

Jan. 31, 1967

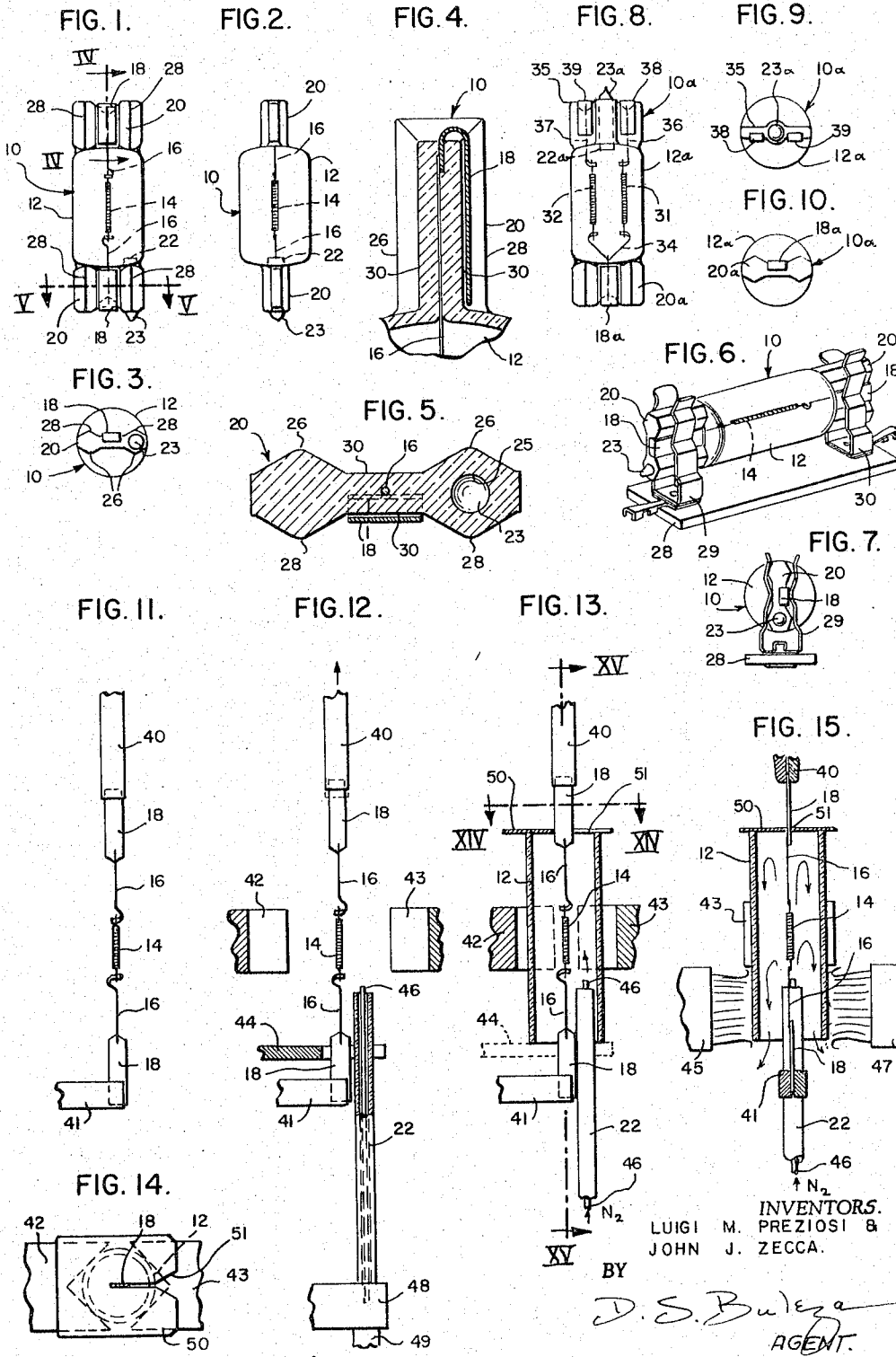
L. M. PREZIOSI ET AL

3,301,623

METHOD OF MANUFACTURING DOUBLE-ENDED ELECTRIC LAMPS

Original Filed March 19, 1963

2 Sheets-Sheet 1



Jan. 31, 1967

L. M. PREZIOSI ETAL

3,301,623

METHOD OF MANUFACTURING DOUBLE-ENDED ELECTRIC LAMPS

Original Filed March 19, 1963

2 Sheets-Sheet 2

FIG. 16.

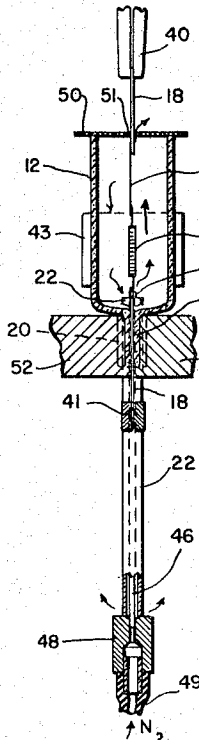


FIG. 17.

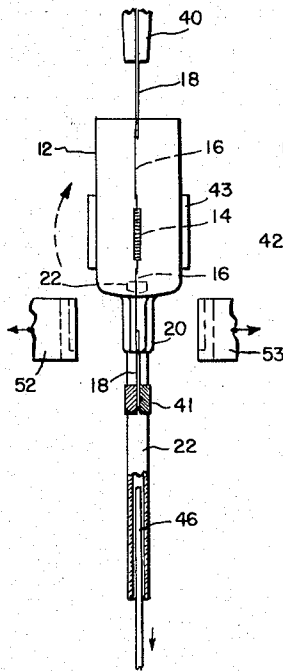


FIG. 18.

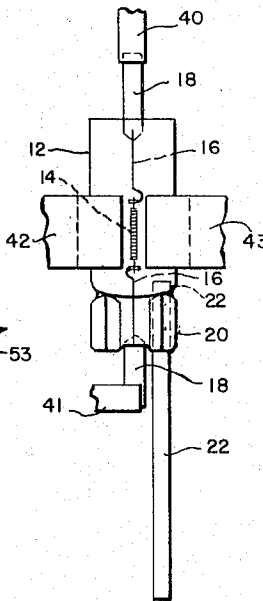


FIG. 19.

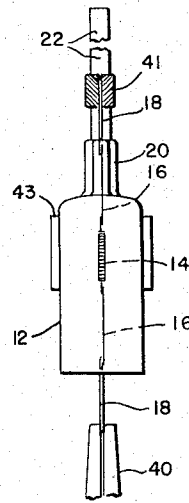


FIG. 20.

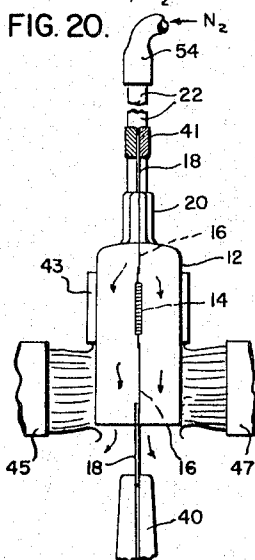


FIG. 21.

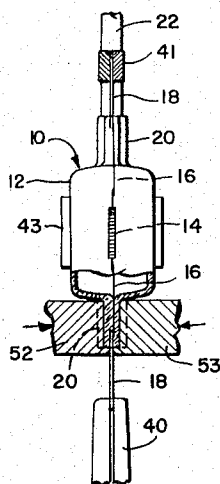


FIG. 22.

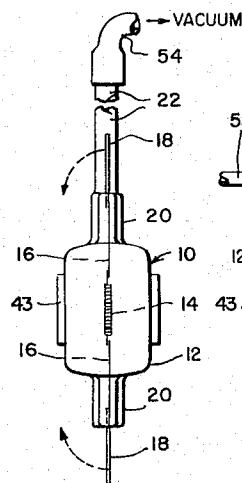
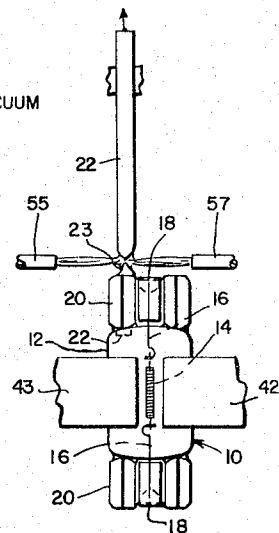


FIG. 23.



INVENTOR.
LUIGI M. PREZIOSI &
JOHN J. ZECCA.

BY

D. S. Bulge
AGENT.

1

3,301,623

METHOD OF MANUFACTURING DOUBLE-ENDED ELECTRIC LAMPS

Luigi M. Preziosi, East Orange, and John J. Zecca, Belleville, N.J., assignors to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania
Original application Mar. 19, 1963, Ser. No. 266,392, now Patent No. 3,265,923, dated Aug. 9, 1966. Divided and this application Jan. 21, 1965, Ser. No. 426,761
5 Claims. (Cl. 316—21)

This application is a division of copending application Serial No. 266,392, filed March 19, 1963, entitled "Baseless Double-Ended Electric Incandescent Lamp," now U.S. Patent No. 3,265,923.

This invention relates to electric lamps and has particular reference to a method of manufacturing a baseless double-ended incandescent lamp.

In view of the high cost of threaded bases and sockets, there have recently been developed miniature single-ended incandescent and photoflash lamps wherein the neck portion of the lamp envelope is molded into a press seal that serves as the base. The exposed ends of the lead wires are bent over or comprise pins that serve as contacts and the press seal is provided with a groove or the like so that it can be simply inserted into and interlocked with a resilient socket member.

The simplicity of such so-called "wedge base" lamps and sockets and their reduced cost has led to the development of a baseless double-ended incandescent lamp for use in the automotive industry. These lamps resemble a cartridge in form and are designed to fit into a "buss fuse" type socket having a pair of spaced U-shaped clamps or the like that comprise the socket contactors or terminals. Since a press seal is required at each end of such lamps, it is difficult to exhaust the envelope and perform the other operations associated with mounting the filament and still make a good seal, especially when the envelope comprises a section of glass tubing and full-pressure seals must be formed.

It is accordingly the general object of the present invention to provide an improved method for fabricating double-ended baseless electric lamps that are stronger and less expensive than the prior art lamps of this type.

Another object is the provision of a method for making such lamps from drawn glass tubing by a series of operations that can be easily performed by automated equipment.

The aforesaid objects, and other advantages that will become apparent as the description proceeds, are achieved in accordance with the present invention by using predetermined lengths of drawn glass tubing as the envelope and forming the full-pressure seals without completely sealing off the envelope. This is accomplished by sealing an exhaust tube in one of the press seals and keeping it open during the press-forming operation. After the press seals have been completed, the lamp is evacuated, etc. through the exhaust tube which is then tipped off close to the end of the press seal to complete the lamp. Since drawn tubing is inexpensive and has heavy walls of uniform thickness, the lamps are not only cheaper to make but are much stronger than those having blown bulbs.

The novel method of this invention also includes steps for temporarily closing off one end of the envelope while the other end is being sealed, and flushing an inert gas through the envelope to prevent oxidation of the filament and its lead-in conductors during the press sealing operation.

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

2

FIGURE 1 is a front elevational view of an improved single-filament cartridge lamp embodying the present invention;

FIGS. 2 and 3 are side and end views, respectively, of the lamp shown in FIG. 1;

FIG. 4 is an enlarged cross-sectional view of the press seal along the axial line IV—IV of FIG. 1, in the direction of the arrows;

FIG. 5 is an enlarged cross-sectional view through the press seal containing the tipped off segment of exhaust tubing along the line V—V of FIG. 1, in the direction of the arrows;

FIGS. 6 and 7 are perspective and end views, respectively, of the lamp placed in its socket;

FIG. 8 is a front elevational view of a dual-filament lamp embodiment according to the invention;

FIGS. 9 and 10 are plan views of the upper and lower ends, respectively, of the lamp as viewed in FIG. 8; and

FIGS. 11 through 23 are elevational views, partly in section, of the apparatus and the lamp components illustrating various phases of lamp fabrication in accordance with the invention.

While the present invention can be used with advantage in manufacturing various types of double-ended electrical devices, it is particularly adapted for use in connection with cartridge-type miniature lamps for automotive service and has accordingly been so illustrated and will be so described.

EMBODIMENT I

With specific reference to the drawings, in FIGS. 1 and 2 there is shown one form of a double-ended miniature or "cartridge" type lamp 10 adapted for automotive use and comprising a tubular envelope 12 that is closed at each end by a full-pressure seal 20. The envelope 12 consists of a short length of heavy-walled drawn glass tubing of uniform diameter and the seals extend across the full diameter of the envelope. A linear filament 14 of coiled refractory metal wire, such as tungsten or the like, is sealed within the envelope 12 and suspended in substantially coaxial relationship therein by a pair of lead-in conductors 16 that are embedded in each of the press seals 20. A thin metal strip 18 of nickel or the like is attached to the embedded end of each of the lead-in wires 16 and bent around the ends of the respective press seals against a pressed face thereof to provide large flat contacts. The aforementioned filament 14, lead-in wires 16 and terminal strips 18 are attached to each other in end-to-end relationship (as by welding) and constitute an elongated mount assembly that extends along the axis of the envelope 12.

One of the press seals 20 (the lower one as the lamp 10 is viewed in FIG. 1) contains a tipped-off segment 22 of a vitreous exhaust tube. As shown, the open end of the tube segment 22 protrudes into the interior of the envelope 12 and its sealed tip 23 protrudes from the end of the press seal. In this particular embodiment, the tube segment 22 is located in an "off-center" position and passes through a side portion of the press seal, as is explained in greater detail below.

As shown more particularly in FIGS. 3, 4 and 5, each of the press seals 20 have a pair of spaced longitudinally-extending ridges or ribs 26—26 in its pressed face and a second pair of similar ribs 28—28 in its opposite face. These ribs are aligned with one another and merge to form rails or bosses of enlarged cross section that extend along and constitute the sides of the press seals. As will be noted in FIG. 5, each of the ribs 26 and 28 have sides which taper toward the side edges of the press seals and toward the central portion thereof. The central portion of each seal 20 is of reduced and substantially uniform

3

thickness and forms a flat 30 that defines an elongated recess in each of the seal faces. These recesses extend from the ends of the press seals 20 toward the bulbous body portion of the envelope 12 and are located between the ribs 26 and 28 and bosses which they form. The free ends of the metal strips 18 are seated in these recesses. The edges of the press seals 20 are thus beveled and the seal faces are provided with a reverse taper that leads to the flats 30 located at the center of the seals.

The aforementioned beveled edges and reverse taper not only facilitates the insertion of the lamp 10 into the "fuse type" socket with which it is used, but automatically guides the socket contactors into positive electrical engagement with the exposed ends of the metal strips 18 that serve as the lamp contacts. A socket of the foregoing type is shown in FIGS. 6 and 7 and comprises an insulator base 28 and two U-shaped metal spring clips 29 and 30. These clips constitute the socket contactors and are shaped to interlock with and firmly grip the press seals 20 when the lamp 10 is inserted into and seated in the clips, as shown.

As shown in FIG. 3, the sealed tip 23 of the exhaust tube segment 22 projects from one of the seal bosses, and, while the exhaust tube segment is fused and merges with this portion of the seal as shown in FIG. 5, the bore 25 of the tube remains open and communicates with the interior of the lamp envelope 12.

EMBODIMENT II

As is shown in FIG. 8, the use of drawn glass tubing instead of a blown bulb having constricted neck portions and narrow press seals affords the additional advantage of permitting two filaments 31 and 32 to be sealed in side-by-side relation within the envelope 12a and a dual-filament cartridge lamp 10a to be made. As shown, a lead-in conductor 34 having a pair of divergent arms at its inner end is sealed through one of the full-press seals 20a and connected to a metal strip 18a disposed in a centrally-located recess in the seal face in the same manner as hereinbefore described. The ends of the conductor arms are attached to the ends of the filaments 31 and 32 so that a contact common to both filaments is provided at this end of the lamp 10a.

A pair of spaced lead-in conductors 36 and 37 are sealed through the press seal 35 at the opposite end of the lamp 10a and are individually connected to the ends of the respective filaments 31 and 32 and to a pair of spaced metal strips 38 and 39 that are bent around the end of the seal and against one of its pressed faces. The filaments 31 and 32 can, accordingly, be selectively energized by connecting the single contact 18a and a preselected one of the other contacts 38 and 39 to a suitable power source.

According to this embodiment, the exhaust tube segment 22a is sealed through the central portion of the full-press seal 35 and the strip contacts 38 and 39 are disposed on opposite sides thereof, as shown in FIG. 8. The exhaust tube tip 23a thus protrudes from the central edge portion of the press seal 35 and, as illustrated in FIG. 9, the central portion of the seal that is fused to and contains the tube segment 22a is of enlarged cross section. The side portions of the seal, on the other hand, are substantially flat and form seats for the ends of the metal strips 38 and 39.

FABRICATION

The aforesaid cartridge-type baseless lamps are fabricated in accordance with the present invention by the method illustrated in FIGS. 11 through 23, which method will now be described.

Step 1 consists of clamping the ends of the filament mount in a pair of mount holders 40 and 41 spaced a predetermined distance apart, as shown in FIG. 11. When the mount comprises a coiled filament 14, lead-in wires 16 and metal strips 18 attached to one another in end-to-end relationship as in the present case, the free ends of

4

the strips are gripped. It should be noted that the mount holder 41 located at the lower end of the mount grips the metal strip 18 form the side rather than from the end. This arrangement enables the exhaust tube 22 to be positioned adjacent this end of the mount in the next operation. The mount holders 40 and 41 are held in the desired fixed position by a suitable support (not shown).

Step 2 is shown in FIG. 12 and consists of moving the mount holder 40 upward a predetermined distance (as indicated by the arrow) in an axial direction to stretch the filament 14 to the proper length and keep the mount assembly taut. Bulb-holding jaws 42 and 43 are then positioned in line with the filament 14 and on opposite sides thereof as shown. A suitable horizontally-disposed and forked stop 44 is then positioned at a point a predetermined distance below the filament and a glass exhaust tube 22 is disposed adjacent and in substantially parallel relationship with the lower end of the mount. As illustrated, the exhaust tube 22 is located on the side of the mount opposite the mount holder 41 and is oriented so that the end thereof is disposed just below the hooked end of the lead-in wire 16 that is attached to the lower end filament. The exhaust tube 22 is held in the aforesaid position by means of a support 48. A hollow needle 46 of refractory metal such as tungsten is sealed in an opening through support 48 and fits loosely within the bore of the exhaust tube 22. This needle is of such length that it protrudes just beyond the uppermost end of the tube. The opposite end of the needle 46 is connected with a supply of inert gas such as nitrogen by means of a nipple on the support 48 and a suitable conduit 49 that is attached to the nipple, as shown in FIG. 16.

Step 3 is shown in FIG. 13 and consists of threading a length of drawn glass tubing that comprises the envelope 12 over the mount holder 40 and the mount assembly until it strikes the stop 44, whereupon the bulb-holding jaws 42 and 43 are actuated by a suitable mechanism (not shown) and caused to grip the tubular envelope 12. The stop 44 is then withdrawn. The envelope is coaxially aligned with the filament mount by the action of the jaws and the end segment of the exhaust tube 22 is located within the lower end of the envelope, as illustrated. The latter, accordingly, encircles and overlies the end segment of the tube and also extends just beyond the juncture between the metal strips 18 and lead-in conductors 16 at each end of the mount, as shown. A cover 50 is preferably placed over the upper end of the envelope 12 to temporarily close off that end of the bulb and thus avoid the "chimney effect" that would otherwise occur when the opposite end of the envelope is subsequently heated. Purified nitrogen is then fed into the envelope 12 through the needle 46, as indicated, to prevent oxidation of the filament and lead-in conductors during the press sealing operation.

As shown most clearly in FIG. 14, the cover 50 is provided with a slot 51 that accommodates the metal strip 18 and enables the cover to slip therearound completely over the end of the envelope 12.

Step 4 is shown in FIG. 15 and consists of heating the lower end of the envelope 12 after the N₂ has been circulated through the envelope for about sixty seconds and has flushed all of the air out of the envelope, as indicated by the small arrows. The heating is accomplished by a pair of gas burners 45 and 47 that are positioned so that the fires impinge on opposite sides of the envelope in a direction substantially normal to the plane containing the filament mount assembly and the exhaust tube 22, as shown.

Step 5.—After the glass has become plastic, the burners 45 and 47 are withdrawn and the heated end of the envelope 12 is compressed and molded into a full-press seal 20 by a pair of suitably shaped press-jaws 52 and 53, as shown in FIG. 16. The seal is preferably formed in two operations, namely, a preforming operation (in which the press-jaws are partly closed) and then a final pressing

5

operation. Between these operations the glass is reheated to replace the heat withdrawn by the press-jaws. Flushing with nitrogen is continued during both operations to avoid oxidizing the mount. After the press is formed, the gas escapes through the slot 51 in the cover 50 and also from the end of the exhaust tube 22 through the space between its inner wall and the needle 46, as indicated by the arrows.

Step 6 is shown in FIG. 17. Immediately after the press 20 has been formed and just before the press-jaws 52 and 53 are open, the needle 46 is withdrawn from the exhaust tube 22, as indicated by the arrow. Since the glass is still plastic, it does not stick to the needle and the sealed-in end segment of the exhaust tube 22 thus remains open.

Hence, although the end of the envelope 12 has been closed off by the seal 20 and the end of exhaust tube 22 is fused to and extends through one of the enlarged bosses of the seal (see FIG. 18), the tube is kept open and communicates with the interior of the envelope through the formed press.

Step 7.—After the cover 50 has been removed, the entire assembly is inverted as a unit (as indicated by the broken arrow in FIG. 17) without changing the spacing between the mount holders 40 and 41. The open end of the envelope 12 thus points downwardly and the press 20 and exhaust tube 22 extend upwardly, as shown in FIG. 19.

Step 8 is shown in FIG. 20 and consists of connecting the end of the exhaust tube 22 with a supply of nitrogen by a suitable conduit 54, and then heating the open end of the envelope 12 by means of the burners 45 and 47 while nitrogen is flushed through the envelope, as indicated by the arrows.

Step 9.—After the glass becomes sufficiently plastic, the burners are withdrawn and replaced by the press-jaws 52 and 53 which are then actuated to compress the heated end of the envelope into a second full-press seal 20, as shown in FIG. 21. The press-forming operation is again preferably accomplished in two steps as above described. The flow of nitrogen through the exhaust tube 22 is pinched off just prior to the reheating and final pressing operation to avoid deforming the soft seal.

Step 10.—The envelope 12 is then evacuated, as shown in FIG. 22, by connecting the conduit 54 with a suitable vacuum system (not shown) whereupon the conduit 54 is connected with a suitable inert gas, such as argon or the like, and the envelope is filled to a predetermined pressure such as about 600 millimeters. In the interim, the exposed ends of the metal strips 18 are trimmed, if necessary, and bent around the ends of the respective press seals 20 and into the recesses in their pressed faces, as indicated by the broken arrows.

Step 11.—The last step is shown in FIG. 23 and consists of tipping-off the exhaust tube 22 at a point adjacent the end of the full-press seal 20 by means of opposed sealing burners 55 and 57 while the lamp 10 is still in the bulb holders 42 and 43. The exhaust tube is preferably severed at a point as close as possible to the end of the press-seal so that the protruding tip 23 is very short.

It will be appreciated from the foregoing that the objects of the invention have been achieved in that a convenient method has been provided for fabricating double-ended cartridge-type miniature lamps, which method permits the use of full-press seals and lends itself to high-speed automated lamp-making equipment.

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

For example, instead of evacuating and filling the envelope immediately after the second full-press seal has been completed as above described, the exhaust tube can be sealed at a point remote from the press seal and the nitrogen-filled and partly-fabricated lamps placed in an

6

annealing oven and baked for five to ten minutes at about 415° C. to remove residual strains in the glass. In this case, after the lamps have cooled, the exhaust tubes are reopened and the exhaust, filling, and tipping-off operations are completed in the manner described above.

We claim as our invention:

1. The method of manufacturing a baseless double-ended electric incandescent lamp comprising, attaching a lead-in conductor to each end of an elongated filament to provide a mount, positioning a vitreous exhaust tube alongside one of the lead-in conductor portions of said mount, threading an elongated vitreous envelope over said mount and the adjacent end segment of said exhaust tube, positioning said envelope relative to said mount so that the end of the envelope overlies the end segment of said exhaust tube and the ends of each of the lead-in conductor portions of said mount that are attached to said filament,

heating the end of said envelope that encircles the exhaust tube segment and adjacent lead-in conductor until it becomes plastic,

compressing the heated end of said envelope and forming it into a full-press seal that is hermetically united with the underlying segment of said lead-in conductor and is fused with but does not close the aforesaid exhaust tube segment,

heating and compressing the other end of said envelope to form a second full-press seal around the other of said lead-in conductors,

evacuating said envelope through said exhaust tube, and then tipping-off said exhaust tube at a point adjacent the end of the press seal with which it is joined.

2. The method of manufacturing a baseless double-ended incandescent lamp as set forth in claim 1 wherein said envelope is filled with an inert gas to a predetermined pressure after it is evacuated and before the exhaust tube is tipped off.

3. The method of manufacturing a baseless double-ended electric incandescent lamp as set forth in claim 1 wherein an inert gas is flushed through said exhaust tube and envelope before the latter is initially heated, and the end of the envelope opposite the one encircling the exhaust tube end is temporarily closed off while the inert gas is being flushed through said envelope.

4. The method of manufacturing a baseless double-ended electric incandescent lamp comprising,

attaching a lead-in conductor to each end of an elongated refractory wire filament,

attaching a metal strip of predetermined length to the free end of each of the aforesaid lead-in conductors to form an elongated mount comprising said filament, lead-in conductors and metal strips joined together in end-to-end relationship,

holding said mount by its ends and under sufficient tension to keep it taut,

positioning a vitreous exhaust tube adjacent and in substantially parallel relationship with one of said metal strips and the end of the adjoining lead-in conductor, threading a tubular vitreous envelope of substantially uniform diameter over said mount and the proximate end of said exhaust tube,

positioning said envelope relative to said mount so that the filament is substantially centrally located therein and the end of said envelope overlies the portions of the metal strips attached to the lead-in conductors and also the end segment of the exhaust tube that is adjacent said mount,

inserting a hollow metal needle into the end of said exhaust tube remote from said mount until its tip protrudes beyond its opposite end,

flushing an inert gas through said needle and said envelope, heating the end of said envelope that encircles

7

the exhaust tube segment and adjacent portion of said mount until it becomes plastic, compressing the heated end of said envelope and forming it into a full-press seal that is hermetically united with the encircled portion of said mount and is fused with the said exhaust tube segment, withdrawing the metal needle from said exhaust tube immediately after the press seal is formed thereby to maintain the opening through the end segment of the exhaust tube that is fused with the seal, flushing an inert gas through the attached open exhaust tube and said envelope, heating and compressing the other end of said envelope into a second full-press seal that is united to the underlying portion of the mount and concurrently stopping the flow of flush gas just prior to the closure of the envelope, evacuating said envelope through the attached open exhaust tube, and then

8

tipping-off said exhaust tube at a point adjacent the end of the press seal with which it is joined.

5. The method of manufacturing a baseless double-ended incandescent lamp as set forth in claim 4 wherein the end of the envelope opposite the one encircling the exhaust tube segment is temporarily closed off prior to and during the first heating and sealing operation, and the free ends of said metal strips that extend beyond the ends of the respective press seals are bent therearound against the pressed faces of the seals before the exhaust tube is tipped-off.

References Cited by the Applicant

UNITED STATES PATENTS

3,093,768 6/1963 Ayres.
3,156,841 11/1964 Ayres.

RICHARD H. EANES, JR., *Primary Examiner.*