May 19, 1942. J. L. COX 2,283,189

ELECTRIC DISCHARGE LAMP

Original Filed Dec. 22, 1938

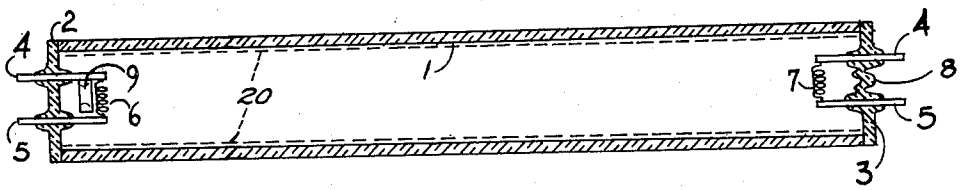

fig. 1

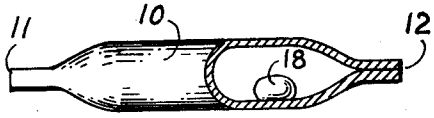

fig. 3

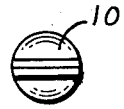

fig. 4

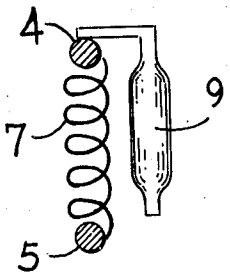

fig. 6

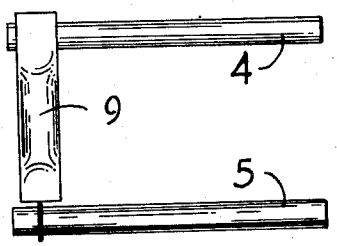

fig. 7

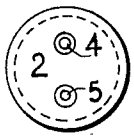

fig 2

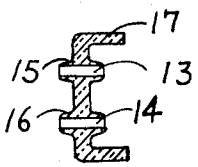

fig. 5

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ELECTRIC DISCHARGE LAMP

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Original application December 22, 1938, Serial No. 247,252. Divided and this application June 28, 1941, Serial No. 400,216

11 Claims. (Cl. 176—126)

This invention relates to electric gaseous discharge lamps, and in particular to such lamps of the tubular type.

An object of the invention is to provide such lamps with a glass end cap directly sealed to the ends of the tube and through which metal contact prongs extend, thus obviating the necessity of cementing an external contact base on the end of the lamp.

Another object is to permit the placing of the electrodes in such a lamp close to the ends of the tube, in order that the discharge may appear to fill the entire length of the tube.

Still another object is to eliminate any pockets at the end of the tube, in which the mercury often used with such lamps might be trapped and kept out of the discharge.

A still further object is to provide a means of inserting an accurately inserted quantity of mercury in such a tube by the use of a metallic bomb; and yet another object is to facilitate starting of the tube.

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

Figure 1 is a sectional elevation of a lamp according to the invention;

Figure 2 is an elevation taken from the end of the tube;

Figure 3 shows an enlarged lengthwise view, partly in section of the bomb used in the invention; and

Figure 4 is a transverse view of the same bomb;

Figure 5 is a side view, in section, of one form of a glass disc, before the wires are sealed through it;

Figure 6 is a front or plan view of the cathode with the bomb placed at the side of, instead of behind, the coiled electrode.

Figure 7 is a side view of the arrangement of Figure 6.

In Figure 1, an elongated glass tube 1, has sealed to each of its ends a glass disc 2, 3, closing the tube. Stiff metal wires 4, 5 are sealed through the glass discs to act as supports for the electrodes 6, 7, inside the tube and as contact prongs outside the sealed envelope. An exhaust tube 8, is attached to at least one of the glass discs. The disc is preferably made concave as 3, so that the exhaust tube 8, can be sealed flush with the ends of the tube as shown, although the disc may be made flat, as 2, in which case if an exhaust tube is used with it, the tube will extend out somewhat beyond the ends of the tube, and may be more easily subject to damage. The electrodes 6, 7, may comprise a coiled tungsten wire, coated with one or more of the alkaline earth oxides, and is preferably arranged as a coiled-coil, in order to better hold a sufficient quantity of the alkaline earth oxide. A form of coiled-coil is described in U. S. Patent No. 2,067,746, issued January 12, 1937, to R. M. Zabel.

Attached to one filament lead-in wire 4, is a small metal bomb 9, containing the quantity of mercury desired to be introduced into the tube. The bomb, shown more clearly in Figure 3, taken in connection with Figure 4, and comprises a metal tube 10 of small diameter, of which each end 11, 12, is closed by being flattened or pressed together as shown, with a drop 18, of mercury of the desired quantity in the tubular portion of the bomb, between the flattened end portions. The mercury is thus roughly sealed into the bomb. One flattened end 11, is welded or otherwise attached to one of the filament lead-in wires 4, as shown in Figure 1, preferably just behind the filament as shown, although it may be placed in front of the filament, that is in the path of the discharge, if desired; or at the side of the filament as in Figures 6, and 7. The mercury remains in the bomb while the lamp is being made and until the lamp is nearly completed. The filament is then brought to the proper temperature and the bomb is heated by it, until the pressure of the heated mercury rises sufficiently to make an opening in the bomb. The mercury then escapes into the lamp atmosphere.

One end 11, of the bomb is preferably welded, or otherwise conductively connected to one lead 4, of the filament, and the other end 12 of the bomb placed close to, but not in contact with, the other filament lead 5. Then when the heating current flows through the filament 4, the drop in voltage across the filament will be present across the small gap between the end 12, of the bomb and the lead 5, of the filament. If the filament voltage is greater than the ionizing voltage of the gas, or at least greater than the resonance potential, the gas in the gap will be excited and will aid in starting the arc between the electrodes at each end of the tube.

In Figures 6 and 7, the bomb 9 is placed at the side of, and parallel to the filament 7, but it still acts as a starting electrode in the manner just related. If the voltage between the bomb and any portion of the filament, rises to a voltage above the excitation potential of the gas, the discharge will begin between the portion of the filament above that voltage, and the bomb, and will aid in starting the discharge as before described. If a bomb is used only at one end of the tube, the improved starting effect above described may be effected at the other end of the tube also, by placing a wire in the same position as that in which bomb is shown. In fact, if the filament is operated on alternating current it may be well to place a wire beside the filament and connected to the end of the filament opposite that to which the bomb is electrically connected.

Figure 2 can be clearly understood from the description of Figure 1, and Figures 3 and 4 have been described above.

Figure 5 shows a glass disc before the wires are sealed through it. The disc is molded, and has holes 13, 14, for the wires 3, 4. Small hubs 15, 16, are placed around the holes to facilitate sealing the wires through the holes. The wires are placed through the holes and the hubs are heated by flames or by some other method to seal the glass to the metal. The disc shown in Figure 5, also has a slight annular flange 17, on one side of its rim. This may be butted against the end of the tube 1, and in register with it to facilitate sealing the disc to the tube. Such a flange is not essential, however, and the discs shown in Figure 1 do not employ it. Whether or not this flange is used, the end of the tube 1 and the rim of the disc are heated, butted together, and heated further until the glass softens to effect a seal. The rim of the disc, and the end of the tube, may be heated by directing gas flames on them, or by placing a carbon ring around the region to be sealed and passing an electric current through the carbon to heat it and the glass.

A filling of one or more inert gases, such as argon at a pressure of 3 mm. of mercury or neon at 8 mm. will generally be present in the tube, in addition to any mercury which may be present.

If the lamp envelope is made of a hard or borosilicate glass, the metal wires 3, 4, may be of a metal known as "fernico" and comprising 54% iron, 28% cobalt, and 18% nickel, or some other metal capable of sealing through the glass. If the glass is softer, such as the lead or lime glasses, an alloy of iron containing 26% chromium may be used, or an alloy of 37% iron, 25% nickel, 30% cobalt, and 8% chromium.

If ultraviolet light is desired from the envelope, a substantially iron-free borosilicate glass will prove satisfactory.

My glass disc construction enables the electrodes to be brought closer to the ends of the tube than is possible in a tube using the usual reentrant stems of the type common in the lamp industry. This eliminates the dark spaces behind the cathodes, and enables the light from the discharge to fill practically the entire length of the tube, which is especially advantageous if a fluorescent coating 20 as shown in Figure 1 is placed on the inside of the tube.

This is a division of my co-pending application Serial No. 247,252 filed December 22, 1938.

What I claim is:

1. In combination in an electric gaseous discharge lamp, an elongated glass tube, a glass disc at each end of said tube with the rim of the disc sealed to the end of the tube, at least one of said discs being slightly concave and having an outwardly extending exhaust tube sealed flush with the end of the tube, at least two straight stiff metal wires sealed through each of said discs and adapted to be contact prongs on the outside of said discs, a coiled-coil tungsten filament supported from each disc by said wires and electrically connected to said wires, a coating of at least one of the alkaline earth oxides on said filament, a metal bomb for holding mercury connected to one of the straight wires supporting a filament and extending close to the straight wire supporting the other end of the filament, and an inert gaseous filling at low pressure in said tube.

2. The combination of claim 1, in which the bomb is placed behind the filament.

3. The combination of claim 1, in which the bomb is placed behind the filament and comprises a metal tube flattened at its ends.

4. The combination of claim 1, in which the bomb is placed behind the filament and comprises a metal tube flattened at its ends, and in which the gaseous filling is argon at a pressure of 3 millimeters of mercury.

5. The combination of claim 1, in which the bomb is placed behind the filament and comprises a metal tube flattened at its ends, in which the gaseous filling is argon at a pressure of 3 millimeters of mercury, and in which the interior of the glass tube is coated with a fluorescent material.

6. The combination of claim 1, in which the bomb is placed at the side of and parallel to the filament coil.

7. In combination in an electric discharge lamp, an elongated glass tube, glass closure members at each end of said tube, lead-in wires sealed through said closure members, a coiled-coil tungsten filament supported by and electrically connected to said wires, a coating of at least one of the alkaline earth oxides on said filament, a metal bomb for holding mercury connected to one of the lead-in wires supporting a filament and extending close to the straight wire supporting the other end of the filament, and an inert gaseous filling at low pressure in said tube.

8. In combination in an electric discharge lamp, an elongated glass tube, glass closure members at each end of said tube, lead-in wires sealed through said closure members, a tungsten filament supported by and electrically connected to said wires, a coating of at least one of the alkaline earth oxides on said filament, an elongated tubular metal bomb for holding mercury connected to one of the lead-in wires supporting a filament, said bomb being supported in heat-receiving relationship to said filament by one of said wires, and an inert gaseous filling at low pressure in said tube.

9. In an elongated closed glass tube for manufacture into an electric discharge device, having wires sealed in each end of said tube, having electrodes supported by said wires, and having a tube for exhaust at one end only thereof: a metal, mercury-containing bomb within said glass tube and supported by one of said wires at the end of said glass tube further removed from said exhaust tube.

10. In an elongated closed glass tube for manufacture into an electric discharge device having lead-in wires sealed in each end of said tube, and electrodes mounted at each end thereof: a metal mercury-containing bomb within said glass tube and supported in heat-receiving relationship to one of said electrodes by one of said lead-in wires.

11. In combination in an electric discharge lamp, an elongated glass tube closed at its ends, wires sealed in said ends, a tungsten filament supported by and electrically connected to two of said wires, a coating of at least one of the alkaline earth oxides on said filament, an elongated tubular metal bomb for holding mercury connected to one of said wires and supported in heat-receiving relationship to said filament, and an inert gaseous filling at low pressure in said tube.

JAMES L. COX.