Oct. 6, 1931. R. C. SMALLEY 1,826,383

METHOD AND APPARATUS FOR INTRODUCING FOREIGN SUBSTANCES INTO VACUUM TUBE LIGHTS

Filed May 1, 1926

Fig. 1

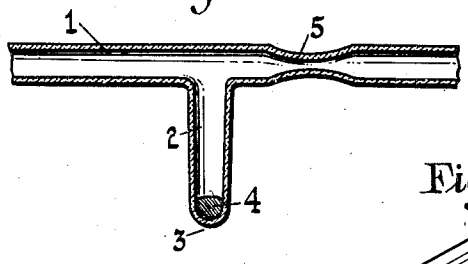


Fig. 2

Fig. 3

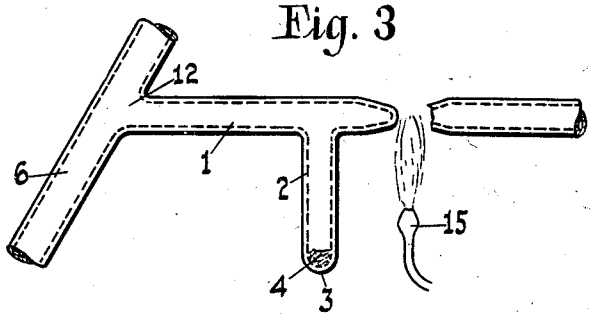


Fig. 4

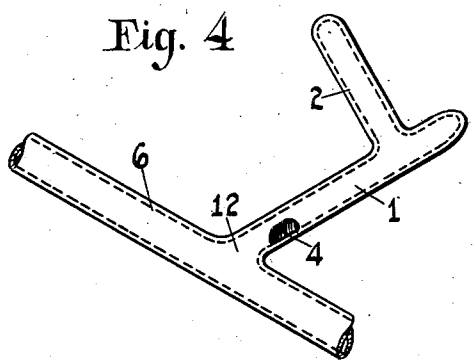
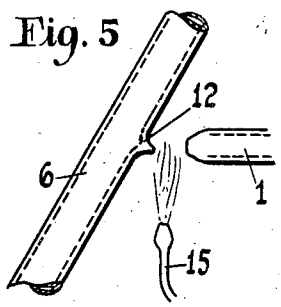


Fig. 5



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Patented Oct. 6, 1931

1,826,383

UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR INTRODUCING FOREIGN SUBSTANCES INTO VACUUM TUBE LIGHTS

Application filed May 1, 1926. Serial No. 105,894.

This invention relates to a method and apparatus for introducing a foreign substance into vacuum tube lamps. More specifically it relates to a method and apparatus for introducing a substance, such as mercury, finely divided solids, etc., into the envelope of a vacuum tube lamp, such as one containing neon under reduced pressure.

In the past it has been the practice to introduce mercury into lamps of the class described in order to modify the light emitted by the lamp. The mercury was introduced by distillation into the evacuated lamp envelope, either before or after the admission of the neon thereto. As will be readily understood, the apparatus required for the distillation of mercury is complicated and more or less difficult to operate and is to a certain degree dangerous to the operator. Moreover, only liquids and solids capable of distillation can be so introduced.

It is an object of this invention to produce a process and apparatus whereby foreign substances such as mercury and the like may be introduced in their normal state into the lamp envelope.

It is still a further object of my invention to produce a method and apparatus whereby substances incapable of being distilled, may be introduced bodily into a lamp.

It is still a further object of my invention to provide a method and apparatus whereby foreign substances may be introduced into a lamp by the action of gravity and substantially without danger to the operator.

It is still a further object of my invention to provide a method and apparatus whereby foreign substances may be introduced into a lamp by relatively unskilled workers and by the use of simple apparatus.

It is still a further object of my invention to eliminate the disadvantages of the former method and to provide a new and improved method and apparatus for introducing foreign substances into a lamp.

Still other objects will be apparent from the specification.

The features of novelty which I believe to be characteristics of my invention are pointed out with particularity in the appended claims. My invention itself however, will best be understood by reference to the specification and accompanying drawings in which:

Figure 1 represents a container arranged to carry the foreign substance to be introduced into a lamp;

Figure 2 shows the container sealed to the lamp and having its interior communicating with the interior of the lamp envelope;

Figure 3 shows the container just after the envelope has been evacuated and sealed off;

Figure 4 shows the bodily transfer of a foreign substance from the container to the lamp envelope; and

Figure 5 the lamp envelope after the container has been sealed off and removed.

Referring now more particularly to Figure 1, 1 designates a section of tubing preferably of glass, having a second portion 2 sealed thereon to form a T. The lower end of the stem of the T is closed off as at 3 and the substance to be transferred to the interior of the lamp is placed therein as indicated at 4. If desired, a neck portion 5 may be formed on the T on each side of the stem thereof, or at one side only if desired for convenience in sealing off and removing portions of the tube.

Referring now to Figure 2 I have shown diagrammatically a lamp envelope 6 consisting of a portion of tubing terminating at either end in bulbs 7 containing, for example, interior electrodes 8 mounted upon lead-in wires 9 passing through a press 10. Strings of glass beads 11 are also shown surrounding the electrodes 8 to maintain them in position but it will be understood that my invention does not relate to the specific construction shown and that it is equally applicable to other types of vacuum tube lamps.

Assuming that there is available an incompleted lamp 6 which it is desired to evacuate and to supply with neon under reduced pressure and also to supply with a small amount of some foreign substance, such for example as mercury, the T tube 1 will be sealed to the lamp envelope 6 as at 12 in such a manner as to establish contact between the interior of the T tube and the interior of the lamp envelope. The junction 12 between T tube

1 and the lamp envelope 6 should be made airtight for a purpose which will be explained later. The opposite open end of the T tube 1 may and preferably will be connected to tube 13 leading off to suitable pumps or other evacuating apparatus not shown, so that the lamp may be evacuated through tube 1, thereby avoiding the necessity of making another connection to evacuate the lamp envelope. Either before or after the T tube 1 is sealed to the lamp envelope, the material which it is desired to transfer to the interior of the lamp envelope will be placed in the stem of the T as shown at 4. The pumps may now be started and the interior of the lamp envelope 6 evacuated. It is to be understood of course, that any necessary heating of the lamp envelope may take place at this time either with or without the passage of current through the lamp and either with or without supplemental heating of the electrodes to drive off occluded gases.

Since the material to be introduced is in the pocket 4, out of the path of current flow in the gas, the passage of current will not cause vaporization of the material to be introduced into the lamp, and its consequent withdrawal from the lamp by the pump, which must be avoided.

After the tube has been properly evacuated, the evacuating apparatus may be disconnected and the proper amount of desired gas, such for example as neon, introduced by opening a valve (not shown) in the evacuating line.

It is now evident that the tube has been evacuated and that it has been supplied with the proper amount of gas for operation. It should now be sealed off which may be done, for example by bringing a flame from a burner 15 to play upon the tube 1 between the junction of the T and the connection to the exhaust line.

The tube may now be aged and tested to make sure that it has the proper operating characteristics, before the introduction of the foreign substance. After the tube has been tested and found in good order the lamp envelope with the T tube attached thereto may be manipulated in a suitable manner to cause the foreign substance, such as mercury 4, to flow down the stem of the T and down the top thereof as shown in Figure 4 into the envelope 6 of the lamp proper. The simplest way of producing this result is simply to invert and tilt the lamp after which the T tube may be tapped gently to dislodge the foreign substance if it be a solid.

The substance has now been introduced and the lamp will now have the desired operating characteristics. However, the T tube, or what remains of it protrudes from the envelope and might be accidentally fractured thereby ruining the lamp. Therefore I prefer to seal off and remove what is left of the T tube as shown in Figure 5 by bringing the burner 15 to the junction point 12 of the T tube and the lamp and sealing off and removing the T tube as will be readily understood.

It will be apparent that many foreign substances may be introduced in the manner shown and described and that while my process and apparatus is of particular advantage in inserting mercury into vacuum tube lamps, it permits the insertion of foreign substances which cannot be distilled, such for example as finely divided solid material, and presents other advantages which will be readily understood.

While I have shown and described certain embodiments of my invention it will be clear that modifications and changes may be made without deviating from the spirit thereof.

What I claim is:

1. The method of producing a vacuum tube lamp having a foreign substance contained therein which comprises sealing in communication with the interior of said envelope one end of a tube having a pocket therein arranged to hold said substance, connecting the other end of said tube to a pump, exhausting the envelope, sealing said tube at a point between said pocket and the connection to the pump, and transferring said substance from said pocket to said envelope.

2. The method of producing a vacuum tube lamp having a foreign substance contained therein which comprises sealing in communication with the interior of said envelope one end of a tube having a pocket therein arranged to hold said substance, connecting the other end of said tube to a pump, exhausting the envelope, sealing said tube at a point between said pocket and the connection to the pump, transferring said substance from said pocket to said envelope and sealing off said tube.

3. The method of making a luminescent tube containing a rare gas and a foreign substance, which comprises sealing in communication with a luminescent tube a container into which the foreign substance is introduced, exhausting the luminescent tube, introducing a rare gas into the luminescent tube, transferring the foreign substance from the container to the luminescent tube while in the non-gaseous condition, and separating the said container from the said luminescent tube.

4. The method of making a luminescent tube containing a rare gas and mercury, which comprises sealing in communication with a luminescent tube a container arranged to hold the mercury, introducing mercury into the container, exhausting the luminescent tube, introducing a rare gas into the luminescent tube, transferring the mercury while in the non-gaseous condition from the container to the luminescent tube, and sepa-

rating the said container from the said luminescent tube.

5. The method of making a luminescent tube containing a rare gas and a foreign substance which comprises sealing a container in communication with the luminescent tube, exhausting the luminescent tube, introducing a rare gas into the luminescent tube, and transferring the foreign substance while in the non-gaseous condition from the container to the luminescent tube.

6. The method of making a luminescent tube containing a rare gas and mercury, which comprises connecting a conduit with the luminescent tube, exhausting the luminescent tube, introducing a rare gas into the luminescent tube, and transferring the mercury while in the non-gaseous condition from the conduit to the luminescent tube.

7. The method of making a luminescent tube containing a rare gas and a foreign substance, which comprises connecting a conduit with the luminescent tube, introducing a rare gas into the luminescent tube, and transferring the foreign substance while in the non-gaseous condition from the conduit to the said luminescent tube.

8. The method of making a luminescent tube containing a rare gas and mercury, which comprises sealing in communication with the interor of the tube a container to hold mercury at a point sufficiently remote from the lamp that it is not unduly heated thereby, exhausting the tube, and discharging mercury in its normal liquid state from said container into said luminescent tube.

9. The method of making a luminescent tube containing a rare gas and mercury, which comprises sealing in communication with the luminescent tube a container having a predetermined amount of mercury introduced therein, exhausting the luminescent tube, introducing a rare gas into the luminescent tube, and tilting the container and luminescent tube whereby the said predetermined quantity of mercury is discharged in its normal state by gravity from the container into the luminescent tube.

In testimony whereof, I have hereunto set my hand this 29th day of April, 1926.

ROBERT C. SMALLEY.