

3,274,426

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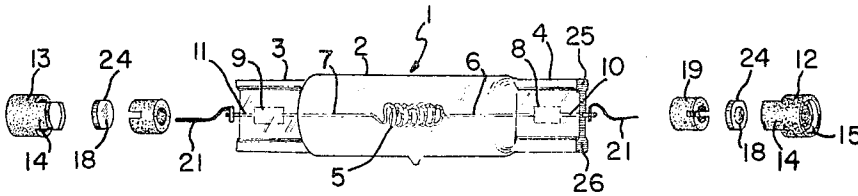


FIG. 1

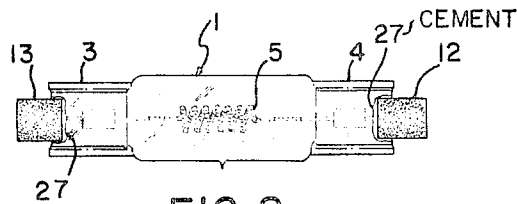


FIG. 2

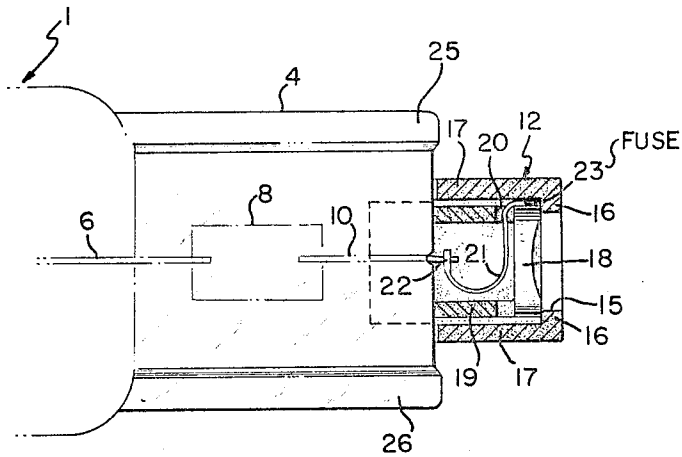


FIG. 3

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ELECTRIC LAMP WITH FUSE

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4 Claims. (Cl. 313-318)

This invention relates to lamps having tubular envelopes with at least one flattened end, and particularly to those in which a lead-in conductor extends through that end. The lamp envelope will generally have both ends flattened, and the tube may enclose an incandescent filament, or electrodes for an electric discharge, or some other means of producing light electrically. The invention is especially useful when the light source in the envelope is an incandescent filament.

In such tubular incandescent lamps, the envelope generally also contains a gas inert with respect to the filament, such as argon or nitrogen, and an additional gas such as iodine, which reduces discoloration of the lamp envelope. A coiled filament, usually of the coiled-coil type, extends along the center line of the envelope, being electrically connected at each end to a lead-in conductor passing through one of the flattened ends of the envelope. However, both lead-in conductors may be sealed through a single end of the lamp, if desired.

When the filament burns out after its useful life, an arc is likely to start between the broken ends, or from a lead-in conductor to such an end or to the other lead-in conductor. Since an arc has a negative resistance, the current through it may generally increase until the lamp envelope is damaged, unless a fuse is used in the circuit to limit the arc current to a safe value. The use of a fuse in the external circuit is generally cumbersome, and in the case of lamps used in portable reflectors adds considerably to the size of the unit, since the only place available to place the fuse is usually in the handle of the reflector. Placing the fuse inside the lamp envelope is generally impractical, especially in the smaller of lamps, because some protection or covering for the fuse wire is necessary; without it, an arc would merely start across the fuse itself, and the problem would not be solved. In addition, the metal used in the fuse, such as nickel, will react with the iodine vapor and interfere with its action if put inside the lamp.

We have found, however, that the fuse wire can be placed in a ceramic cap used as a contact base around the lead-in conductor at the end of the lamp. The ceramic cap can be hollow, with the fuse wire inserted between a lead-in conductor, which extends slightly out of the flattened glass end of the envelope, and a contact button held by the ceramic cap, the cap having a slot which fits over the flattened end and is cemented in place.

An inner ceramic tube surrounds part of the fuse and holds the contact button in place between itself and the ceramic cap, the latter having an opening through which connection can be made from the outer circuit to the contact.

The present invention, by placing the fuse in an end cap of the lamp, reduces the cost of protecting the lamp, permits the use of a more compact reflecting and accessory unit, and insures that the proper size fuse will always be used, since it will be part of the lamp. It prevents the user from replacing a blown fuse with one of an incorrect size, which might allow the lamp to crack or explode on burnout.

Although a fuse can be used at one end only of the lamp, the placing of a fuse in each ceramic cap, one for each lead-in conductor, is preferable. When a single fuse is used, the entire voltage, other than the small drop in the lamp arc, will be applied across a single fuse,

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whereas if two fuses are used, they will be in series, with only half the voltage across each. This splitting of the voltage tends to reduce the arcing at the fuse itself, and also permits the use of a shorter fuse than would be required if all the fusing was at one end.

Other objects, features and advantages of the invention will be apparent from the following specification taken in connection with the accompanying drawing, in which:

FIG. 1 is a view of a lamp according to the invention, with the parts of the end caps shown in sequence at each end of the lamp;

FIG. 2 is a view of the lamp with the end caps in place; and

FIG. 3 is an enlarged view of a flat end of the lamp, with the end cap shown in section.

In FIG. 1, the lamp envelope 1, of quartz of "Vycor" (the latter being a trademark used on glass of about 98% silica content by the Corning Glass Works, Corning, New York), has a central tubular portion 2 and the flattened ends 3, 4. A coiled-filament 5, generally a coiled-coil, of tungsten wire or other refractory material, is electrically connected at its ends to the lead-in wires 6, 7, of tungsten, which are connected to the molybdenum ribbons 8, 9 sealed through the flattened ends 3, 4. Other wire pieces 10, 11 extend from said ribbons 8, 9 to points just outside the flattened ends 3, 4. The wires 10, 11 can extend about $\frac{1}{16}$ inch outside the ends 3, 4, for example, and can be of molybdenum, platinum, platinized molybdenum or other suitable material.

The end caps 12, 13 can be of ceramic material, for example, that known as "Steatite," and are fixed to the ends 3, 4 as shown in more detail in FIG. 3.

In the latter figure, the end cap 13 is shown slotted at one end 14 to fit over the end portion 4 of the lamp envelope 1. The cap 12 is hollow and has an opening 15 at its end opposite the slotted end 14. A shoulder 16 extends from the cylindrical wall 17 toward the center of the opening 15. A contact 18, shown enlarged in FIG. 3, is held against the inside flat portion of the shoulder by the inner ceramic cylinder 19, which has the slot 20 to allow passage of the wire 21 to the outside edge of contact 18.

The wire 21 includes a nickel portion 22 of 0.025 inch diameter and about 2 mm. long and a nickel portion 23 of 0.012 inch diameter and about $6\frac{1}{2}$ mm. long, an end of each being butt-welded together to form a unitary wire with the two portions in series electrically. The smaller diameter portion 23 is the part that acts a fuse, and the larger diameter portion is welded to the molybdenum lead-in wire 10, the lower diameter facilitating the making of a weld, and being shown somewhat flattened. The outer end of the smaller diameter wire is welded to the flat side portion 24 of the contact 18, and passes through the slot 20 in order to reach it.

The end cap 12 can be cemented to the flat end portion 4 by the refractory cement 27 so that it will be firmly affixed to it. The cement known as Saureisen 31 is especially effective.

The wire sizes given above are for a 650 watt lamp operated at 110 volts. A lamp of that type is shown in copending application Serial No. 26,228, filed May 2, 1960, by Dayton et al. The invention can be used with other similar lamps, for example the 1,000-watt lamp, the fuse being of proper size to blow at a desired current.

In the embodiment described, the fuse wire 21 is welded to the flat portion 24 of contact 18. The contact 18 can instead be made circular without the flats 24, and the fuse silver-soldered to the center of the portion of the contact 18, if desired. The contact 18 is generally made concave on its outer end as shown in FIGS. 1 and

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3, to facilitate its engagement with the contact prongs in the usual sockets or holders.

What we claim is:

1. An electric lamp comprising an envelope having at least one flattened end, a lead-in conductor extending through said end, a hollow insulating end cap having an opening with a rim at one end of said cap and being slotted at the other end to fit over said flattened end of said envelope, contact means, a fuse inside said end cap and connected between said contact means and said lead-in conductor, an insulating cylinder inside said end cap and enclosing the outside end of said lead-in conductor and at least part of said fuse, said insulating cylinder forcing said contact means against the internal rim of said cap.

2. An electric lamp comprising a tubular envelope having flattened ends, a lead-in conductor at each end, a hollow insulating end cap at each end, said cap having an opening with a rim at one end of said cap and being slotted at the other end to fit over the flattened end of said envelope, contact means, a separate fuse inside each of said end caps and connected between said contact means and said lead-in conductor, and an insulating cylinder inside each cap and enclosing the outside end of said lead-in conductor and at least part of said fuse at said end, said insulating cylinder forcing said contact means against the internal rim of said cap.

3. An electric lamp comprising an envelope having

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at least one end flattened longitudinally, a lead-in conductor extending through said end, an end cap having a longitudinal slot fitting over and attached to said end, means for making contact with an external circuit inside said end-cap, a member inside said end-cap for spacing said means from said end, and a fuse inside end cap and electrically connected between said lead-in conductor and said means.

4. An electric lamp comprising a tubular envelope having flattened longitudinally ends, a lead-in conductor at each end and extending through said end, an end cap at each said end and attached thereto and having a longitudinal slot fitting over said end, means for making contact with an external circuit in said end cap, a member inside each said end cap spacing said means from said end, and a fuse inside each said end cap and electrically connected between the lead-in conductor and means at that end.

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