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HIGH PRESSURE METAL VAPOR LAMP

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Fig. 1

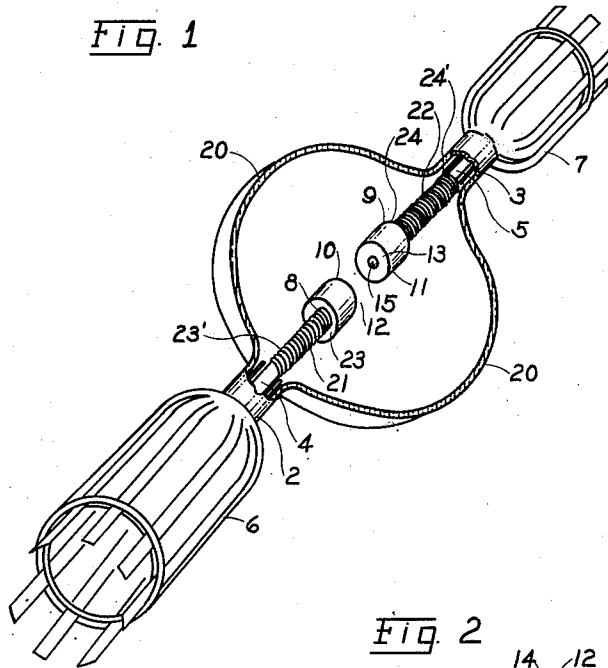
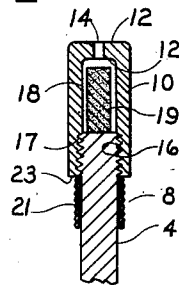


Fig. 2



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HIGH PRESSURE METAL VAPOR LAMP

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1 Claim. (Cl. 313—184)

This invention relates to high pressure metal vapor electric discharge lamps comprising within a sealed envelope at least one pair of main electrodes for the passage of the lamp discharge, and a filling of vaporizable metal together with a small quantity of rare gas such as argon for facilitating starting of the discharge. The metal of the filling is usually mercury, with which may sometimes be included one or more other metals, such as cadmium or zinc, for modifying the color of the light from the discharge; the pressure of the rare gas components of the filling is usually about 30 mms. rise of mercury column. The metal vapor pressure, during operation, is usually in excess of about a half atmosphere and may be many atmospheres.

For starting such lamps, it is usual to apply an over-voltage, greater than the normal operating voltage of the lamp, between the main electrodes of the lamp, or between one main electrode and an auxiliary electrode mounted adjacent to this main electrode, but difficulties have been experienced due to the magnitude of this over-voltage required to start the lamp being inconveniently high with regard to the normal lamp operating voltage.

The object of this invention is therefore to provide an improved form of lamp with which the magnitude of the over-voltage required for starting the discharge is reduced as compared with similar known lamps.

According to the invention, in a high pressure metal vapor electric discharge lamp of the type specified, the inner end of at least one main electrode is provided by a hollow block of tantalum containing activating material and pierced by one or more passages through which the activating material can diffuse to the terminal surface of the electrode.

The term "inner end" means of course that end of the electrode on which the discharge terminates in full normal operation, and the "terminal surface" of the electrode means the part of the end on which the discharge actually does terminate. The activating material may consist of any suitable refractory electron emissive material, for example sintered alkaline earth oxides, or thorium.

I have found that lamps in accordance with the invention, after the initial period of operation usually referred to as "ageing," give uniformly low starting voltages, lower than have previously been obtained with known lamps of the type specified, not using tantalum electrodes.

I believe this to be due to the fact that the tantalum inner end of the said main electrode acts as a selective getter during the initial ageing of the lamp, absorbing gaseous impurities without appreciably affecting the metal or rare gas filling, and thereby preventing these impurities from giving rise to an increase in the starting voltage such as has previously been experienced with known lamps of the type specified. The activating material within the hollow end of the electrode ensures that an adequate electron emission is obtained from the electrode in operation of the lamp.

The said main electrode may consist entirely of a tantalum block such as a rod, suitably hollowed at its

inner end, or the hollow tantalum inner end may be attached to a part of the electrode which is of a different metal, for example, tungsten or molybdenum; the hollow tantalum block may be attached to a part of the electrode which is of a different metal by means of cooperating screw threads formed on the said electrode and on the tantalum block.

In the case of a lamp designed for operation on an alternating supply, preferably each main electrode is provided with a hollow tantalum inner end in accordance with the invention.

One embodiment of the invention will be described, by way of example, with reference to Fig. 1 and Fig. 2 of the accompanying drawings, wherein:

Fig. 1 shows a perspective view of a high pressure metal vapor electric discharge lamp in accordance with the invention, having a mid-portion of the lamp broken away for clearness, and designed for operation from an alternating supply and;

Fig. 2 shows a cross-sectional view along the longitudinal axis of one of the lamp electrodes.

Referring now to Fig. 1, the lamp shown is a high pressure mercury cadmium filled compact source lamp adapted to dissipate 2.5 kilowatts in normal operation and comprises a spheroidal quartz bulb 1 of longer internal diameter 61 mms. and shorter internal diameter 56 mms., provided at opposite ends of its longer diameter with tubular sealing stems 2, 3 through which pass molybdenum rods 4, 5 respectively, each of diameter 4 mms., the sealing stems being closed at their outer ends by lead-in seals 6, 7 respectively; the bulb is provided with a filling of argon gas at a pressure of 30 mms. of mercury and a globe of 0.47 gm. of mercury together with 0.47 gm. of cadmium.

Each of the molybdenum rods 4, 5 is provided at its inner end 8, 9 respectively, with a hollow cylindrical tantalum block 10, 11 respectively, having an external diameter of 6 mms., an internal diameter of 3.5 mms., and an over-all length of 15 mms.; the terminal surfaces 12, 13 of the blocks 10, 11 respectively, are spaced 15 mms. apart and each surface is provided, as shown in greater detail in Fig. 2, with a hole 14, 15 respectively, having a diameter of 1 mm. which is arranged to pass through the block between the terminal surface 12 and the inner surface 12' of the block; the distance between the surface 12 and the inner surface 12' of the block is 2.5 mms.

For mounting each of the blocks 10, 11 on the molybdenum rods 4, 5 respectively, each of the rods is provided at its end 8, 9 respectively with a screw thread, one of which, 16, is shown in Fig. 2 for cooperating with a similar screw thread, one of which, 17, is shown in Fig. 2, formed in the internal surface 18 of the block 10. Pellets, one of which 19 is shown, containing activating material comprising a mixture in the indicated proportions, by molecular weight, of barium oxide—2.5, calcium oxide—1.0, thorium oxide—3.0, and having a quantity of tungsten powder, of a grain size such that it will pass through a 200 mesh sieve, and of weight equivalent to 3% of the total weight of the above mixture of oxides, added to this mixture, are contained within the hollow blocks 10, 11 and held in position within the blocks by the rods 4, 5.

For reducing blackening of the envelope 1 of the lamp, in operation, due to the arc possibly wandering over the surface of the tantalum block so that it comes into contact with the molybdenum rods 4, 5 respectively, thereby causing molybdenum to be vaporized onto the interior surface 20 of the envelope 1, tungsten coils 21, 22 respectively are provided on the rods so that the ends 23, 24 of the coils about the adjacent ends of the blocks 10, 11 respectively, and the other ends 23', 24' of the coils

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abut the adjacent ends of the sealing stems 2, 3 respectively.

What I claim as new and desire to secure by Letters Patent of the United States is:

A high pressure metal vapor lamp operable at kilowatt loadings comprising a sealed envelope containing an ionizable medium including an inert starting gas and vaporizable metal including mercury in an amount sufficient to furnish a pressure in the range of approximately 1 atmosphere and above during operation of the lamp, a pair of main operating electrodes sealed into said envelope and having relatively closely spaced conjugate terminal surfaces defining a short arc gap, at least one of said electrodes comprising a molybdenum rod having fastened to its inner end a relatively massive hollow block of tantalum containing in the interior thereof activating material comprising a mixture of approximately 2.5 parts barium oxide,

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1 part calcium oxide and 3 parts thorium oxide by molecular weight and a tungsten powder in an amount of about 3 percent by weight of the said oxides, said tantalum block being provided with an aperture through its terminal surface exposing the activating material within it and allowing diffusion of activating material to its terminal surfaces, and a coil of tungsten wire wound around said molybdenum rod and extending up to said tantalum block.

References Cited in the file of this patent

UNITED STATES PATENTS

2,175,345	Gaidies -----	Oct. 10, 1939
2,249,672	Spanner -----	July 15, 1941
2,453,118	Buckingham -----	Nov. 9, 1948
2,460,738	Francis -----	Feb. 1, 1949