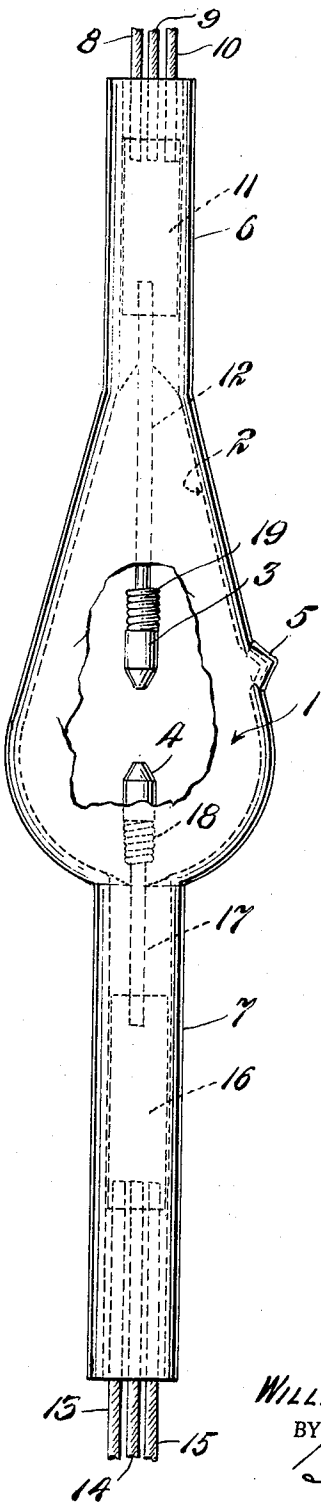


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GASEOUS ELECTRIC DISCHARGE LAMP

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GASEOUS ELECTRIC DISCHARGE LAMP

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The present invention deals with gaseous electric discharge lamps and more particularly with high pressure gaseous electric discharge lamps in which the final or operating pressure exceeds about ten atmospheres, which have short discharge paths of the order of one centimeter and less, and which are known as compact arc lamps.

Compact arc lamps of the types containing an ionizable filling consisting of rare gas, e.g. xenon, at a pressure above two atmospheres at temperatures of about 25° C., or an ionizable filling consisting of mercury and rare gas at a pressure of from a few millimeters to several atmospheres at temperatures of about 25° C., have been used as light sources of high intensity, e.g. in search lights.

These lamps are provided with a substantially spherical envelope containing electrodes spaced apart about one centimeter and less, and containing the above-described ionizable atmosphere.

All such lamps develop, as a limiting factor of useful life, accumulation on the inner surface of the lamp envelope of materials evaporated from the electrodes by intense heat concentrated at the electrodes and by sputtering of the electrodes resulting from ionic bombardment. This accumulation is opaque to the useful radiations from the lamp and causes depreciation in light output.

It is an object of this invention to provide a high pressure metal vapor discharge lamp which is structurally adapted to minimize the accumulation of materials from the electrodes on such portions of the inner surfaces of the lamp envelope through which useful light radiations are transmitted. It is another object of the present invention to provide a compact arc lamp envelope structurally adapted to substantially reduce lamp depreciation due to accumulation of electrode materials on such portions of the inner surface of the lamp envelope through which useful light radiations are transmitted. Other objects and advantages of the invention will become apparent from the description hereinafter following and the drawing forming a part hereof, which represents an elevational view including a partly broken-away portion of the envelope and which embodies the subject matter of the present invention.

The present invention applies in particular to compact arc lamps in which the final or operating gaseous pressure exceeds about ten atmospheres and which contain an ionizable filling consisting of at least a rare gas, e.g. xenon or xenon with not more than five percent of another rare gas at a pressure exceeding two atmospheres at a temperature of about 25° C., or such rare gas together with a vaporizable metal, e.g. mercury, in an envelope structurally adapted to minimize accumulation of materials from the electrodes on such portions of the inner surface of the envelope through which useful light radiations are transmitted.

Regarding the illustration, the compact arc lamp of the invention comprises a pear-shaped envelope 1 having internal walls 2 forming a discharge cavity. The envelope contains spaced electrodes 3 and 4 and an ion-

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izable atmosphere consisting of a rare gas, e.g. xenon, at a pressure of more than two atmospheres at a temperature of about 25° C., or such rare gas together with a vaporizable metal, e.g. mercury, preferably in an amount sufficient to become completely vaporized during the operation of the lamp, and which atmosphere attains a pressure of more ten atmospheres during operation. The electrodes 3 and 4 are spaced apart at a distance not greater than one centimeter, said spacing providing for an operating discharge path located in the longitudinal axis of said pear-shaped envelope. The internal walls 2 substantially follow the contour of the pear-shaped envelope. The location and position of the spaced electrodes and the discharge path are of critical significance when such lamp is operated in a vertical position with the bulbous end of the envelope positioned below the narrow end. The discharge path, defined by the distance or spacing between the electrodes, is located substantially in the bulbous portion of the envelope or at a greater distance from the top of the discharge cavity than from the bottom of the cavity. With the discharge path and electrodes so located in a cavity which converges from the bottom toward the top of the envelope, the dynamic conditions of the high pressure compact arc lamp during operation are considerably different than if the lamp were reversed in vertical position. In a reversed position, the sweeping action of the hot gases, upon ignition of the lamp, are not sufficiently strong to prevent the evaporated electrode material from accumulating on such portions of walls 2 of the envelope 1 which are located laterally of the arc or at such portions of walls 2 through which useful radiations are transmitted.

Even with the lamp and its component parts positioned as illustrated, the electrode materials will still accumulate on the critical wall surfaces, unless the rare gas is at a pressure in excess of two atmospheres when the lamp is cold, e.g. at a temperature of about 25° C. For example, a lamp constructed substantially in accordance with the illustration had a filling of xenon at two atmospheres pressure and sufficient mercury so that during operation the total gas pressure was about 45 atmospheres. During operation the deposition on the walls of the lamp was similar to the deposition on the walls of a spherical envelope and produced only about 60% of its light output after 100 hours operation. However, when a lamp constructed substantially according to the illustration was provided with a filling of xenon at 6 atmospheres pressure and sufficient mercury so that during operation the total gas pressure was about 50 atmospheres, the lamp was operated for 300 hours and still produced over 70% of its light output.

The accumulation of electrode material on the critical portion of envelope occurs mostly during the starting of the discharge lamp when the walls of the envelope are cold. For the convection sweeping action of the starting gas, e.g. xenon, to be sufficient to carry the evaporated and sputtered electrode particles above the critical portion of the envelope wall, it is necessary that the density, and therefore, the pressure of the gas be relatively high. If, in the type of lamp substantially as illustrated, the gas pressure is at one or even two atmospheres, the gas density is not sufficient to provide the required sweeping action. However, when the gas pressure, e.g. xenon pressure, is above about two atmospheres, e.g. about three atmospheres and greater, a very noticeable decrease in deposition occurs on the walls opposite the discharge, being deposited instead on the inner walls of the envelope above the discharge where it remains and does not interfere with the passage of useful light radiations through the envelope. In this manner the practical life of the lamp is substantially increased.

The rare gas, or rare gas and mercury, is introduced

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into the discharge cavity by conventional means, for example through a tube which is subsequently sealed off as at 5. The envelope 1 is provided preferably with elongated tubular extensions or seal stems 6 and 7 axially positioned on opposite ends of the envelope. The seal stem 6 is provided with either a single lead-in conductor or a plurality of flexible lead-in conductors 8, 9 and 10 connected to a vacuum-tight seal strip 11 which is connected to electrode support 12 leading into the discharge cavity and supporting the electrode 3. Portions of said lead-in conductors, said seal strip 11 and a portion of said electrode support 12 are embedded by said seal stem 6. The seal stem 7 is provided with a single lead-in conductor or a plurality of flexible lead-in conductors 13, 14 and 15 connected to a vacuum-tight seal strip 16 which is connected to electrode support 17 leading into the discharge cavity and supporting the electrode 4. Portions of said lead-in conductors, the seal strip 16 and a portion of said electrode support 17 are embedded by said seal stem 7.

Supported by said electrode supports 12 and 17 and close to the electrodes 3 and 4 are cooling means, 18 and 19 for example tungsten coils, which operate to decrease excessive heat conduction along the electrode supports toward the lamp seals.

The invention is not intended to be limited to the specific structural components illustrated since modifications are contemplated within the scope of the appended claims.

What is claimed is:

1. A high pressure gaseous electric discharge lamp comprising a light transmissive envelope containing a

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plurality of electrodes spaced apart one centimeter and less and an ionizable atmosphere at a pressure of more than two atmospheres at a temperature of about 25° C., said envelope defining a discharge cavity which converges from one end of the envelope toward the other end, said spaced electrodes defining a vertical discharge path located below the narrow end of the cavity at a greater distance from the narrower end of the cavity than from the wider end of said cavity.

2. A high pressure gaseous discharge lamp according to claim 1, wherein said envelope is a pear-shaped envelope.

3. A high pressure gaseous discharge lamp according to claim 1, wherein said ionizable atmosphere consists of xenon.

4. A high pressure gaseous discharge lamp according to claim 1, wherein said ionizable atmosphere consists of xenon with not more than five percent of another rare gas.

5. A high pressure gaseous discharge lamp according to claim 1, wherein said ionizable atmosphere consists of rare gas and a vaporizable metal.

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