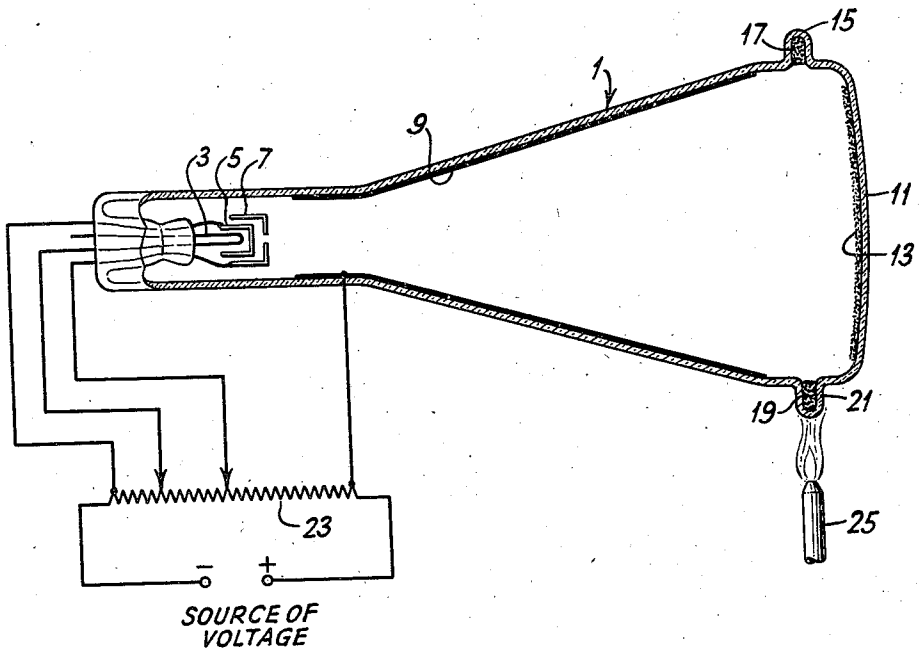
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LUMINESCENT SCREEN

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LUMINESCENT SCREEN

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This invention relates to luminescent screens and more particularly to an improved luminescent screen and the method and means for preparing such screens for use in electron discharge devices wherein the screen is adapted to be impacted by electrons.

When the cathode rays falling on the fluorescent screen of a cathode ray tube confer a negative charge on the screen, the tube, of course, cannot operate correctly. For this reason it has been proposed to provide the luminous screen with a conductive layer to which is connected a source of potential for carrying off the charges of the electrons impinging on the screen.

In the absence of this conductive layer it is necessary that the screen should emit at least as much secondary electrons as it collects primary electrons, otherwise the screen would be charged and the tube would not operate or only in a defective manner. The necessary secondary emission can be attained when the electrons acquire a sufficiently high velocity. The potential of the screen referred to the source of electrons will then become about equal to the anode potential. However, to give the electrons the necessary high velocity to produce the secondary electrons, the potential difference through which the electrons pass must be likewise very high.

A cathode ray tube according to the invention comprises a fluorescent screen whose power of emitting secondary electrons is increased. For this purpose a caesium oxide layer is adsorbed to the luminescent substance of the screen. By adsorbing caesium oxide to the luminescent material, the emission of secondary electrons is so copious that the tube is adapted to operate at comparatively low voltages which, of course, is an important advantage, as well as to overcome any distortion in light values which would arise from the charging of the screen.

With the method according to the invention, a caesium deposit is formed on the luminescent screen. The caesium adsorbed to the fluorescent substance is subsequently oxidized by means of oxygen.

It has been found that a screen made according to this method has such a capacity of emitting secondary electrons that the desired equilibrium is obtained and charging of the screen is avoided even at an electron speed corresponding to a voltage comprised between 200 and 300 volts. The method according to the invention may be carried out in a very simple manner by providing that the caesium and the oxygen used for oxidizing it are set free from a capsule inside the tube itself. The free caesium may either be provided in a hermetically closed envelope or a mixture is used containing a caesium compound which readily evolves caesium by reduction. Such method and means for releasing caesium are well known in the prior art and are shown in Patents Nos. 1,738,420, entitled "Method of preparing electric discharge device" issued December 3, 1929, to Charlton, 1,835,117, entitled "Introduction of alkali metals into evacuated containers," and 1,835,118, entitled "Alkali metal tubes" issued on December 8, 1931, to Marden. For this purpose a mixture of caesium chromate and zirconium may by preference be used.

For releasing oxygen a capsule is preferably used containing a compound which by heating to a temperature exceeding the pumping temperature of the tube evolves oxygen. A suitable agent satisfying this condition is MnO_2 which does not release oxygen to any considerable extent below 600 to 700° C. In this case the tube can normally be exhausted after providing the material for the luminescent screen and assembling the bulb and the electrode system.

The luminescent material may, for instance, be an activated zinc silicate which is provided on the surface of the screen by means of a binder such as nitro-cellulose. The binder is subsequently burnt away and the zinc silicate is gently sintered. After that, caesium vapour is introduced in the vacuum space. The tube is preferably heated to such a temperature that the caesium does not form a permanent deposit on the parts of the tube, whilst the excess caesium vapour is removed by pumping. The caesium is left as an adsorbed layer only on the luminescent screen due to which the latter acquires a brown color. With further high temperature treatment and sintering, it displays a blue color. It is understood, of course, that other methods of depositing the luminescent material upon the supporting surface, such as the end wall of the cathode ray tube, may be used. Such methods include either spraying the luminescent material onto the surface, or by settling out the material from a suspension onto the end wall.

Subsequently oxygen is introduced into the vacuum space and the caesium, which has a high affinity to oxygen, is completely oxidized due to which the screen acquires again its initial white color.

Preferably, the cathode is activated in a manner known per se only after removing the free

oxygen, in order that it shall not be attacked by the oxygen used for oxidizing the caesium.

In the drawing I have shown schematically a cathode ray tube embodying a luminescent screen upon which is absorbed caesium oxide. The cathode ray tube 1 is provided with a cathode 3, a concentrating or control electrode 5, a first anode 7, and a second anode 9 formed by a conductive layer deposited within and on the tube wall. These elements constitute the means for producing a focused beam of electrons which is to be projected upon the luminescent screen 13 deposited upon the end wall 11 of the tube 1. The luminescent screen 13 deposited upon the end wall is formed from any suitable fluorescent material, such as an activated zinc silicate, upon which material there is absorbed a layer of caesium oxide. For purposes of illustration, I have shown the tube formed with two tips 15 and 19. The tip 15 is filled with the caesium compound and the reducing agent 17, while the tip 21 is filled with the manganese dioxide or other oxygen bearing compound, which is to be decomposed.

In practice, the tip 15 would be heated by a frame 25 until the chemical reaction takes place, which releases the caesium vapor and following the condensation of the caesium vapor only upon the fluorescent material, the tip may be sealed off. Likewise, following the step of oxidizing the caesium layer by application of heat to the tip 21 to produce the decomposition of the oxygen bearing compound, the tip 21 is sealed off.

Having described my invention, what I claim is:

1. The method of preparing an improved luminescent screen which comprises the steps of depositing a luminescent material upon a supporting surface, thermally decomposing a caesium compound to produce caesium vapor, condensing the produced vapor upon the deposited material, heating the condensed caesium to produce a predetermined color, thermally decomposing manganese oxide to produce oxygen, and oxidizing the heated condensed caesium by the produced oxygen.

2. The method of preparing an improved luminescent screen which comprises the steps of depositing a luminescent material upon a supporting surface, thermally decomposing a caesium compound to produce caesium vapor, condensing the produced vapor upon the deposited material, heat treating the condensed caesium to produce a blue color, and subsequently oxidizing the heat treated caesium.

3. The method of preparing an improved luminescent screen which comprises the steps of depositing a luminescent material upon a supporting surface, thermally decomposing a caesium compound to produce caesium vapor, condensing the produced vapor upon the deposited material, sintering the condensed caesium to produce a blue color, and subsequently oxidizing the sintered caesium.

4. The method of preparing an improved secondary electron emissive luminescent screen which comprises the steps of depositing a luminescent material upon a supporting surface, producing caesium vapor, adsorbing the produced vapor to the deposited material to provide a brown color thereto, heating the deposited material and the adsorbed caesium to change said brown color to blue, and subsequently oxidizing the adsorbed caesium.

5. The method of preparing an improved luminescent screen which comprises the steps of depositing a luminescent material upon a supporting surface, thermally decomposing a caesium compound to produce caesium vapor, condensing the produced vapor upon the deposited material to impart a brown color thereto, heating the condensed caesium to alter said brown color to blue, thermally decomposing an oxygen bearing compound to produce oxygen, and oxidizing the heated adsorbed caesium by the produced oxygen.

6. The method of preparing an improved luminescent screen which comprises the steps of depositing a luminescent material upon a supporting surface, reducing a caesium compound to produce caesium vapor, condensing the produced vapor upon the deposited material to impart a brown color thereto, heating the condensed caesium to alter said brown color to blue, thermally decomposing an oxygen bearing compound to produce oxygen, and oxidizing the heated adsorbed caesium by the produced oxygen.

7. The method of preparing a secondary electron emissive luminescent target which comprises depositing luminescent material upon a support member, producing a caesium vapor, condensing the produced caesium vapor and forming an adsorbed caesium coating upon the deposited luminescent material, decomposing an oxide compound to produce oxygen and oxidizing the condensed adsorbed caesium by the produced oxygen.

8. The method of preparing a secondary electron emissive luminescent target which comprises the steps of depositing a luminescent material upon a support member, producing a caesium vapor, condensing the caesium vapor and forming by condensation an adsorbed caesium coating upon the deposited luminescent material and oxidizing the condensed adsorbed caesium coating.

9. A secondary electron emissive luminescent target adapted to be activated by an electron beam comprising a support member, a layer of luminescent material deposited upon the support member, and a layer of caesium adsorbed upon the said luminescent material, said caesium having the surface thereof remote from the luminescent material oxidized and adapted to release secondary electrons under electron beam impact.

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