Jan. 16, 1968 E. M. BEESLEY 3,364,378

ELECTRIC INCANDESCENT LAMP UNIT BUILT-IN FUSE

Filed April 27, 1966

Fig. 1.

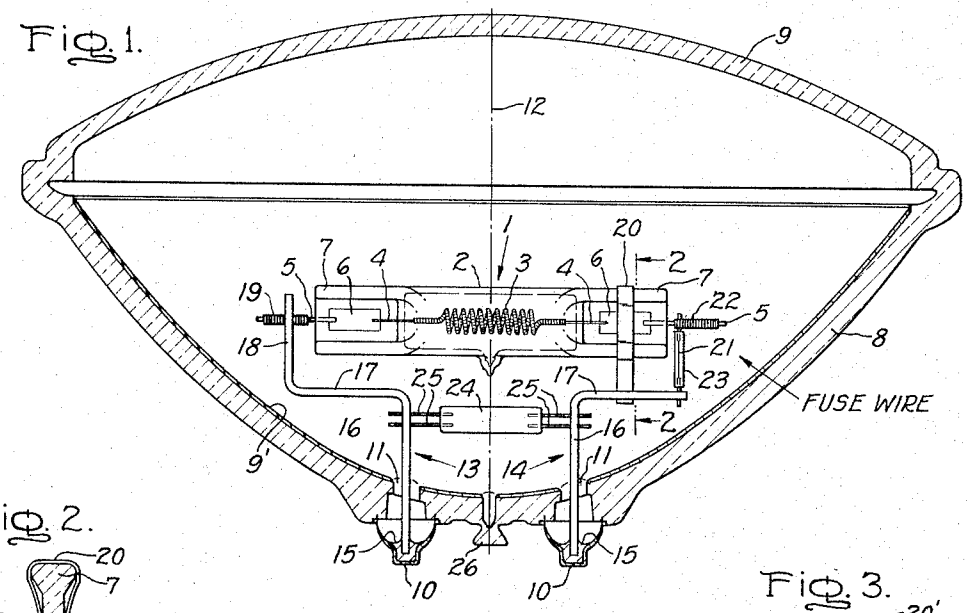


Fig. 2.

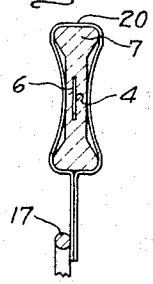


Fig. 3.

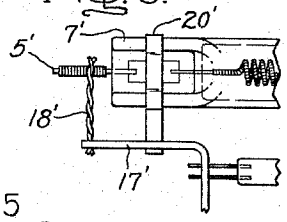


Fig. 4.

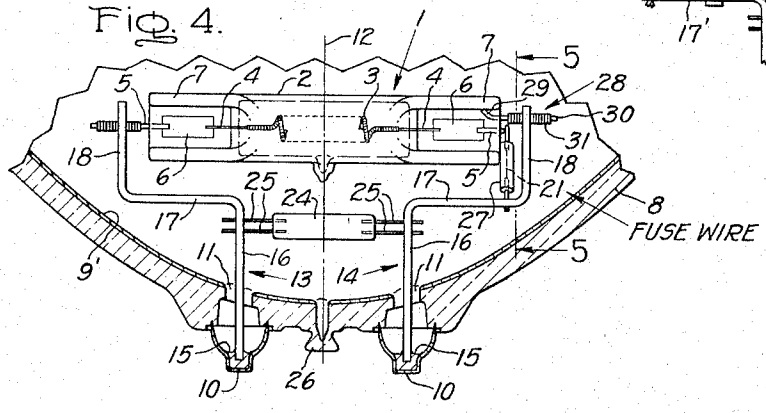
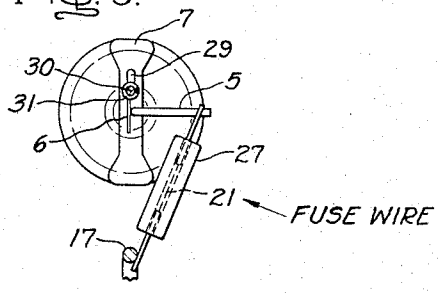


Fig. 5.



Inventor:
Edward M. Beesley
by Otto Tichy
His Attorney

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3,364,378
ELECTRIC INCANDESCENT LAMP UNIT BUILT-IN FUSE

Edward M. Beesley, South Euclid, Ohio, assignor to General Electric Company, a corporation of New York

Continuation-in-part of application Ser. No. 362,382, Apr. 24, 1964. This application Apr. 27, 1966, Ser. No. 545,705

10 Claims. (Cl. 313—315)

This application is a continuation-in-part of my application Ser. No. 362,382, filed Apr. 24, 1964, and assigned to the same assignee as the present invention. The invention relates generally to electric incandescent lamps.

More particularly, this invention relates to composite lamp units comprising an outer bulb or jacket and a compact inner incandescent lamp supported therein. The compact inner incandescent lamp usually contains a gas such as argon and possibly a small quantity of a halogen to perform a regenerative cycle whereby the evaporated tungsten from the filament reacts with the halogen and is redeposited on the filament. An example of this regenerative cycle is the well known iodine cycle which is fully disclosed and claimed in Patent 2,883,571, Fridrich et al.

In such gas-filled compact incandescent lamps as described above, it is necessary to provide a fuse to open circuit the lamp when the filament burns out or breaks to prevent arcing which could result in an explosion of the lamp. In argon filled lamps, a fuse within the envelope of the compact inner lamp does not act fast enough; whereas, a fuse in the fixture externally of the lamp unit also has disadvantages. Therefore, an object of this invention is to provide a structure wherein the fuse is incorporated outside the inner lamp unit but within the outer bulb where it should be such more efficient.

Placing a fuse, which is generally a thin, fragile wire, within the outer bulb and exteriorly of the inner envelope inherently causes a structural weakness. Thus, a further object of the invention is to provide a structure wherein the fuse is located within the bulb, of the lamp unit but does not weaken the support structure therefor.

Briefly stated, and in accordance with one aspect of the invention, an electric lamp unit having an outer bulb is provided with a pair of rigid lead-in supports each secured at one of its ends to the outer bulb to support and supply electrical energy to an inner incandescent lamp unit composed of a double-ended envelope containing a filament connected to lead wires extending outwardly from respective ends of the envelope. A fuse wire is electrically connected to and between the lead-in support and the lead wire to at least one end of the inner lamp; a physical support means provides mechanical support to this end of the lamp independently of the lamp lead wire. The lead wire at the opposite end is preferably secured by means to provide both physical support and electrical connection.

Further features and advantages of the invention will appear from the following detailed description to be read in conjunction with the following drawing wherein like reference symbols denote corresponding parts throughout the several views.

FIG. 1 is an elevation of a lamp unit embodying the invention with the outer bulb shown in section;

FIG. 2 is a section through one end of the inner lamp unit along the line 2—2 in FIG. 1;

FIG. 3 is a fragmentary elevation showing a modified support structure for one end of the inner lamp unit;

FIG. 4 is an elevation of a lamp unit embodying another species of the invention and showing only a portion of the outer bulb; and

FIG. 5 is a section along the line 5—5 in FIG. 4 showing an end view of the inner lamp and the associated fuse structure.

Referring to FIG. 1 of the drawing, the inner lamp unit 1 may be of the type disclosed and claimed in the aforementioned Patent 2,883,571. It comprises a tubular envelope 2 of suitable light-pervious material such as fused quartz which contains a coiled-coil tungsten filament 3 connected at its ends to respective lead wires comprising inner and outer portions 4 and 5 of tungsten and molybdenum, respectively, and intermediate molybdenum foil sections 6 which are hermetically sealed in compressed pinch seal portions 7 which may be pressed to an I-shaped section as shown in FIG. 2. The interior of the envelope 2 is filled with a suitable gas such as argon, krypton or xenon at a substantial pressure such as about 1400 mm. Hg or higher at room temperature. The envelope may also contain a small amount of halogen vapor which functions as a regenerative cycle as aforementioned.

The inner lamp unit 1 is mounted within an outer bulb, here illustrated as of the so-called sealed beam type comprising pressed glass reflector and cover glass sections 8 and 9 which are hermetically sealed at their peripheries. The reflector section 8 has a reflecting coating 9' on its interior surface and is provided with terminal members comprising metallic ferrules 10 which have their edges fused and embedded around openings 11 at opposite sides of the apex and axis 12 of the reflector section which may be of paraboloidal shape. The inner lamp unit 1 extends transversely of the axis 12 and is supported from a pair of relatively stout and rigid lead-in support wires 13 and 14 of nickel, for example, and which are each secured mechanically and electrically at one end to respective ferrules 10, for example, by a quantity of brazing material 15. Said lead-in supports 13 and 14 have portions 16 extending into the outer bulbs 8, 9 generally parallel to the axis 12 with continuing portions 17 extending laterally away from said axis under and parallel to the inner lamp 1. The lead-in support 13 has a further continuing portion 18 extending parallel to said bulb axis 12 and is mechanically and electrically connected to the proximate lead wire 5 of the lamp 1. Preferably, the lead wire 5 has thereon an overwind of coiled wire 19 which may be of any suitable weldable material such as steel or nickel, and the leads 5 and 18 and coil 19 are welded together.

In accordance with the invention, the other end of the lamp unit 1 is supported independently of the lead wire 5, in this case by a harness means 20 consisting of a strip of metal, such as nickel, which tightly encircles the seal portion 7 of the envelope and is secured to the poriton 17 of lead-in conductor 14, preferably by welding. The proximate lead wire 5 of the lamp unit 1 is electrically connected to lead-in conductor portion 17 by a fuse wire 21. The fuse wire 21 may be a nickel wire of sufficient thinness to melt upon passage of an abnormal current therethrough due to the formation of an arc upon rupturing of the filament 3 during operation of the lamp. The fuse wire 21 may be welded to lead support portion 17 and to an overwind coil 22 on lead wire 5. The fuse 21 is preferably covered by a tube 23 of insulating material such as glass to quench the arc which may form upon rupturing of the fuse wire.

The supporting structure is preferably strengthened by a bridge member interconnecting the lead-in supports 13 and 14, such as a glass rod or bead 24 having wires 25 embedded at its ends and welded to the supports 13 and 14.

The outer bulb is preferably evacuated and filled with an inert or non-oxidizing gas and preferably an arc quenching gas such as, for example, nitrogen at a pressure of about 450 mm. Hg. The evacuation and gas filling

is performed through an exhaust tube having its sealed or tipped-off residue shown at 26.

In case the internal lamp is sufficiently heavy to impose undue strain on the seal of the lead wire 5 connected to lead support portion 18, that end of the lamp may be supported similarly to the other end. To that end, there is provided (FIG. 3) a second harness 20' like that shown at 20 and encircling the left-hand pinch seal 7' and secured to the lead-in support portion 17'. If desired, the lead support portion 18 of FIG. 1 may then be replaced by a flexible wire section 18' to provide the electrical connection between lead support portion 17' and the proximate lead wire 5'.

Another species of the invention is shown in FIG. 4 of the drawing, which is a fragmented view of a so-called seal beam type lamp unit. A portion of the pressed glass reflector section 8 is shown with reflective coating 9' thereon. The cover glass section 9 is not shown; however, the corresponding numbered parts in FIG. 1 appear in FIG. 4 unless otherwise noted.

This species differs from that shown in FIG. 1 in the manner of providing mechanical support for the fuse end of the inner incandescent lamp unit 1; thus, all changes appear to the right of apex and axis 12 of the reflector section. As shown in FIG. 4, the lead-in support wire 14 has portion 16 extending into the bulb generally parallel to the axis 12 and the continuing portion 17 extending laterally away from said axis under and parallel to the lamp 1 as in FIG. 1; in addition, however, the lead-in support 14 has a further continuing portion 18 extending parallel to the bulb axis 12. Thus, the two lead-in supports 13 and 14 are of symmetrical construction which aids in locating their ends in the ferrules 10 during assembly since the lamp and supports can be gripped by a symmetrical tool.

In accordance with the invention, a fuse wire 21 (see also FIG. 5) is welded between the outer portion 5 of the lead wire on the right-hand side and the lead-in support portion 17 to provide electrical energy to the right end of the inner lamp. The outer portion of the lead wire 5 is preferably bent normal to the flat portion of pinch seal 7 on the right-hand side to provide adequate space for the fuse between the lamp lead wire and the lead-in support. In this case the fuse wire is preferably surrounded by ceramic tube 27 to quench the arc which may form when the fuse ruptures. As aforementioned, the fuse wire is generally a thin nickel wire which melts upon the passage of abnormal current which open circuits the lamp. The mechanical support at the right end of the inner lamp unit 1 is provided by an auxiliary support wire or dummy lead 28 (FIG. 4) insulated from the filament and having an inner end portion 29 which is embedded in the pinch seal 7 and an outer end portion 30 which may have an overwind coil 31 of suitable welding material such as steel or nickel. The outer portion 30 of auxiliary support wire 28 with overwind 31 is welded to lead-in support 18.

As mentioned in connection with the FIG. 1 embodiment, if the internal lamp is sufficiently heavy to impose undue strain on the seal of the lead wire 5 at the left end of the lamp which is connected to lead support portion 18, the left end of the inner lamp may be supported by an auxiliary support lead 28 in a similar manner as the right end with possibly a flexible wire section supplying the electrical current.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An electric lamp unit comprising an outer bulb having terminal members attached thereto,
- a pair of rigid lead-in supports each secured at one end to respective said terminal members and extending into the interior of said outer bulb,
- an inner incandescent lamp unit comprising
- a double-ended envelope containing a filament connected to lead wires extending outwardly from respective ends of the envelope,

said inner lamp unit having each end physically supported from and electrically connected to a respective one of said lead-in supports,

the physical support at least at one end of the lamp unit comprising a support member which has a portion thereof secured to the proximate lead-in support and another portion thereof secured directly to the envelope of the lamp unit independently of the proximate lamp lead wire and is electrically insulated from the filament,

and the electrical connection at said one end of the lamp unit comprising a fuse wire which is electrically connected to and between the said proximate lamp lead wire and lead-in support.

2. An electric lamp unit as set forth in claim 1 wherein said physical support is a harness member encircling the envelope at said one end of the inner lamp unit and mechanically connected to said proximate lead-in support.

3. An electric lamp unit as set forth in claim 2 wherein both the physical support and the electrical connection at the other end of the inner lamp unit is an extension of the associated lead-in conductor which is secured both mechanically and electrically directly to the associated lamp lead wire.

4. An electric lamp unit as set forth in claim 1 wherein said physical support is an auxiliary support wire which has one end portion thereof embedded in a pinch seal at said one end of the envelope and the other end portion projecting from said seal and mechanically secured to said proximate lead-in support.

5. An electric lamp unit as set forth in claim 4 wherein both the physical support and the electrical connection at the other end of the inner lamp unit is an extension of the associated lead-in conductor which is secured both mechanically and electrically directly to the associated lamp lead wire.

6. An electric lamp unit comprising an outer bulb composed of a concave reflector section and a cover glass section sealed at their peripheries,
- terminal means hermetically sealed at opposite sides of the apex and axis of said reflector section,
- an inner incandescent lamp unit comprising
- a generally tubular, double-ended envelope extending transversely of the said axis of said reflector section and having pinch seals at each end,
- said envelope containing a filament connected at its ends to lead wires extending through said pinch seals,
- a pair of rigid lead-in supports each secured at one end to said terminal means and having portions extending into the outer bulb generally parallel to its said axis,
- continuing portions of said supports extending laterally away from said axis under and parallel to said inner lamp unit, said inner lamp unit having each end physically supported from and electrically connected to a respective one of said lead-in supports,
- the physical support at least at one end of the lamp unit comprising a support member which has a portion thereof secured to the proximate lead-in support and another portion thereof secured directly to the associated pinch seal of the lamp unit independently of the proximate lamp lead wire and is electrically insulated from the filament,
- and the electrical connection at said one end of the lamp unit comprising a fuse wire which is electrically connected to and between the said proximate lamp lead wire and lead-in support.

7. An electric lamp unit as set forth in claim 6 wherein said physical support is a harness means encircling the envelope at said one end of the inner lamp unit and securing it to said proximate lead-in support.

8. An electric lamp unit as set forth in claim 7 wherein both the physical support and the electrical connection at the other end of the inner lamp unit is an extension of the associated lead-in conductor which is secured both me-

chanically and electrically to the associated lamp lead wire.

9. An electric lamp as set forth in claim 6 wherein said physical support is an auxiliary support wire insulated from the lamp filament and portion of which is embedded in said pinch seal and a portion projecting therefrom and which is secured to a further continuing portion of said proximate lead-in support which extends parallel to said bulb axis.

10. An electric lamp as set forth in claim 6 wherein both said lead-in supports have further continuing portions which extend parallel to the bulb axis to opposite ends of the inner lamp unit, one said continuing portion secured mechanically and electrically directly to its associated lamp lead wire, the physical support at the other end of the lamp unit comprises an auxiliary support wire insulated from the filament and a portion of which is embedded in the associated pinch seal and a portion projecting therefrom and secured to the associated further continuing portion of the lead-in support, and the electrical connection at said other end of the lamp unit comprises a fuse wire which is electrically connected to and between the associated lamp lead wire and lead-in support.

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JOHN W. HUCKERT, *Primary Examiner.*

J. SHEWMAKER, *Assistant Examiner.*