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[72] Inventors **Horst Grabner; Herbert Konow, both of Munich, Germany**

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[73] Assignee **Patent-Trevhand-Gesellschaft Fur Elektrische Gluklampen m.b.H. Munich, Germany**

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[54] **RESTARTING ARRANGEMENT FOR HIGH-PRESSURE MERCURY-VAPOR LAMP WHICH INCLUDES METALLIC HALIDE ADDITIVES**
7 Claims, 1 Drawing Fig.

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[50] **Field of Search** 313/184, 201, 25, 197

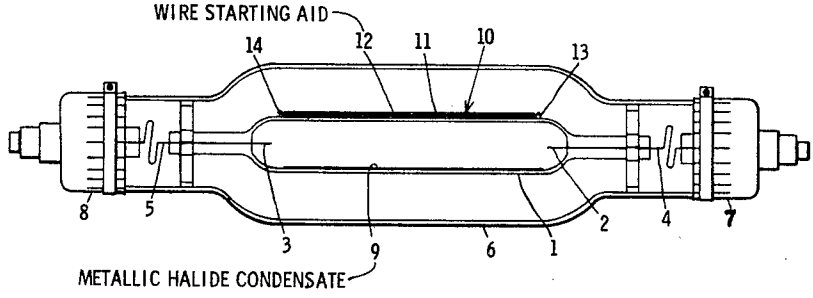
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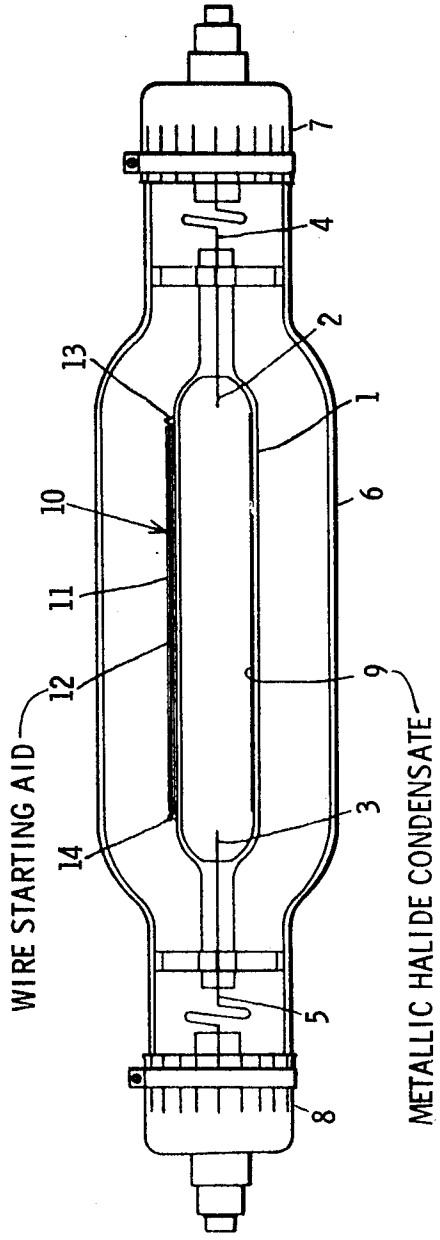
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Primary Examiner—Roy Lake
Assistant Examiner—Palmer C. Demeo
Attorneys—A. T. Stratton and W. D. Palmer

ABSTRACT: High-pressure mercury-vapor discharge lamp which includes metallic halide additives is adapted to be operated in a horizontal orientation. To restart the lamp when it is still hot from being operated, an elongated electrically conductive refractory member is positioned proximate the outer surface of the arc tube and extending longitudinally thereof. The conductive member is electrically insulated from the lamp electrodes and is positioned generally diametrically opposite the lowest longitudinally disposed portion of the arc tube where the metallic halide has condensed.




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WIRE STARTING AID
METALLIC HALIDE CONDENSATE
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RESTARTING ARRANGEMENT FOR HIGH-PRESSURE MERCURY-VAPOR LAMP WHICH INCLUDES METALLIC HALIDE ADDITIVES

BACKGROUND OF THE INVENTION

The invention relates to an arrangement for restarting a high-pressure mercury-vapor electric discharge lamp with additives of metal halogen compounds when the lamp is still hot from operation, said lamp enclosed in an outer envelope and connected with an ignition device. The electrode spacing is a multiple of the envelope diameter.

High-pressure mercury-vapor electric discharge lamps, more particularly lamps with metal halide additives, are of high efficiency and, for this reason, are used for general lighting services such as, for example, lighting of streets or athletic grounds. It is well known that all the high-pressure mercury-vapor electric discharge lamps, once they have been switched off, cannot immediately be started again without starting aid due to the high operating pressure, and this proves unsatisfactory, even for restarting after temporary interruptions of the power supply. For hot start by means of high-frequency pulses, high voltages are required exceeding 50kv. and pulse sequences of at least 15 per half cycle each. In addition, it is well known to use in such lamps metal halide additives, saturated halide vapors, or excess of halogen in order to obtain optimum efficiency and high color rendition. This leads to a severe handicap for hot start, for in this case the requisite starting voltages and pulse sequences are considerably higher. In horizontal operating position, a conductive condensate of the metal halogen is present in most cases at the bottom of the arc tube. Even with extreme starting efforts it is impossible in this case to start the lamp. The spark flashes over from the electrodes to the condensate across the shortest distance, and the discharge path is not ionized.

SUMMARY OF THE INVENTION

The foregoing problem is solved according to the invention by the arrangement for restarting a high-pressure mercury-vapor electric discharge lamp with additives of halogen compounds when the lamp is still hot from operation, said lamp being enclosed in an outer envelope and connected with an ignition device wherein the electrode spacing is larger than the bulb diameter, said arrangement characterized in that a starting aid with open potential is provided on the outer wall surface of the discharge tube and parallel to its long axis on the side opposite to the condensate of the metal halides.

BRIEF DESCRIPTION OF THE DRAWING

In the sole FIGURE of the drawing is illustrated an elevational view of a high-pressure mercury-vapor discharge device which includes a metallic halide additive, and which lamp is provided with a metallic starting aid in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

When the starting aid is used, the spark most surprisingly does not flash over to the condensate but passes from the electrode along the upper portion of the discharge tube, parallel to the starting aid, to the opposite electrode. By this means a conductive channel of ionized gas is established and the lamp can be started. Pursuant to the invention it is necessary that the conductivity of the starting aid is at least one magnitude higher than that of the condensate. The specific resistance of the starting aid should be similar to the resistance of metals, preferably below $3\Omega mm.^2/m$. In accordance with the invention, a wire not too small in thickness is used which is inserted in a narrow quartz capillary and is of refractory metal because of the high bulb wall temperature; moreover, the wire should have as low a coefficient of expansion as possible. For example, a refractory wire of 0.6 mm. in diameter of an iron-chromium-aluminum alloy has proved suitable. A starting strip such as is used, for example, with photoflash lamps, cannot be used in lamps according to the invention due to its high resistance to conduction and the high bulb temperature of from 800° to 900° C. The present starting aid, in contradistinction to conventional forms of construction of HPM electric discharge lamps, is without fixed potential, i.e. it is neither directly nor indirectly electrically conductively connected with any part of the lamp but acts capacitively. The ignition wire extends along the wall of the discharge tube from electrode to electrode and is directly affixed to the discharge tube. For this purpose, for example, loops of quartz glass are provided on the discharge tube through which the ignition wire is passed and bent off at its ends. Alternately, a plurality of ignition wires distributed over the circumference of the discharge tube may be used as starting aid.

The arrangement of the starting aid according to the invention also permits, in case of mercury-metal halide lamps, the use of ignition devices of conventional size, even in case of high lamp wattages. Due to the high voltages applied to the lamp, the lead-in wires are passed out of the outer envelope at a respective distance from one another. Generally, they are passed out at opposite ends of the outer envelope.

The outer envelope may be evacuated, mainly in case of lamps rated for lower wattages. On account of improved heat dissipation it is, however, advantageous if the outer envelope of high wattage lamps is filled with an inert gas such as, for example, nitrogen. In this case, care has to be taken that the atmosphere in the outer envelope is not more readily ionizable than the atmosphere in the discharge tube in order to avoid a short circuit by an unintended discharge in the outer envelope. Accordingly, a pressure exceeding 300 torrs is chosen, preferably 600 torrs.

The invention will now be described by way of example in the accompanying drawing:

The high pressure electric discharge lamp comprises the discharge tube **1** of quartz glass, the electrodes **2** and **3**, and one lead-in wire **4** and **5** all enclosed in an outer envelope **6** provided with bases **7** and **8**. The diameter of the discharge tube **1** is 45 mm., the electrodes **2** and **3** are spaced apart a distance of 220 mm. The lamp discharge tube is filled with 1 mg./cc. of mercury, 2 mgrs/cc. of sodium iodide, 0.4 mg./cc. of thallium iodide, and with a basic argon gas at a pressure of 50 torrs. The condensate **9** of metal halide is also present on the wall of the arc tube during operation of the lamp. The lamp is operated at 18 amperes and 250 volts and a wattage of 4 kw. Starting of the cold lamp and restart are effected by means of a conventional ignition device, not shown, to which the electrodes **2** and **3** are adapted to be electrically connected. The quick restart is rendered possible by starting aid **10** which comprises, for example, a refractory wire **12** of an alloy comprising about 65 percent by weight iron, 30 percent by weight chromium and 5 percent by weight aluminum. The wire **12** is 0.6 mm. in diameter and 220 mm. in length, and is enclosed in a capillary **11** of quartz, and the wire conductivity amounts to about 100 times the maximum conductivity of the condensate. The wire **12** is held on the discharge tube **1** by the loops **13** and **14** of quartz glass. The outer envelope **6** of the embodiment is filled with nitrogen at a pressure of 600 torrs. The diameter of the outer envelope **6** is about three times the diameter of the discharge tube.

With the starting-aid arrangement of the invention, restart of the lamp occurs after the extremely short interval of about 1 second, without requiring a more complex ignition device.

We claim:

1. In combination with a high-pressure mercury-vapor discharge lamp which is adapted to be operated in a generally horizontal orientation and which comprises an elongated light-transmitting arc bulb adapted to be disposed generally horizontally during operation and having electrodes operatively disposed therein proximate the ends thereof, the spacing between said electrodes being greater than the diameter of said arc-enclosing bulb, said electrodes adapted to be electrically connected to an external source of starting and energizing potential, a discharge-sustaining filling within said arc-en-

closing bulb and comprising mercury and metallic halide, said metallic halide condensed proximate the lowest longitudinal portion of said arc-enclosing bulb, and an outer bulb surrounding said arc-enclosing bulb, the improved structure for starting said lamp when it is still hot from operation, which structure comprises: an elongated electrically conductive refractory member having an electrical conductivity substantially greater than that of said condensed metallic halide and positioned exteriorly of and proximate the outer surface of said arc-enclosing bulb and extending longitudinally thereof, said member also positioned generally diametrically opposite the lowest longitudinally disposed portion of said arc-enclosing bulb, and said member insulated from direct electrical connection with said electrodes.

2. The combination as specified in claim 1, wherein said conductive refractory member has an electrical conductivity which is at least 10 times higher than the conductivity of said condensed metallic halide.

3. The combination as specified in claim 1, wherein the specific resistance of said conductivity refractory member is less than 3 ohm mm.^{2}.

4. The combination as specified in claim 2, wherein said conductive refractory member is formed as a wire and extends longitudinally along said arc-enclosing bulb from one of said electrodes to the other of said electrodes, and said wire is substantially enclosed throughout its longitudinal dimension by a quartz capillary member.

5. The combination as specified in claim 4, wherein said wire is affixed to the exterior surface of said arc-enclosing bulb by means of quartz formed as loops.

6. The combination as specified in claim 1, wherein said outer bulb is evacuated.

7. The combination as specified in claim 1, wherein said outer envelope is filled with inert gas at a pressure exceeding 300 torrs.