June 4, 1940. J. L. COX 2,203,612

ELECTRIC DISCHARGE LAMP

Filed May 4, 1939

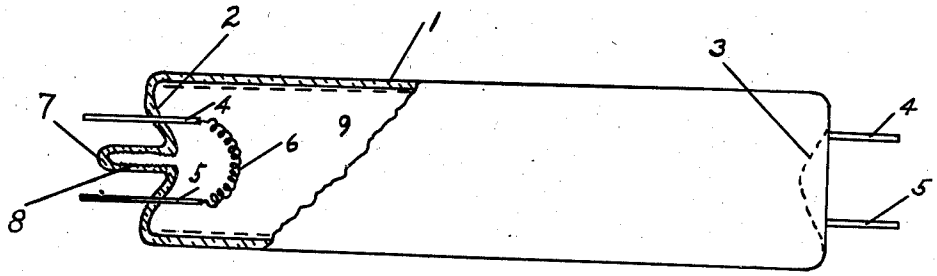


Fig. 1.

Fig. 2.

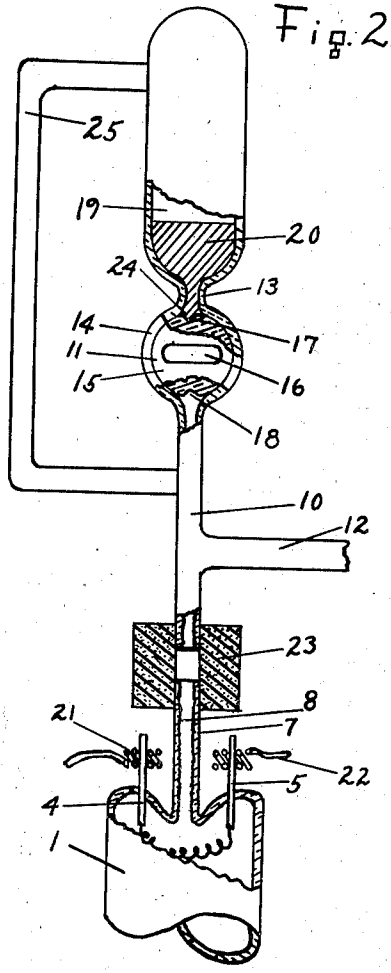
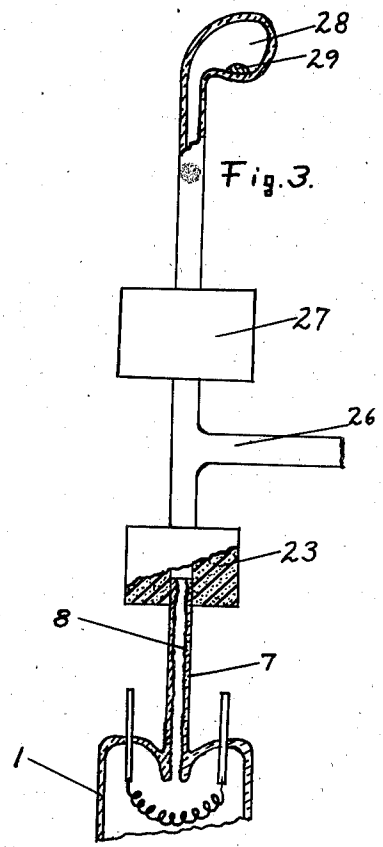


Fig. 3.



JAMES L. COX, INVENTOR.

BY Laurence Burns, ATTORNEY.

Patented June 4, 1940 2,203,612

UNITED STATES PATENT OFFICE

2,203,612

ELECTRIC DISCHARGE LAMP

James L. Cox, Danvers, Mass., assignor to Hygrade Sylvania Corporation, Salem, Mass., a corporation of Massachusetts

Application May 4, 1939, Serial No. 271,698

2 Claims. (Cl. 250—27.5)

This invention relates to electric discharge devices, and particularly to those containing a small quantity of mercury and the like.

An object of the invention is to provide a method and apparatus for introducing a predetermined quantity of mercury, or the like, into the envelope of such a lamp. Another object is to provide a type of discharge tube which is especially adapted to have the mercury or the like introduced by said method and apparatus.

Another object of the invention is to provide a more efficient electric discharge tube of the vapor type.

A feature of the invention is the use of an exhaust tube etched or roughened on its interior surface. Another feature is the use of a rotatable mercury feeding device.

Other objects and advantages will be apparent from the following description taken in connection with the accompanying drawing, in which:

Figure 1 is an electric discharge lamp according to the invention;

Figure 2 is an elevation of apparatus used in making said lamp; and

Figure 3 is an elevation of apparatus for filling the lamp with mercury.

In Figure 1, a tubular glass envelope 1 is sealed at its ends to the glass stems 2 and 3, through which the lead-in wires 4, 5 are sealed, to support the electrode 6, which may be a coiled-tungsten wire coated with one or more of the alkaline earth oxides. The sealed exhaust tube 7 is attached to the stem 2, and the portion 8 of the exhaust tube is roughened or etched on its inside surface. The lamp contains an atmosphere of inert gas, and a drop of mercury or the like. A coating 9, of fluorescent material is on the interior of the lamp bulb 1.

In operation, the neighborhood of the stems 2, 3 is preferably arranged to be the coolest part of the lamp, so that any excess mercury will condense there, rather than on the coating 9. Mercury condensed on the coating will, of course, reduce the light output from the lamp. In some cases, however, the coating will become the coolest part of the lamp, and the mercury will condense on it. For that reason, the quantity of mercury should not be greatly in excess of the amount vaporized at the operating temperature of the lamp. Such a limitation on the quantity of mercury is also desirable to limit the voltage rise across the lamp with increase in the lamp temperature. The fluorescent coating 9 may comprise one or more layers of small particles of a fluorescent material, zinc beryllium silicate for example. I have found that if these particles are made very fine, less than 400-mesh or 10 microns, that the layer, although present on the interior surface, will appear to be on the outer surface, and will give a more pleasing appearance to the lamp. The difference in appearance as we make the particles smaller than 10 microns may be due to a reduction in the internal reflections in the glass envelope 1.

The lamp requires a predetermined quantity of mercury to be introduced into it while the lamp is exhausted and Figure 2 shows how the introduction may be accomplished. The lamp envelope 1 is sealed to the exhaust tube 7 having a roughened or etched interior portion 8. The end of the exhaust tube extends into the rubber clamping piece 23, which joins the exhaust tube 7 to the glass tube 10, which leads to the exhaust and filling system. The interior surface of tube 10 should also be roughened.

The glass tube 10 extends upward to the modified stopcock 11, the tube 12 being sealed to the tube 10 between the clamp 23 and the stopcock 11, and leading to the exhaust system for the lamp. The stopcock 11 comprises the outer annular ring 14, and the cylinder 15 which can be turned inside the ring by the handle 16. The small cups 17, 18 are set around the rim of the cylinder 15, and may be formed by drilling a short hole into the cylinder 15.

The annular ring 14 will have a slight taper, and the cylinder 15 will have a corresponding one, so that the handle can be turned easily without the danger of pushing the cylinder through the ring. The cylinder will be arranged to fit tightly, yet turn smoothly, in the ring 14. From the top of the annular ring 14, a tube 13 projects into a reservoir 19 of mercury 20. The equalizer tube 25 may be used to insure that the pressure is the same on both sides of the device.

In operation, a lamp 1 is placed in position by clamping its exhaust tube 7 in the rubber hose 23. The stopcock 11, may be in the position shown. The exhaust apparatus is connected to the tube and to the lamp being exhausted. The lamps are generally heated in some way during exhaust. A voltage may be connected across the filament leads 4, 5 by the convenient spring clips 21, 22 and the filament heated to properly form the oxide coating on the filament. A coating of strontium and barium carbonates, for example, may be originally placed on the filament, and the heating will transform it to the corresponding oxides, carbon dioxide being emitted in the

process. When the latter has been exhausted, the handle 16 is turned to collect a drop 24 of mercury in the cup 17 and then further turned until the mercury falls out when the cup is in the position of cup 18. The path between lamp and stopcock is preferably in a straight line to allow the mercury to drop directly into the tube. If the drop of mercury hits the inside of the tube 10, it will wet the tube and adhere to it, rather than drop down into the lamp, if the interior of the tube has a smooth surface, such as a clear glass surface. If, however, the interior of the tube is roughened, the drop will not adhere to the glass, but will run down into the lamp.

In some cases, to prevent adhesion of mercury to the glass it may be desirable to have the surface of the mercury drop covered with talc or the like.

In Figure 3, a somewhat simpler method of placing the mercury in the lamp is shown. The lamp envelope 1 has the internally-etched exhaust tube 7, which is fastened through the rubber piece 23, to the exhaust system connection 26, and through another rubber piece 27, to the mercury reservoir 28, which contains the drop of mercury 29, to be placed in the tube. The tube of the mercury reservoir is bent backward and down as shown to hold the mercury drop in the position shown. After the tube is exhausted, however, the rubber piece 27 being flexible the reservoir tube 28 is pushed slightly sidewards so that the drop of mercury will be displaced enough to run down into the tube 7, into the lamp envelope 1. The drop 29 of mercury is preferably just sufficient for the lamp, so that each time a new lamp is attached to the rubber piece 23, a newly-filled mercury reservoir is attached to the piece 27.

When the lamp 1 is exhausted on an automatic exhaust machine, it may be desirable, instead of connecting the lamp directly to the mercury filling equipment by the rubber pieces 23, 27, to have the lamp and the filling equipment connected to parts which come in register at the proper time to permit the mercury filling to be introduced, or to use some other suitable valve control.

What I claim is:

1. A mercury filling device for an electric gaseous discharge lamp having an exhaust tube, said apparatus comprising a resilient connection between said exhaust tube and exhaust apparatus, a tube extending upward from said resilient connection and substantially in line with said exhaust tube, said upward-extending tube terminating in a member having a recess sufficient to hold a drop of mercury, a mercury reservoir in contact with said member, and in position to fill said recess with mercury, and a second member to shear from the first member any mercury other than that in the recess, said first member being capable of dropping the mercury held in its recess, into the upwardly-extending tube when moved sufficiently.

2. The combination of claim 1, and a pressure equalizing path between the top of the mercury reservoir and the tube into which the mercury is dropped.

JAMES L. COX.