Oct. 28, 1952 M. PIPKIN 2,615,472

GLASS TUBULATURE FOR FEEDING MERCURY

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Fig. 1.

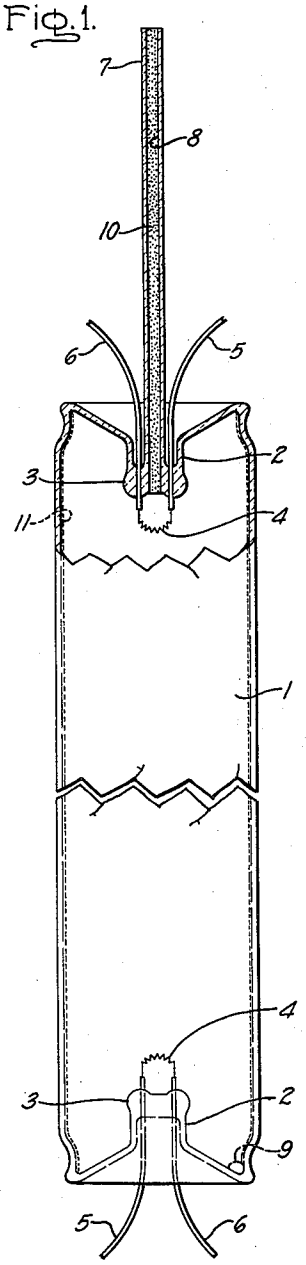
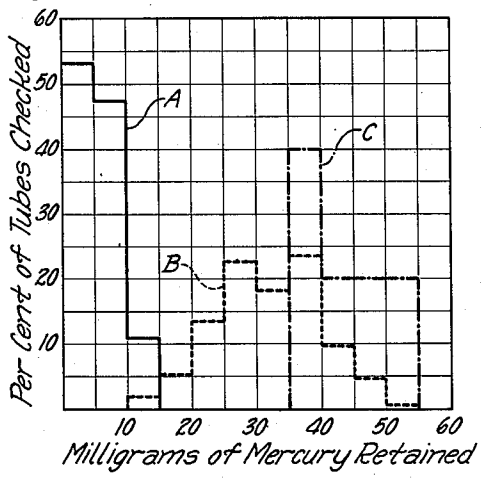


Fig. 2.



Inventor:
Marvin Pipkin,
by Vernet C. Kauffman
His Attorney.

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GLASS TUBULATURE FOR FEEDING MERCURY

Marvin Pipkin, Cleveland Heights, Ohio, assignor to General Electric Company, a corporation of New York

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2 Claims. (Cl. 138—68)

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My invention relates to enclosures or containers which are to be filled with a measured small quantity of mercury, and more particularly to a glass tubulature or tubulated stem for such containers through which the measured quantity of mercury is introduced into the container.

In the manufacture of gaseous electric discharge devices or fluorescent lamps according to present methods, it is common practice to introduce the measured quantity of liquid mercury with which the lamps are filled, into the lamp envelope through the glass exhaust tube thereof while the lamp is still in the exhausting machine. Due to the heated condition, among other things, of the glass exhaust tube resulting from the heating of the lamp envelope during the exhausting operation, the entire measured quantity of mercury does not pass freely through the exhaust tube into the lamp envelope. Instead, a considerable portion of the mercury sticks to and remains on the inner wall of the glass exhaust tube due to condensation or mechanical adherence of the mercury, thereby resulting not only in a possible deficiency of mercury within the lamp but also causing an unnecessary waste of mercury.

To overcome this adherence of the mercury to the glass surface of the exhaust tube, it has been customary to provide such glass exhaust tubes with frosted interior walls. However, while this measure does effect some reduction in the amount of mercury retained in the exhaust tube as compared to that retained within a clear glass or unfrosted exhaust tube, nevertheless a considerable quantity of mercury still adheres to the inner wall of such inside frosted exhaust tubes. In addition, the frosting of such exhaust tubes is a relatively expensive as well as hazardous operation.

It is one object of my invention, therefore, to provide a glass tubulature for a container or lamp envelope through which a measured quantity of liquid mercury may be introduced into the container, said tubulature having its inner wall surface of such character as to substantially prevent or at least greatly minimize adherence of the mercury thereto.

Another object of my invention is to provide a stem for an electric device having a glass exhaust tube extending therefrom, the inner wall surface of said exhaust tube being of such character as to substantially prevent adherence thereto of liquid mercury upon passage thereof through the tube.

A feature of the invention is the provision, on the inner wall surface of the glass tubulature or exhaust tube, of a thin, uniform and adherent coating of a finely powdered material to minimize

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adherence of mercury to the said inner wall surface, the powder material being of unctuous character and being preferably applied to the tube wall by being dusted thereon.

Further objects and advantages of my invention will appear from the following description of a species thereof and from the accompanying drawing in which:

Fig. 1 is a longitudinal view, partly in section, of an envelope assembly for an electric discharge lamp having an exhaust tube according to the invention for introducting mercury into the envelope; and Fig. 2 is a chart showing the frequency of distribution of mercury retained in glass exhaust tubes according to the invention as compared to exhaust tubes having inside-frosted and clear glass interiors, respectively.

Referring to the drawing, I have there shown my invention in connection with the manufacture of electric discharge lamps or similar devices such as fluorescent lamps in general use at present. The lamp illustrated comprises an elongated tubular envelope 1 of glass provided at each end thereof with a reentrant stem tube 2 having a seal portion 3. The interior of the envelope 1 may be provided with a coating 11 of a suitable fluorescent material such, for instance, as zinc-beryllium silicate. A thermionic electrode 4, such as a coiled coil tungsten filament coated with a suitable electron emissive material such as barium oxide, is mounted within the envelope 1 at each end thereof, each electrode 4 being supported by a pair of current supply or leading-in wires 5, 6 connected to opposite ends of the electrode and sealed into the seal portion 3 of the stem 2. An exhaust tube 7 is also sealed at one end into the seal portion 3 of one of the stems 2, as shown in the drawing. The interior passageway 8 of this exhaust tube is open through the seal portion 3 of the stem 2 to thereby provide an unobstructed passageway communicating with the interior of the lamp envelope 1. Through this passageway 8, a measured quantity 9 of mercury is introduced into the envelope 1.

In accordance with the invention, the interior wall of the exhaust tube 7 is provided with a thin, uniform and tightly adherent coating 10 of a fine powder material of unctuous character, preferably magnesium trisilicate of the approximate formula $Mg_2Si_3O_8 \cdot 5H_2O$ which has been found to be particularly effective for the intended purpose. The powder material is preferably applied to the exhaust tube 7, before the latter is sealed to the stem tube 2, by dusting the powder onto the interior wall of the exhaust tube. This may be accomplished by connecting the interior of the exhaust tube with the interior of a smoke chamber

filled with a smoke of the powder material under a slight pressure, for instance, 3 lbs. pressure or thereabouts.

For the production of a satisfactory coating 10 of the powder material by such a dusting-on process, the powder material employed should be of very fine particle size and of a character such as to cohere well and form agglomerates. In particular, magnesium trisilicate powder having an average particle size of around 1 micron or less and which readily agglomerates has been found to produce a very satisfactory coating for the purpose of the invention.

Following the application of the powder material to the interior wall of the exhaust tube 7, the loosely attached powder particles are preferably removed from the tube wall in a suitable manner, preferably by directing a jet of air through the tube at a suitable pressure, or connecting the latter to a vacuum, or both. The pressure of the air jet employed is preferably equal to twice, or slightly more than twice that of the atmosphere, e. g., 18 lbs. gauge pressure, so as to approximate the actual pressure conditions which exist in the tube when the latter is first opened to the exhaust line on the lamp exhaust machine. Such removal of the loose or excess powder particles from the exhaust tube interior thus leaves a uniform film or layer 10 of fine, tightly adhering powder on the tube interior which film otherwise might be scrubbed off to an appreciable extent by the loose powder particles when the exhaust tube is first opened to the exhaust line on the lamp exhaust machine.

Exhaust tubes 7 provided with a coating 10 in accordance with the invention retain a considerably lower percentage of any given dose of liquid mercury, upon passage thereof through the tube, as compared to that retained by inside-frosted glass exhaust tubes or by clear (uncoated or unfrosted) glass exhaust tubes. Thus, comparative tests show that exhaust tubes 7 provided with a dusted-on air-cleaned coating 10 of magnesium trisilicate retain on the average less than 15% of the mercury dose whereas inside-frosted tubes retain on the average over 40% and clear glass tubes retain on the average over 80% of the mercury dose. Most important, however, is the marked improvement in the frequency distribution of the mercury retained in the coated exhaust tubes according to the invention as compared to that occurring in clear glass and inside-frosted exhaust tubes, as shown by the charts in Fig. 2. Referring to Fig. 2, it will be seen that 100% of exhaust tubes provided with an air-jet cleaned magnesium trisilicate coating 10 in accordance with the invention (chart A) retained less than 15 mgs. or 29% (actually no more than 12.2 mgs. or about 24%) of an average 51.5 mg. mercury dose, whereas only 3% of inside-frosted (chart B) and 0% of clear glass exhaust tubes (chart C) retained less than 15 mgs. or 29% of the same 51.5 mg. average mercury dose.

In addition to their much lower retention of mercury, the coated exhaust tubes according to the invention can be produced with less hazardous manufacturing procedures and at considerably lower cost than the inside-frosted glass exhaust tubes customarily employed heretofore. While the coating 10 is preferably applied on the exhaust tube interior before the tube is sealed to the stem tube 2, it may, if desired, be applied after the exhaust tube has been sealed to the stem tube, i. e., after the lamp stem is completed.

In manufacturing a lamp of the type described in connection with the drawing, an exhaust tube 7 provided with an interior coating 10 according to the invention is assembled with a stem 2, leading-in wires 5, 6 and electrode 4 to form a complete stem mount. This stem mount is then sealed to an end of the lamp envelope 1 the other end of which is sealed by a similar stem mount which, however, may or may not be provided with a residue of exhaust tubing. After evacuation of the lamp envelope, but while it is still in the exhaust machine, the desired quantity of mercury is fed or dropped through the exhaust tube 7, as shown by the arrow in the drawing, into the lamp envelope 1. The exhaust tube is then sealed or tipped-off adjacent the stem seal portion 3 to thereby hermetically seal the lamp envelope. The envelope is then provided at each end with suitable bases having contact terminals, to which terminals the electrode lead-in wires 5, 6 are connected.

While I have shown and described my invention in connection with the manufacture of an electric discharge lamp, it should be understood that it can be applied equally as well to the manufacture of any other mercury-containing device where it is necessary to introduce a measured quantity of mercury into the device by means of a glass tube which is in a heated condition during the mercury-introducing operation.

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

1. A stem for an electric device comprising a glass stem tube and a glass exhaust tube sealed to said stem tube and having a passage extending therethrough, said exhaust tube having its interior surface provided with a substantially uniform coating of an unctuous pulverulent material to which mercury is substantially nonadherent whereby to minimize retention of liquid mercury on the said surface upon passage thereof through the exhaust tube.

2. A stem as set forth in claim 1 wherein the coating on the interior surface of the exhaust tube consists of fine magnesium trisilicate powder.

MARVIN PIPKIN.

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