June 5, 1956 S. A. R. RIGDEN 2,749,467

ELECTRODE CONSTRUCTION

Filed April 30, 1952

Fig. 1

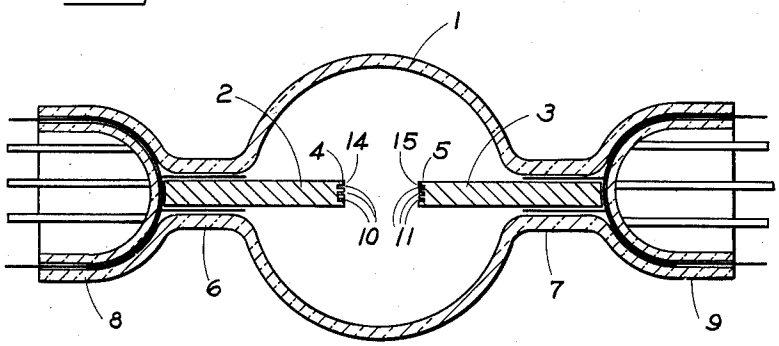
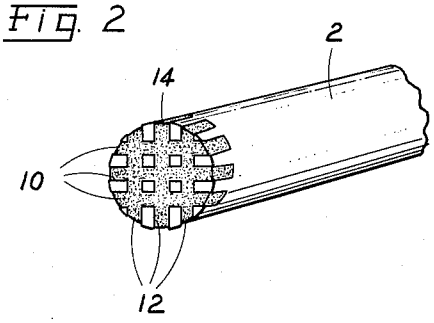


Fig. 2



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ELECTRODE CONSTRUCTION

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3 Claims. (Cl. 313—184)

This invention relates to electric discharge lamps of the type adapted for operation on alternating supplies and comprising within a sealed envelope a pair of main electrodes for the passage of the lamp discharge, and a filling of gas or vapor which is at such high pressure during normal operation of the device that the discharge between said electrodes takes the form of a constricted arc. The term "main electrodes" is used to distinguish these electrodes from other electrodes which may be present to facilitate starting of the discharge.

The main electrodes usually consist of blocks, such as rods, of tungsten or molybdenum, and it is often found that in operation of the lamp small projecting pips of metal appear on the part of each electrode surface on which the discharge terminates, which part will hereinafter be referred to as the terminal surface of the electrode. These pips are probably caused by the growth of crystals of the metal, and are disadvantageous in that they are soon vaporized, and the metal deposited on the envelope walls, where it gradually builds up an opaque film which reduces the life of the lamp. It is known that the growth of pips on an electrode can be prevented or retarded by providing the terminal surface of the electrode with a store of activating material, that is to say, material which emits electrons more readily than does the material of the electrode itself, and the object of this invention is to provide an improved arrangement of this nature.

According to the invention, in an electric discharge lamp of the type specified, at least one (preferably each) main electrode consists of a block of tungsten or molybdenum, and its terminal surface is provided with one or more recesses filled with a solid sintered mixture of the powders of two or more refractory materials, at least one of which materials constitutes an activating material for the electrode.

The term refractory implies that the said materials are capable of withstanding the heat produced by the discharge in operation without rapid evaporation, so that the life of the lamp is increased, and not decreased, by virtue of the presence of the said materials.

The activating material preferably consists of thoria, and the refractory material with which it is sintered consists of tungsten and/or molybdenum, the weight of thoria preferably being half the total weight of the mixture.

The mixture of refractory metal powders is preferably sintered to form a solid mass while contained within the said recess or recesses in the electrode.

The said recesses may conveniently consist of a plurality of intersecting slots cut into the terminal surface of the electrode, the width across each slot being much less than the width of said surface measured in the same direction.

The invention will be further explained in describing, by way of example, one embodiment of it which is illustrated in the accompanying drawing in which Fig. 1 shows an axial section through the lamp and Fig. 2

shows an enlarged perspective view of one of the electrodes.

In this embodiment the lamp is of the compact source type adapted to dissipate 2½ kw. in normal operation from a 110 volt A. C. supply and comprises a spheroidal quartz bulb 1 having a longer internal diameter 61 mms. and a shorter internal diameter 56 mms. Two tungsten rod electrodes 2, 3, each of 0.6 cms. diameter, are mounted along the longer diameter of the bulb so that their terminal surfaces 4, 5, respectively, are diametrically opposite and spaced approximately 15 mms. apart about the center of the bulb. The electrodes 2, 3 are supported from tubular sealing stems 6, 7, respectively, projecting outwardly from the bulb 1, the stems being closed by metal-foil lead-in seals 8, 9, respectively.

The terminal surfaces 4, 5 of the electrodes 2, 3 are formed, as shown in more detail in Fig. 2, with a plurality of regularly spaced parallel slot recesses 10, 11 intersected at right angles by a further plurality of regularly spaced parallel slot recesses 12, 13 respectively, each slot being approximately 0.75 mm. deep and 0.375 mm. wide and extending across the terminal surface of the electrode. These recesses are filled with a sintered mixture 14, 15, respectively, of thoria and tungsten.

The sintered mixture is preferably formed in the recesses of the electrodes before mounting of the electrodes in the lamp envelope. Each electrode is first mounted on a seal body for subsequent sealing into an aperture of the envelope. A paste is formed by mixing with distilled water 50 per cent by weight of thoria powder and 50 per cent by weight of tungsten powder, each powder having a particle size of about 2 microns, and a quantity of this paste is placed within the said recesses of the electrode and allowed to dry, several such applications of paste followed by drying being made until the recesses are completely filled, any surplus paste on the terminal surface of the electrode then being removed. The application of the paste in several steps in this way reduces the shrinkage on subsequent heating.

The electrode assembly is then mounted in an enclosure so that the paste-filled terminal surface of the electrode cooperates with the terminal surface of another tungsten electrode. The enclosure is filled with a reducing atmosphere and an electric discharge is then passed between the electrodes, the heating produced by the discharge being arranged to be sufficient to sinter the paste. The discharge current (which may be, for example, about 5 amperes) is supplied from a source of D. C. supply, it being arranged that in operation the paste-filled electrode operates as an anode.

The electrodes, with the sintered mixture formed in the terminal surfaces thereof, are then mounted in the lamp envelope and the further manufacture of the lamp completed in the usual way.

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

1. In a gaseous electric discharge lamp comprising a sealed envelope containing an ionizable gaseous atmosphere at such high pressure during normal operation of the lamp that the discharge therein is in the form of a constricted arc, a pair of main electrodes spaced apart within said envelope for a discharge therebetween, at least one of said electrodes being composed of a solid massive body of metal of the group consisting of tungsten and molybdenum and having its arc-supporting terminal surface provided with a plurality of intersecting slots extending entirely thereacross, and a filling in said slots and exposed at said surface and consisting of a sintered mixture of powders of a refractory metal of the group consisting of tungsten and molybdenum and an activating material consisting primarily of thoria.

2. In a gaseous electric discharge lamp comprising a

sealed envelope containing an ionizable gaseous atmosphere at such high pressure during normal operation of the lamp that the discharge therein is in the form of a constricted arc, a pair of main electrodes spaced apart within said envelope for a discharge therebetween, at least one of said electrodes being composed of a solid massive body of metal of the group consisting of tungsten and molybdenum and having its arc-supporting terminal surface provided with a plurality of intersecting slots extending entirely thereacross and a filling in said slots and exposed at said surface and consisting of a sintered mixture of powders of a refractory metal of the group consisting of tungsten and molybdenum and thoria, the weight of thoria being about half the total weight of the mixture.

3. A high intensity compact source discharge lamp comprising a vitreous envelope containing an ionizable gaseous atmosphere including mercury vapor attaining a pressure of several atmospheres during normal operation of the lamp to cause the discharge to take the form of a constricted arc, a pair of main electrodes spaced apart

within said envelope and defining a short arc path therebetween, at least one of said electrodes being composed of a solid massive body of metal of the group consisting of tungsten and molybdenum and having its arc-supporting terminal surface provided throughout with a plurality of relatively closely spaced recesses, and an electron-emissive sintered mixture filling said recesses substantially flush with said surface, said mixture consisting of powders of a refractory metal of the group consisting of tungsten and molybdenum and an activating material consisting primarily of thoria.

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