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ELECTRIC DISCHARGE DEVICE

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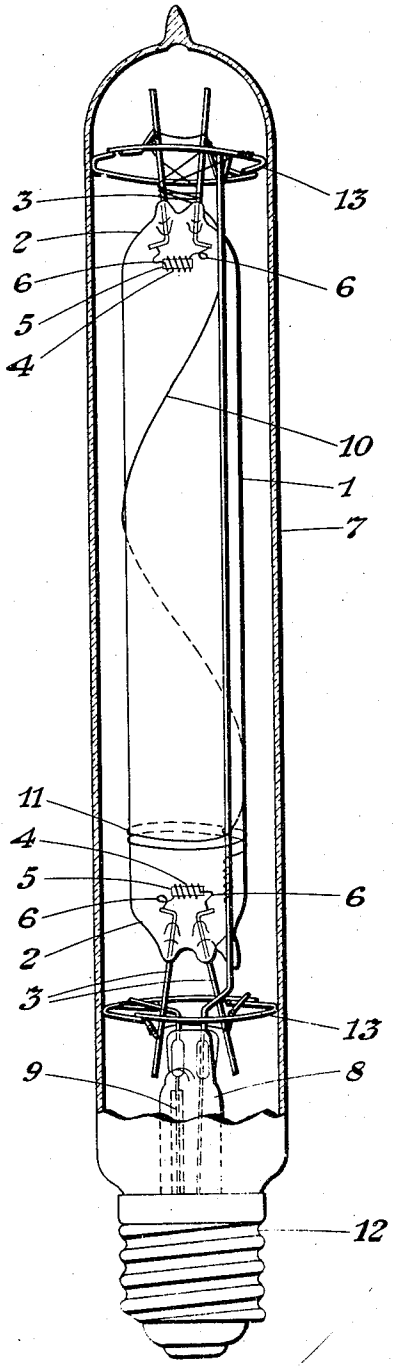

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ELECTRIC DISCHARGE DEVICE

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2 Claims. (Cl. 176—2)

This invention relates to electrical discharge devices of the type having at least one thermionic cathode of which one part at least consists of a refractory metal whose oxide is appreciably volatile at any temperature reached during manufacture or operation of the device. Tungsten is an example of such a metal. More particularly it relates to luminous electrical discharge tubes having thermionic cathodes consisting of bodies of alkaline earth compounds surrounded by tungsten spirals.

When the cathode is sealed into a tube of the type specified, the tungsten is often oxidized superficially. During subsequent manufacture and/or during operation this oxide is deposited on the walls of the tube forming a dark deposit which intercepts some of the light from the discharge. The purpose of the invention is to overcome this objection.

According to the invention, the manufacture of an electric discharge tube of the type specified includes the step of introducing a reducing gas into the tube with the cathode sealed in and heating the refractory metal in this gas, so that its oxide is reduced. Since the reduced metal is not volatile, there is then less blackening of the tube during subsequent manufacture and life.

Thus in one manner of manufacture of a high-pressure mercury vapour discharge lamp, according to the invention, the tube, furnished with electrodes consisting of tungsten spirals enclosing alkaline metal silicates, is sealed to the pump and exhausted. During the making of the tubes, the tungsten will probably have become oxidized, especially if, as is usual in such lamps, the electrodes are near the end of the tube. The tube is then filled to about 700 mm. with a mixture of 40% hydrogen and 60% nitrogen, and the tungsten spirals are heated to 1100° C. for about 3 minutes. The gas is then pumped out; if the tungsten is much oxidized, it may be desirable to refill with the same mixture and repeat the treatment at the same temperature. But in any case, the tube is refilled with the same gas, and the spirals heated at 1300°–1500° C. for about 5 minutes. The gas is then pumped out, and the electrodes degassed at about 1500° C. Manufacture then proceeds in the normal way.

A similar process may be usefully employed in the manufacture of sodium vapor discharge lamps.

Pure hydrogen may be used in place of the mixture. If the mixture is used, its freedom from oxidizing impurities become more important, the lower the hydrogen content.

If oxides, instead of silicates, are enclosed by the tungsten spiral, the treatment may have to be modified in order to avoid their reduction. The use of silicates in place of oxides is described in British patent specification Nos. 384,067 and 411,266.

In the drawing accompanying and forming part of this specification a gaseous electric discharge lamp having electrodes treated by the process described above is shown in a front elevational, partly sectional view.

Referring to the drawing the lamp comprises an internal envelope of glass 1 having approximately spherical ends 2 into which are sealed the leading-in wires 3. To these leads are spot-welded the thermionic electrodes each consisting of a short refractory rod 5 composed of alkaline metal silicates surrounded by a tungsten spiral 4; two turns 6 of the spiral, free of the rod, are used as the curved part of the leads for preventing the conduction of excessive heat to the seals. The electrodes are mounted very close to the spherical ends of the tube, being not more than 10 mm. from the wall.

The internal envelope 1 is arranged within an outer envelope 7 (shown as partly cut away in the drawing) having a foot-tube 8 and a standard form of lamp cap 12 at one end. The leads 9 for the discharge tube are brought through the foot-tube in the ordinary way, and connected to the leads 3 sealed into the inner envelope; these leads 9 may conveniently carry wire rings 13 which bear against the inside of the outer envelope and serve as supports for the inner envelope. The outer envelope is exhausted after assembly and sealed off.

The internal envelope contains enough mercury to give a pressure of about 1 atmosphere when operating on a current of from 2½ to 3 amperes—in the case of a tube about 17 cm. long by 3 cm. diameter, for example, about 0.2 to 0.25 gm. of mercury are adequate—together with a few mm. of argon to facilitate starting. Furthermore, to render the tube self-striking, a wire 10 is carried from one of the leads along the outside of the inner envelope to a point near the other electrode of the tube and there wound round the outside of the inner envelope to form a conductive ring 11.

After the electrodes 4, 6 are mounted in the inner tube 1 in the manufacture of the lamp but before the tube 1 is sealed off from the exhaust system the electrodes 4, 6 are treated by the process disclosed above after which the other steps in the manufacture of the lamp are per-

formed. The inner tube 1 is free from light absorbing, dark deposits of tungsten oxide for a long useful operating life of the lamp.

What is claimed is:—

1. In the manufacture of a high pressure mercury vapour discharge lamp having an envelope containing electrodes comprising tungsten spirals enclosing alkaline metal silicates, the steps which comprise exhausting the envelope with the electrodes sealed therein, filling the envelope to about 700 mm. with a mixture of 40% hydrogen and 60% nitrogen, and heating the tungsten spirals to 1100° C. for about 3 minutes.

2. In the manufacture of a high pressure mercury vapour discharge lamp having an envelope containing electrodes comprising tungsten spirals enclosing alkaline metal silicates, the steps which comprise exhausting the envelope with the electrodes sealed therein, filling the envelope to about 700 mm. with a mixture of 40% hydrogen and 60% nitrogen, heating the tungsten spirals to 1100° C. for about 3 minutes, exhausting the envelope of said gas mixture, refilling the envelope with the same gas mixture to the same pressure, heating the tungsten spirals to a temperature of from 1300° C. to 1500° C. for about 5 minutes, exhausting the envelope and degassing the electrodes.

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