated, and hydrated chromium chloride ($CrCl_3.6H_2O$) which changes from a normally violet color when heated.

Figures 13 and 14 illustrate a further modification in which the two portions of the looped fuse element on opposite sides of the part of reduced cross section immediately back of the window are separated by a transverse insulating partition 61 of cardboard, fiber or the like, which acts to prevent excessive arcing when the fuse element blows, this decreasing the heat evolved and the amount of hot gases to be vented when the element blows.

From the foregoing description of certain embodiments of this invention, it should be evident to those skilled in the art that various other changes and modifications might be made without departing from the spirit or scope of this invention as defined by the appended claims.

We claim:

1. A device of the class described, comprising a non-conductive receptacle comprising a base and a glass top member having a cylindrical side wall portion and a closed end provided with a transparent window portion, a contact extending through said base, a conductive shell surrounding adjacent portions of said base and top member, and a fuse element secured at opposite ends to said shell and contact and having an intermediate portion positioned adjacent to and inwardly of said window portion, said base having an integral portion extending between said fuse element and said wall portion toward the end of said element secured to said shell.

2. A device of the class described, comprising a non-conductive receptacle including a base and a top, said top having a transparent window through its end, said base having a central contact extending therethrough, a conductive shell enclosing portions of said top and base, and a fuse element secured at one end to said contact within said receptacle, extending toward said window and then backwardly therefrom and between said base and top and secured at its opposite end to said shell, said base having a pair of integral radially spaced wall portions extending toward said window within said top between which said fuse element passes backwardly from said window toward its securement to said shell.

3. A device of the class described, comprising a non-conductive receptacle comprising a base and a glass top member having a cylindrical side wall portion and a closed end provided with a transparent window portion, a contact extending through said base, a conductive shell surrounding adjacent portions of said base and top member, and a fuse element secured at opposite ends to said contact and shell and having an intermediate portion positioned adjacent to and inwardly of said window portion, said base having an integral wall portion extending inwardly of said side wall portion toward said window portion and between said side wall portion and fuse element and having a perforation adjacent to the end of said side wall portion remote from said window portion through which and between said base and top member said element passes to said shell.

4. A device of the class described, comprising a non-conductive casing including a base and a glass top, said top having a cylindrical side wall portion and a closed end provided with a window portion, a conductive shell surrounding adjacent portions of said top and base, a contact extending through said base, said base having a pair of substantially concentric wall members extending within said side wall portion toward said window portion, and a fuse element secured at one end to said contact within said receptacle, extending within the inner of said wall members adjacent to and back of said window portion, and then turned back and between said wall members and through a perforation through the outer of said wall members and between said base and top and secured to said sleeve.

5. A device of the class described, comprising a receptacle having a window portion, a fuse element in said receptacle having a portion of reduced cross section opposite to said window portion, and a piece of non-conductive sheet material forming a background for said fuse element as viewed through said window portion, said sheet material having an opening therethrough back of said reduced cross section portion.

6. A device of the class described, comprising a receptacle having a window portion, a fuse element in said receptacle having a portion of reduced cross section opposite to said window portion, a piece of non-conductive sheet material forming a background for said fuse element as viewed through said window portion, said sheet material having an opening therethrough back of said reduced cross section portion, and material presenting a color different from that of said background positioned back of said opening and normally visible through said window portion adjacent to said reduced cross section portion, said last mentioned material being lightly secured for removal from said opening when said fuse element blows.

7. A device of the class described comprising a non-conductive receptacle having a base and a top, said top having a side wall and a closed end having a window portion, a conductive shell enclosing the adjacent portions of said base and top, a contact extending through said base, a fuse element in said receptacle secured at its ends to said contact and shell, respectively, and having an intermediate reduced cross section portion positioned back of and adjacent to said window portion, and a piece of sheet material positioned back of a portion of said fuse element and inwardly of said side wall and forming a background for said fuse element when viewed through said window portion, said piece having a hole therethrough opposite to said reduced cross section portion.

8. A device of the class described, comprising a non-conductive receptacle having a base and a top, said top having a side wall and a closed end having a window portion, a conductive shell enclosing the adjacent portions of said base and top, a contact extending through said base, a fuse element in said receptacle secured at its ends to said contact and shell, respectively, and having an intermediate reduced cross section portion positioned back of and adjacent to said window portion, a piece of sheet material positioned back of a portion of said fuse element and inwardly of said side wall and forming a background for said fuse element when viewed through said window portion, said piece having a hole therethrough opposite to said reduced cross section

portion, and background material of a different color from said sheet material back of said opening and normally visible therethrough adjacent to said reduced cross section portion, said background material being so lightly secured in position as to be removed from said opening when said fuse element blows.

9. A device of the class described, comprising a receptacle having a glass top provided with a tubular side wall and a closed end provided with a window portion, a fuse element within said receptacle and having a portion extending across said receptacle back of and visible through said window portion, and a piece of non-conductive sheet material back of said fuse element portion and having an integral portion lying between said fuse element and said tubular side wall in position to protect said side wall from breakage by impingement of hot material thereagainst when said fuse element blows.

10. A device of the class described, comprising a receptacle having a glass top provided with a tubular side wall and a closed end provided with a window portion, a fuse element within said receptacle and having a portion extending across said receptacle back of and visible through said window portion, and a disk of non-conductive material back of said fuse portion and having an integral wing extension bendable into substantial conformity with the inner face of said side wall and lying between said side wall and fuse element in position to protect said side wall from breakage by impingement of hot material thereon when said fuse element blows.

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