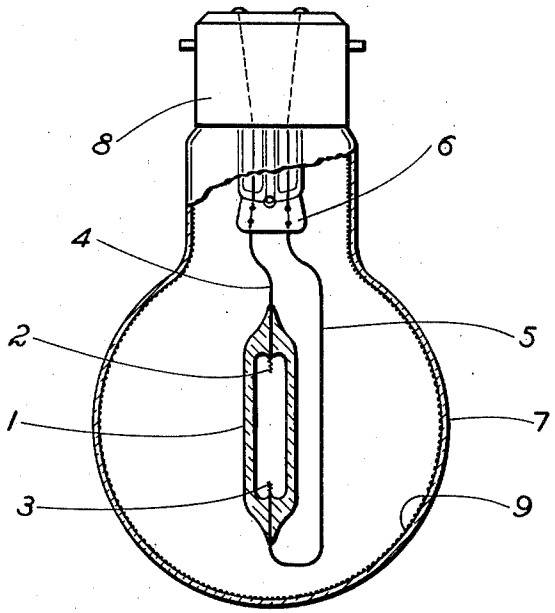
Jan. 7, 1941. N. W. H. ADDINK 2,227,418

ELECTRIC LAMP

Filed May 25, 1938



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Patented Jan. 7, 1941

2,227,418

UNITED STATES PATENT OFFICE

2,227,418

ELECTRIC LAMP

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Application May 25, 1938, Serial No. 210,056
In Germany June 9, 1937

5 Claims. (Cl. 176—122)

The present invention relates to electric lamps and more particularly the invention relates to such lamps comprising a gaseous electric lamp device and a luminescent material mounted in light receiving relation to said discharge device to transform part of the rays emitted by said device, such as ultra violet rays, into visible light rays.

The object of the present invention is to provide a luminescent material which is resistant to elevated temperatures. Another object of the invention is to provide a gaseous electric discharge lamp device comprising a luminescent material which is emissive in the red spectral region on excitation by radiation emitted by the discharge in said device. A further object of the invention is to provide a luminescent coating for a gaseous electric discharge lamp device which permits the operation of said device at higher temperatures without harmful effect on said coating than has been possible heretofore. Still further objects and advantages attaching to the device and to its use and operation will be apparent to those skilled in the art from the following particular description.

I have discovered that aluminum oxides when properly activated are light emissive under excitation by radiation from gaseous electric discharges and that the light emitted thereby is on the long-wave side of the visible spectrum. I have discovered, further, that aluminum oxide activated by rhodium emits an orange-red color and that aluminum oxide activated with chromium emits a deep red color. I have discovered further that these aluminum oxides are peculiar and different from the luminescent materials now in use in the art in that the light emitted thereby changes in color with changes in temperature of the material and that as the temperature of the luminescent material increases the wave length of the light decreases and approaches more closely the color of light to which the eye is most sensitive. As a result of peculiar property of these luminescent aluminum oxides it is advantageous, for the first time, to mount a luminescent material in such position relative to a gaseous electric discharge that the luminescent material is at an elevated temperature during the operation of the discharge. This, of course, is contrary to the practice in the art at present since the luminescent materials now in use are extremely sensitive to temperature and lose their light emitting power when the temperature exceeds a certain limit, such as about 100° C. The luminescent materials embodying the present invention are very stable as far as heat is concerned and it is advantageous from a color standpoint to mount such materials in such position relative to a discharge and to operate the discharge with such current density that the luminescent material is at a temperature higher than 150° C. or even 200° C.

The luminescent aluminum oxides of this invention are, therefore, not only useful with discharge devices of the type which operate with a container temperature of 100° C. or less, such as discharge devices of the neon positive column type or the low mercury vapor pressure, positive column type, but are also useful with devices of the type operating with an elevated container temperature, such as a mercury vapor arc discharge lamp operating with a vapor pressure of about 1 atm., or with similar types of devices operating with a vapor pressure of 10 atm. and higher. In the type of device operating with a low container temperature the luminescent materials of the present invention can be mounted directly on the inner or outer surface of the container itself, or, of course, on an element outside the container and in light receiving relation to the discharge in the device. In the high temperature type of devices I prefer to mount the coating on the outer envelope which encloses the container of the high temperature device. It will be understood, of course, that I contemplate that the luminescent coating of my invention may be applied either to the container of any gaseous electric discharge lamp device now known in the art or on the auxiliary apparatus for such discharge devices provided the temperature of the coating during the operation of the discharge device is not so elevated as to destroy the light emitting power of the luminescent aluminum oxide.

In the drawing accompanying and forming part of this specification I have illustrated, in a side elevational, partly sectional view, one type of discharge lamp device in which the new luminescent aluminum oxide material may be incorporated to advantage.

Referring to the drawing, the electric lamp which is illustrated comprises a gaseous electric discharge device having a tubular container 1 consisting preferably of quartz and having an inside diameter of 6.5 mm. and an outside diameter of 10 mm. A pair of cooperating electrodes 2 and 3 are sealed into the end of the container 1 and said electrodes 2 and 3 are of the thermionic, activated type heated to and maintained at a high electron emitting, arc discharge supporting temperature by the discharge incident

thereat. Said electrodes 2 and 3 are separated a distance of about 22 mm. Said container 1 has a starting gas therein, such as argon, at a pressure of about 20 mm. and a quantity of mercury in sufficient amount that the discharge device is capable of operation with an elevated vapor pressure, such as a vapor pressure of 10 atm. and higher. A lamp of this type is shown in U. S. Patent 2,094,694, patented October 5, 1937. The device operates with a contracted arc discharge and is an efficient light source of high brilliancy. Preferably the current input of the device is about 75 watts and the temperature of the container 1 during the operation of the device is higher than 600° C.

The discharge lamp is mounted in an envelope 7, such as a glass envelope, and is supported therein by the current leads 4 and 5 attached to the electrodes 2 and 3, respectively, and fused into the pinch 6 of the envelope 7. Said leads 4 and 5 are connected to contacts on the base 8 attached in the usual manner, as by cementing, to the envelope 7. The envelope 7 is either evacuated or is filled with an inert gas, such as nitrogen, when desired. The diameter of the spherical part of the envelope 7 is comparatively small and is preferably about 5 to 7 cm. The inner surface of the envelope 7 has a coating 9 thereon consisting of luminescent aluminum oxide activated with chromium. The temperature of said coating 9 when the discharge device is at operating equilibrium is higher than 200° C. and the color of the light emitted by said coating 9 is red to complement the spectrum of the light emitted by the mercury vapor discharge in the discharge device which is somewhat deficient in red rays. At room temperature, that is about 16° C. the light emitted by the coating 9 is a very deep red, thus it is apparent that the light emitted by the coating 9 more nearly approaches the color to which the eye is most sensitive as the temperature thereof is increased. A further advantage of the luminescent aluminum oxides used with lamps of the above type is that the envelope of the lamp may be made smaller in diameter than has been possible heretofore when the heat sensitive luminescent coatings of the prior art have been used. This, of course, is advantageous in the transportation of the lamp device as well as in the mounting thereof. Thus is made available to the arts generally a lamp comprising a high pressure mercury vapor discharge device and a luminescent coating which is smaller in size for the same light output than has been available heretofore.

The coating 7 is applied to the inner surface of the container 1 by methods now known in the art such as by using a binding material of phosphoric acid or water glass. An advantageous process for accomplishing this result is by suspending the aluminum oxide powder in a collodion solution, that is, a solution of nitro-cellulose in alcohol and ether. This suspension is then applied in a thin layer on the envelope 7 after which the binding agent is volatilized off and reduced by flowing air through the envelope 7 and heating the latter to a temperature of about 300° C. When desired, the aluminum oxide is incorporated in the glass of the envelope 7 so that the envelope 7 consists of a luminescent glass.

While I have shown and described and have pointed out in the annexed claims certain novel features of the invention, it will be understood that various omissions, substitutions and changes in the forms and details of the device illustrated and in its use and operation may be made by those skilled in the art without departing from the broad spirit and scope of the invention.

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

1. An electric lamp comprising in combination a gaseous electric discharge lamp device comprising a container, a gaseous atmosphere therein and electrodes sealed therein and a luminescent material mounted in radiation receiving relation to the discharge in said device and so closely thereto as to be heated during operation to a temperature of at least about 150° C. and capable of emitting light under excitation by such radiation, said luminescent material containing aluminum, oxygen and chromium.

2. In combination a luminescent material and a support for said material, said material containing aluminum, oxygen and rhodium.

3. A vitreous body having incorporated therein a luminescent material, said material containing aluminum, oxygen and rhodium.

4. A lamp unit comprising in combination an electric lamp device comprising an hermetically sealed envelope, a gaseous electric discharge lamp device mounted in said envelope, a luminescent material supported by said envelope and being capable of emitting visible light in the red spectral regions under excitation by radiation from the discharge in said lamp device, the visible light from said luminescent material decreasing in wave length as the temperature of said material increases, said luminescent material containing aluminum, oxygen and an activating material and means to supply sufficient electrical energy to said lamp device to maintain said luminescent material at a temperature higher than about 150° C. during the operation of said lamp device whereby the visible light from said material is in the part of the red spectral regions to which the eye is most sensitive.

5. A lamp unit comprising in combination an electric lamp device comprising an hermetically sealed envelope, a gaseous electric discharge lamp device mounted in said envelope, a luminescent material supported by said envelope and being capable of emitting visible light in the red spectral regions under excitation by radiation from the discharge in said lamp device, the visible light from said luminescent material decreasing in wave length as the temperature of said material increases, said luminescent material containing aluminum, oxygen and rhodium and means to supply sufficient electrical energy to said lamp device to maintain said luminescent material at a temperature higher than about 150° C. during the operation of said lamp device whereby the visible light from said material is in the part of the red spectral regions to which the eye is most sensitive.

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