METHOD OF MANUFACTURING GAS-FILLED LAMPS

Inventors: Ferdinand Jose Maria Schenkels, Emmasingel, Eindhoven, Netherlands; Ghislain Felix Alfons Arthur Verboven, Zonneweeldelaan 29, Belgium

Filed: Dec. 7, 1971

Appl. No.: 205,535

U.S. Cl. .................................................. 316/20
Int. Cl. .................................................. H01J 9/38
Field of Search .... 316/20, 24; 53/79; 313/222

ABSTRACT

Lamps are provided with a filler gas by condensing the filler gas in the envelope and by subsequently sealing the envelope. Condensation of the filler gas is effected by spraying the envelope locally with a liquefied gas so that the envelope is cooled to below the condensation temperature of the filler gas.

2 Claims, 1 Drawing Figure
METHOD OF MANUFACTURING GAS-FILLED LAMPS

The invention relates to a method of manufacturing gas-filled lamps in which the envelope is filled with gas by cooling the envelope to a temperature below the boiling point of the filler gas, by condensing the desired quantity of filler gas in the envelope and by sealing the envelope while the filler gas is at least largely in a condensed state.

The invention particularly relates to a method of manufacturing gas-filled lamps provided with an envelope of a material which is transparent to visible light and which has a low thermal coefficient of expansion, the filler gas consisting, for example, mainly of argon or krypton and having a pressure of several atmospheres in the finished lamp. Examples of such lamps are halogen incandescent lamps which are filled with a mixture which consists mainly of argon or krypton and a small amount of a halogen or a halogen compound.

According to a method known from U.S. Pat. specification No. 3,311,439 the envelope to be filled with gas is partly immersed in a liquid gas having a boiling point which is lower than the boiling point of the filler gas.

This method has the drawback that during immersion of the envelope a gas cushion is formed around the immersed part of the envelope, which cushion has a poor thermal conductance (Leidenfrost phenomenon). As a result there is hardly any cooling or no cooling at all for several seconds.

A further drawback of this method is that during sealing part of the gas condensed of the wall of the envelope evaporates again when the envelope had been entirely immersed. This drawback becomes particularly manifest in the manufacture of small lamps (envelope contents in the order of 0.5 cubic cm). In these small lamps the quantity of gas evaporating during sealing and escaping from the envelope is relatively large. As a result it is difficult to manufacture these small lamps with a reproduction pressure of the filler gas and with a reproducible lifetime directly connected therewith, unless a special method of sealing is used.

An object of the present invention is to obviate the drawbacks of the known method.

This object is achieved by a method according to the invention which is characterized in that a liquid gas, which has a boiling point below that of the filler gas, is sprayed onto a part of the wall of the envelope in order to bring this part to a temperature below the boiling point of the filler gas, and that this filler is condensed on this part of the wall of the envelope.

In a preferred embodiment of the invention liquid nitrogen is sprayed onto the wall of the envelope when manufacturing halogen lamps which are filled with a filler gas consisting mainly of argon or krypton and a small amount of a halogen or halogen compound. Other gases which may be used instead of liquid nitrogen are, for example, liquid helium and neon.

The method according to the invention provides the advantage that lamps can be manufactured with a reproducible pressure of the filler gas at a faster rate and with a smaller quantity of coolant (for example, liquid nitrogen). The smaller quantity of coolant used and the faster manufacturing rate is probably due to the fact that during cooling by means of spraying with coolant the previously described Leidenfrost phenomenon does not occur or does not occur to the same extent as in the immersion method.

A further advantage of the method according to the invention is that only a small part of the wall of the envelope is to be cooled and this part may be chosen to be such that condensed filler gas cannot evaporated during sealing. In this manner it becomes possible to manufacture lamps, including small lamps, at a faster rate with a reproducible pressure of the filler gas and consequently with a reproducible lifetime while using a smaller amount of coolant.

As compared with a method in which a liquid cooled at a low temperature and having a boiling point above 20°C is used for cooling the envelope of a lamp (see U.S. Pat. specification 2,870,586), the method according to the invention has the advantage that more efficient use of the coolant is made with equipment which, in comparison is much simpler. In the method known from said patent specification the heat is conducted away by the coolant which serves as a heat-transferring medium and which must therefore be circulated rapidly between the product to be cooled and a cooling installation.

In the method according to the invention in which a liquid gas is sprayed onto the envelope there are no heat-transfer problems because the heat to be conducted away is used for evaporating liquid gas. Moreover, in the method according to said U.S. patent specification it is impossible to condense the filler gas because the low temperatures required for this purpose cannot be reached in this method.

In order that the invention may be readily carried into effect, an embodiment thereof will now be described in detail by way of example with reference to the accompanying diagrammatic drawing.

The sole FIGURE of the drawing shows part of an arrangement for condensing filler gas in a halogen incandescent lamp.

The FIGURE shows a halogen incandescent lamp 1 whose envelope 2 is provided with a tube 3 which is in free communication with the envelope space, and at the other end, at 4, it is connected to the filling device 5 shown in part. The filling device consists of a T-shaped part 6, three taps 7, 8 and 9 and two tubes ends 10 and 11 which are connected to a vacuum pump and a filler gas container, respectively, (vacuum pump and filler gas container are not shown). The lamp is filled as follows: taps 8 and 9 are opened and the envelope and the tube ends 3 and 6 are evacuated. Subsequently taps 8 and 9 are closed and tap 7 is opened and, after tube end 6 is filled with filler gas, it is closed again. A measured amount of filler gas is then present in the tube part 6. Subsequently the shaded part 12 of the wall of the envelope is sprayed with liquid nitrogen (only the end 13 of the double-walled spraying device is shown) and tap 9 is opened. The filler gas condenses on the part 12 of the wall of the envelope cooled with liquid nitrogen. After several seconds the filler gas is condensed on the wall of the envelope at 12 and the envelope is then sealed (see the arrows at 14).

When performing the process the lamp is held at its pinch by means of clamping halves not shown. The lamp 1 includes a filament 15 and is provided with a pinch 16 and a conventional current lead-through wires 17 and 18. By using the method according to the invention the manufacturing rate can be increased by approximately 60 percent while 2.5 litres of liquid ni-
trogen are economized per 100 lamps as compared with the immersion method.

What is claimed is:

1. In a method of manufacturing gas-filled lamps, the improvement comprising the steps of:
   evacuating the envelope for the lamp;
   preparing a measured amount of filler gas for insertion into said evacuated envelope;
   cooling the envelope and inserting the filler gas, said cooling being effected by spraying a liquid gas having a boiling point below that of the filler gas onto an external side of a part of the wall of the envelope in order to bring that part to a temperature below the boiling point of the filler gas, said measured amount of filler gas condensing on the internal side of said part of the wall of the envelope; and sealing the envelope while the filler gas is at least largely in the condensed state.

2. A method as claimed in claim 1 wherein liquid nitrogen is sprayed onto the part of the envelope to be cooled.
UNIVERSAL STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,788,724 Dated January 29, 1974

Inventor(s) FERDINAND JOSE MARIA SCHENKELS

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the title page, insert


Signed and sealed this 19th day of November 1974.

(SEAL)

Attest:

McCoy M. Gibson Jr. C. Marshall Dann
Attesting Officer Commissioner of Patents