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[54] METHOD OF TIPPING-OFF THE EXHAUST TUBE OF AN ELECTRIC LAMP, AND A BASELESS SINGLE-ENDED INCANDESCENT LAMP PRODUCED BY SUCH METHOD

8 Claims, 2 Drawing Figs.

[52] U.S. Cl. 313/318, 220/2.2; 316/19; 339/144
[51] Int. Cl. H01j 5/50
[50] Field of Search 220/2.2; 313/318; 316/19, 20, 24; 339/144

[56] References Cited

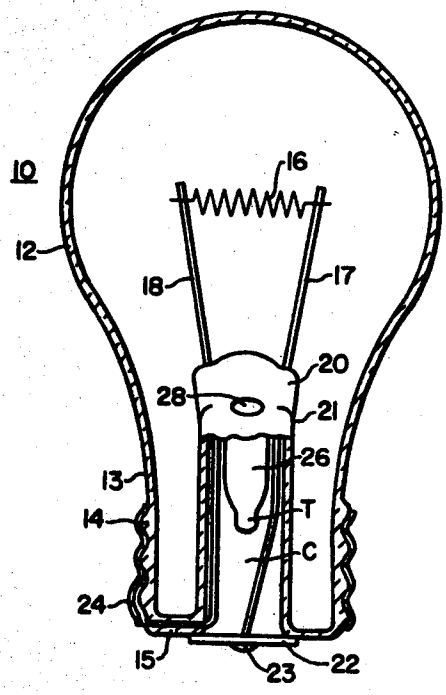
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3,162,502 12/1964 L. H. Verbeek 339/144

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ABSTRACT: The exhaust tube of an electric lamp is tipped off at a point which is recessed within the stem cavity by fabricating the envelope and stem from infrared-radiation transmitting glass and by fabricating the exhaust tube from infrared-radiation absorbing glass. The exhaust tube is tipped off within the stem cavity by a focused beam of infrared-radiation that is generated by an external source and passes through the intervening portions of the lamp envelope and stem tube. Since the tipping-off operation is accomplished without gas fires, it can be performed in a pressurized chamber. This, in turn, facilitates the manufacture of incandescent lamps containing a fill gas at supra-atmospheric pressure.

The recessed tipping-off of the exhaust tube also provides a practical single-ended baseless incandescent lamp wherein the lead wires are electrically connected to side and end contacts that are fastened directly to the sealed neck of the envelope.



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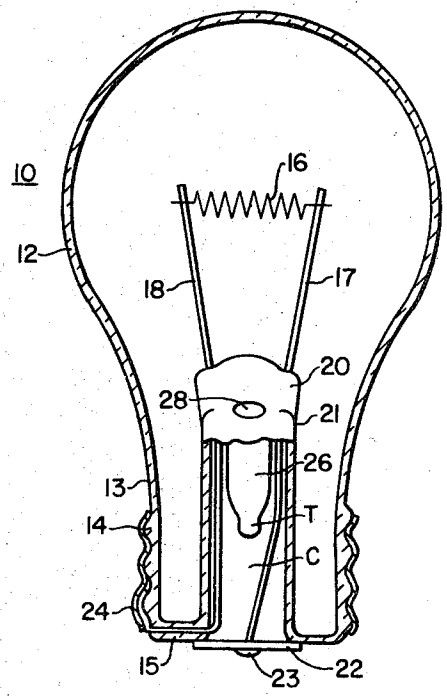


FIG. 1.

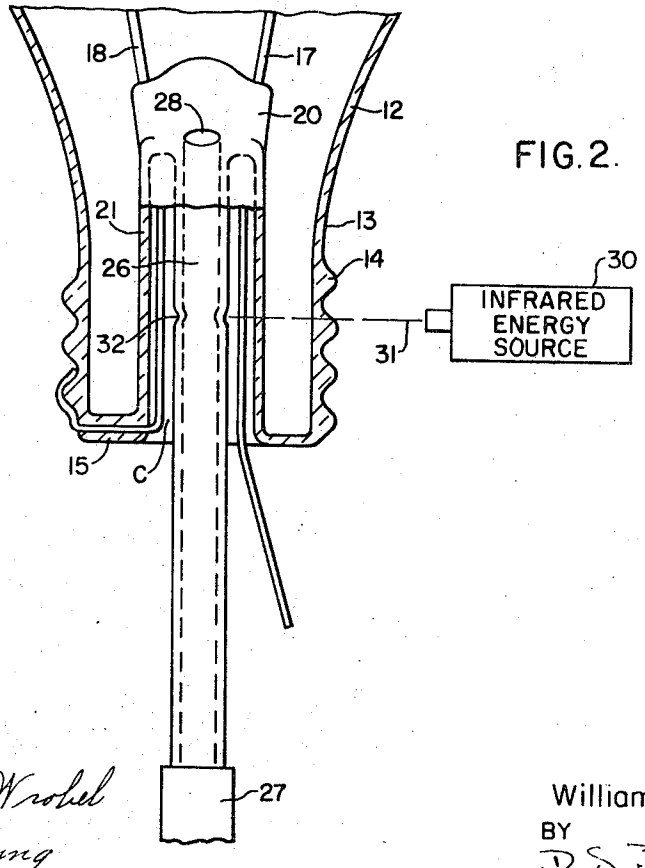


FIG. 2.

WITNESSES

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METHOD OF TIPPING-OFF THE EXHAUST TUBE OF AN ELECTRIC LAMP, AND A BASELESS SINGLE-ENDED INCANDESCENT LAMP PRODUCED BY SUCH METHOD

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to electric lamps and has particular reference to an improved method of tipping-off the exhaust tube of an incandescent-type lamp and to a baseless high-pressure incandescent lamp which incorporates such a recessed tipoff.

2. Description of the Prior Art

Conventional gas-filled incandescent lamps are charged to a pressure below atmospheric pressure due to the face that the exhaust tip "blows out" and ruptures while in softened condition when a high-fill-gas pressure is employed. The manufacturing complications or pressure tipping or reducing the internal gas pressure by cooling the lamp and then tipping-off the exhaust tube with gas fires make these solutions impractical. As a result, the exhaust tubes of such lamps are customarily tipped off at a point beyond the sealed neck of the envelope. The protruding tip is protectively enclosed by a hollow base member having a metal shell which is secured by cement to the envelope neck. Such metal base members are quite expensive and materially increase the manufacturing cost of the lamp.

Because of the aforementioned problems it has heretofore been very difficult, if not impossible from a practical standpoint, to tipoff the exhaust tube at a point which is recessed deeply enough within the stem cavity to provide the degree of protection requisite for a baseless incandescent lamp. While baseless incandescent lamps are per se known in the art, they either completely eliminate the exhaust tube or employ an end cap which protectively encloses the protruding fragile tip of the exhaust tube. Baseless lamps in which the exhaust tube is omitted are disclosed in U.S. Pat. Nos. 1,946,104 issued Feb. 6, 1934 to T. Ohara et al. and U.S. Pat. No. 2,327,622 issued Aug. 24, 1943, to P. H. Craig. Baseless incandescent lamps having protectively capped exhaust-tube tips are disclosed in U.S. Pat. No. 3,162,502 issued Dec. 22, 1964 to L. H. Verbeek and Canadian Pat. No. 696,040 issued Oct. 13, 1964 to the same inventor.

SUMMARY OF THE INVENTION

It is accordingly the general object of the present invention to provide a practical and inexpensive means for tipping-off the vitreous exhaust tube of an electric lamp at a point which is recessed within a reentrant cavity that is formed at the end of the lamp envelope either by the stem tube or by the end wall of the envelope itself.

Another object is the provision of a method for tipping-off the exhaust tube of an electric lamp without the use of gas fires and thereby facilitating the manufacture of lamps that contain a fill gas at supraatmospheric pressure.

Still another object is the provision of a baseless incandescent lamp having a recessed exhaust-tube tip that is formed by the aforementioned method.

The foregoing objects and other advantages are achieved in accordance with the present invention by fabricating the lamp envelope and stem tube from a glass which transmits infrared radiation and by fabricating the exhaust tube from a glass which absorbs such radiation. The tipping-off of the exhaust tube at a recessed location within the stem cavity is achieved by directing a beam of infrared radiation through the intervening portions of the envelope and stem tube from a point located outside of the lamp being processed. The infrared radiation can be generated by an incandescent coil of oxidation-resistant material but it is preferably generated by a compact quartz halogen-type incandescent lamp that is fitted with a suitable reflector which focuses the infrared energy onto the exhaust tube.

A single-ended high-pressure baseless incandescent lamp having a recessed exhaust-tube tube tip formed by the aforementioned method and having inexpensive side and end contacts is also disclosed.

BRIEF DESCRIPTION OF THE DRAWING

A better understanding of the invention will be obtained by referring to the accompanying drawing, wherein:

FIG. 1 is a longitudinal sectional view of a single-ended baseless incandescent lamp incorporating the novel recessed tipoff of the present invention; and

FIG. 2 is an enlarged view of the basal end portion of the lamp illustrating the manner in which the exhaust tube is tipped off by a beam of infrared energy while the exhaust tube is still attached to the "sealex" machine.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1 there is shown a single-ended baseless electric incandescent lamp **10** having a vitreous envelope **12** that is terminated by a constricted neck portion **13** having threads **14** molded on its exterior surface. The envelope contains a filament **16** of suitable coiled refractory metal wire, such as tungsten, which is attached as by clamping or spot welding to the inner ends of a pair of lead wires **17, 18**. The lead wires **17, 18** are hermetically sealed through a press **20** formed on the inner end of a vitreous stem tube **21** the flared end of which is sealed to the envelope neck **13** in the customary fashion.

The outer ends of the lead wires **17, 18** extend through the cavity C defined by the stem **21** and the outer end of the lead wire **17** is connected to a disclike contactor member **22** that is cemented or sealed to the end of the envelope neck **13** and closes the stem cavity C. The contactor member **22** can comprise a metal eyelet that is soldered to the lead wire **17** so as to provide a centrally located segment **23** that protrudes outwardly from the eyelet and serves as an end contact for the lamp **10**. The end of the other lead wire **18** is sealed through a thickened end wall portion **15** of the envelope neck **13** so as to be electrically insulated from the contactor member **22**, and the end of this lead is bent around the end portion of the adjacent molded thread **14**. A layer **24** of electrically conductive material, such as a suitable conductive paint, is applied over the exposed end of the lead wire **18** and thus serves as a side contact for the lamp **10**.

The envelope **12** is evacuated and subsequently charged with an inert gas fill through a vitreous exhaust tube **26** that is sealed to the inner end of the stem **21** and communicates with an aperture **28** provided in the wall of the stem tube just below the stem press **20**. After the lamp has been evacuated and gasfilled, the exhaust tube **26** is tippedoff at a point adjacent the inner end of the stem **21** in accordance with the present invention to provide a recessed tip T of fused vitreous material that is located deep within the stem cavity C.

The tipping-off of the exhaust tube **26** at the aforementioned recessed location within the stem cavity C is achieved in accordance with the present invention by fabricating the envelope **12** and stem tube **21** from a glass that transmits infrared radiation and by fabricating the exhaust tube **26** from a glass which absorbs such radiation.

As a specific example, the envelope **12** and stem tube **21** are composed of the customary soda-lead glass (Corning Code No. 0120) customarily used for these components. The exhaust tube **26** is composed of a green-colored potash-soda-lead glass that contains a small but sufficient amount of iron oxide to render the glass infrared absorbing. Such infrared-absorbing glasses are well known in the art and are commercially available as Corning Code 9362 and Code 9363 sealing glasses. These sealing glasses have viscosity and expansion characteristics that are almost identical with Code 0120 glass and thus permit the exhaust tube **26** to be sealed to the stem tube **21** in the customary manner.

Information published by Corning shows that samples of Code 9362 and Code 9363 glasses approximately 1 millimeter thick absorb approximately 80 percent of infrared energy in the 1 to 2 micron wavelength range. Thus, an exhaust tube **26**

made of such tipped off can be tipped off within the stem cavity C in a very efficient and convenient manner by focusing a beam of infrared radiation which has the proper wavelength and is generated by a source located outside of the lamp **10** being processed. While various types of infrared-generating sources (such as incandescent radiant-heat coils etc.) may be used, a high-wattage halogen-type incandescent lamp such as an infrared quartz iodine lamp is preferred since it has an output which peaks at approximately 1 micron.

As is shown in FIG. **2**, the exhaust tube **26** is tipped off while it is still attached to the compression head **27** of a "sealex" machine which has evacuated and charged the envelope **12** with a suitable inert fill gas. At this stage of manufacture, the outer end of the lead wire **18** has been sealed within the end wall **15** of the envelope neck **13** and has been bent over the adjacent portion of the molded glass thread **14**. The end of the other lead wire **17** is unattached and merely extends from the stem cavity C on the opposite side of the exhaust tube **26**. Tipping-off is accomplished by positioning a suitable infrared energy source **30**, such as a pair of 400 watt quartz-iodine lamps, adjacent the envelope neck **13** and focusing the infrared radiation, as by a suitable reflector, into a concentrated beam **31** that passes through the intervening portions of the envelope neck **13** and stem tube **21** and impinges upon a segment of the exhaust tube **26** that is located deep within the stem cavity C. The beam of infrared energy quickly heat softens the exhaust tube **26** and causes it to collapse inwardly and form a constriction **32**, as shown in FIG. **2**. The intensity of the infrared energy is such that the exhaust tube **26** melts and forms a fused glass tip T (shown in FIG. **1**) which hermetically closes off the exhaust tube **26** and the envelope **12** from the atmosphere.

After the tipping-off operation has been completed, the metal contactor plate or eyelet **22** is fastened to the end of the envelope neck **13**, the lead wire **17** is trimmed and soldered to the eyelet to provide the protruding end contact **23**, thus completing the fabrication of the lamp **10**.

While the invention has been illustrated and described in connection with an incandescent lamp having a cavity C that is defined by a stem tube **21**, the novel tipping-off method can be employed in the manufacture of various types of lamps and devices which are terminated by an end wall which defines a reentrant type cavity through which a vitreous exhaust tube initially extends.

The novel tipping-off method of the present invention facilitates the manufacture of incandescent lamps that are charged with a fill gas (such as argon, krypton, etc.) to a pressure higher than atmospherio pressure (1 ½ to 2 atmospheres, for example) since it does not require a combustible heat source such as a gas flame. Tipping-off of lamps having supraatmospheric fill pressure is readily accomplished by pressurizing the stem cavity C to prevent the heat-softened segment of the exhaust tube **26** from distending and rupturing during the tipping-off operation. This pressurizing can be accomplished by filling the cavity C with compressed air or other suitable inert gas to a pressure which is approximately equal to that of the fill gas contained by the envelope **12** and conjoined exhaust tube **21**. Alternatively, the partly fabricated lamp can be placed within a pressurized enclosure having an infrared-radiation transmitting window through which the beam of infrared energy is directed onto the recessed segment of the exhaust tube. The infrared source can also be located within the pressurized enclosure.

It will be appreciated from the foregoing that the objects of the invention have been achieved in that a very convenient and inexpensive means has been provided for tipping-off the exhaust tube of an electric lamp at a location which is recessed within the stem cavity or body of the lamp envelope.

While a preferred embodiment has been illustrated and described, it will be appreciated that the various modifications can be made without departing from the spirit and scope of the invention.

I claim:

1. In the manufacture of an electric lamp having a vitreous envelope that is terminated at one end by a reentrant wall that defines a cavity and includes a conjoined vitreous exhaust tube which initially extends through and beyond the cavity and provides a passageway for evacuating the envelope and subsequently charging it with a fill gas, the method of hermetically closing and tipping-off said vitreous exhaust tube at a location that is recessed within the cavity defined by said reentrant end wall, which method comprises;

fabricating said envelope from a vitreous material that transmits infrared radiation;

fabricating the conjoined vitreous exhaust tube from a vitreous material that absorbs infrared radiation; and

subjecting a recessed segment of said exhaust tube to an externally generated beam of infrared radiation that passes through the intervening portion of the lamp envelope and is of sufficient intensity that it heat-softens said tube segment and causes it to collapse into a tip of fused vitreous material that hermetically seals the envelope and terminates the exhaust tube.

2. The method of claim **1** wherein;

the reentrant end wall of said envelope comprises a hollow stem that is composed of vitreous material that transmits infrared radiation; and

the heat-softening and tipping-off of said recessed segment of the exhaust tube is effected by passing said beam of infrared radiation through the intervening portions of said envelope and said vitreous stem.

3. The method of claim **2** wherein:

said envelope is charged to a pressure above atmospheric pressure with an inert fill gas through the exhaust tube prior to the tipping-off thereof; and

the tipping-off of said exhaust tube by said beam of infrared radiation is effected after the stem cavity has been pressurized with an inert gas to a pressure that is substantially equal to the pressure of the fill gas contained by said envelope and conjoined exhaust tube so that the heat-softened recessed segment of the exhaust tube and newly formed tip will not be distended and ruptured by the supraatmospheric pressure exerted by the contained fill gas.

4. The method of claim **2** wherein:

said beam of infrared radiation is generated by a halogen type incandescent lamp; and

the infrared radiation generated by said lamp is focused onto the recessed segment of the exhaust tube which is to be collapsed and tipped off.

5. A baseless single-ended incandescent lamp comprising: that contains

an envelope of infrared-radiation transmitting glass that is terminated by a neck portion that has a molded thread formed on its exterior surface;

a hollow stem of infrared-radiation transmitting glass sealed to said envelope neck portion and defining a stem cavity that extends into said neck portion;

a pair of lead wires sealed through a press formed on the inner end of said stem;

an incandescible filament fastened to the inner ends of said lead wires;

an exhaust tube of infrared-absorbing glass sealed to the inner end of said stem and communicating with an adjacent aperture in the wall of said stem;

said exhaust tube being terminated by a fused hermetically-sealed tip that is located proximate the inner end of the stem and is thus recessed within said stem cavity;

a layer of conductive material overlying at least a part of the thread on said envelope neck portion and constituting a side contact for said lamp;

a disclike contact member secured to the end of said envelope neck portion and having an outwardly protruding segment that constitutes an end contact for said lamp;

the outer end portion of one of said lead wires being located in the stem cavity and extending through the end of said

envelope neck portion and having its end electrically connected to said layer of conductive material; and

the outer end portion of the other of said lead wires being disposed in said stem cavity and electrically connected to said contact member.

6. The incandescent lamp of claim 5 wherein said envelope contains an inert fill gas at supraatmospheric pressure.

7. The incandescent lamp of claim 5 wherein;

the lead wire that is connected to said layer of conductive material is interposed between said layer and the underlying portion of the molded thread; and

said disclike contact member closes said stem cavity.

8. The incandescent lamp of claim 5 wherein:

said envelope and stem are composed of soda-lead glass; and

said exhaust tube is composed of potash-soda-lead glass that contains an amount of iron oxide such that approximately 80 percent of infrared radiation having a wavelength of from 1 to 2 microns is absorbed by a section of said glass that is approximately 1 millimeter thick.