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CATHODE RAY TUBE WITH SILICA COATED PHOSPHOR SCREEN

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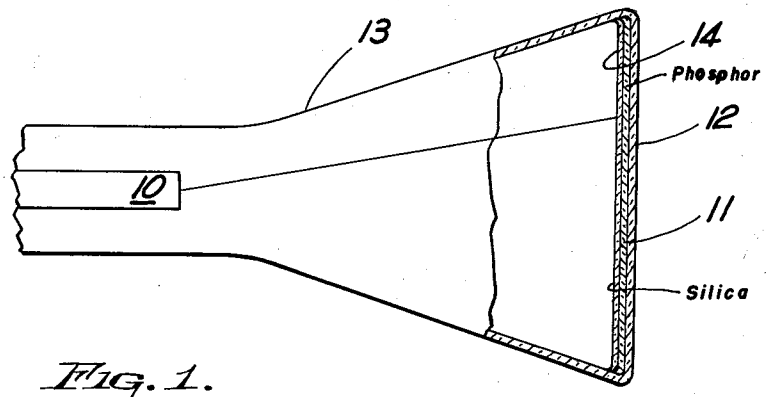


Fig. 1.

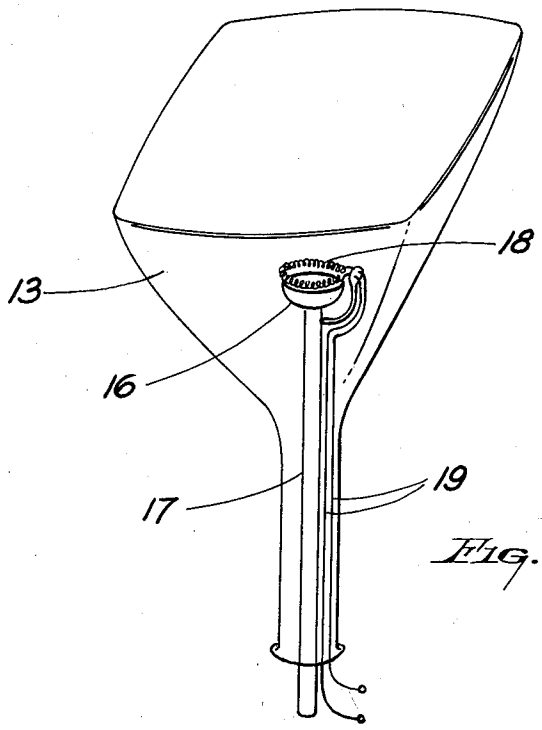


Fig. 2.

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CATHODE RAY TUBE WITH SILICA COATED PHOSPHOR SCREEN

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2 Claims. (Cl. 313—92)

This invention relates to cathode ray tubes such as are used as television picture tubes and has for its object to provide means for reducing the effects of ion bombardment of the phosphor screen.

The phosphors which are generally used for the screens of cathode ray tubes for television purposes have a secondary electron emission co-efficient of less than unity at the operating voltages which are normally encountered. The effect of this low secondary emission co-efficient is that electron bombardment is the equivalent of a negative charging current to the surface of the phosphor screen, so that the latter tends to assume a high negative voltage with respect to the final anode of the electron gun producing the electrons. This gives rise to an electric field between the surface of the screen and the final anode. This field causes any positive ions which occur within the field to be accelerated towards the screen. Bombardment by ions in this way leads to deterioration of the screen efficiency and if the bombardment is localized, the characteristic dark pattern usually described as ion burn becomes apparent.

There are two main methods available whereby this phenomenon can be avoided. Firstly, the phosphor screen may be provided with a metal backing, which backing is connected to a suitable point in the circuit, so that the voltage of the screen is maintained at a predetermined value. Secondly, the screen may be provided on the surface facing the electron beam with a layer of material of secondary electron emission coefficient greater than unity, so that the building-up of negative charge is prevented. The present invention is concerned with the last-mentioned alternative.

According to the present invention, that surface of the phosphor screen on which the electron beam is incident is coated with an even layer of finely divided silica. Such a layer not only has a sufficiently high secondary emission co-efficient to prevent any substantial charge from building up on the phosphor screen, but the secondary emission co-efficient remains substantially constant throughout the normal life of the cathode ray tube, so that there is no variation in properties of the tube in this respect during such life. The thickness of the silica layer and the size of the particles in the layer may vary within very wide limits. Preferably the coating is such that the secondary emission co-efficient is not less than 1.5 at the operating voltage. A suitable value in practice for the secondary emission co-efficient of the coated screen is 1.6 to 1.7 at 16 kv., which is the voltage of the highest positive electrode in the tube and mainly responsible for the sigh kinetic energy of the electrons.

The invention will now be described with reference to the accompanying drawing in which:

FIG. 1 is a partial cross-sectional view of a cathode-ray tube of the invention;

FIG. 2 is a perspective view showing the tube in position for applying the silica layer.

In the drawing, FIG. 1 shows the completed cathode-ray tube comprising an electron gun **10** for producing

and directing an electron beam, shown as a solid line, toward a phosphor screen **11** on the faceplate **12** of a glass envelope **13**. Overlying the phosphor **11** is a coating of finely-divided silica **14** in accordance with the invention so that the electron beam impacts the silica resulting in the generation of many secondary electrons.

The finely divided silica may be deposited on the phosphor coating by any suitable process. It has been found that a satisfactory layer can be produced by burning ethyl silicate at a small jet inside the tube body after the phosphor screen has been prepared and to allow the smoke so produced to settle evenly on the surface of the phosphor screen. Alternatively, the silica smoke can be produced outside the tube body, blown into the bulb and allowed to settle on the phosphor screen.

The preferred method is to introduce into the tube body a rod carrying a small cup containing the amount of ethyl silicate required to produce the desired quantity of silica, and then to burn the ethyl silicate by firing it. When the charge is completely burnt, the rod is removed, the tube is inverted and the silica smoke is allowed to settle on the phosphor screen. A settling time of about 20 minutes is sufficient. For carrying out this preferred method, as shown in FIG. 2, a small metal cup **16** is mounted at the end of an insulating rod **17** of such dimensions that it permits the cup to be introduced through the neck and advanced to about 2 inches beyond the position where the neck and cone of the tube join. Also mounted on the rod and disposed just above the cup is a tungsten filament **18**, the current-carrying connections **19** for which extend along the rod to outside the tube body. For igniting and firing the ethyl silicate in the cup **16**, the filament is heated to about 1,000° C. by passing an electric current through it. For coating a 14″ tube a charge of 100 mg. ethyl silicate is appropriate, whereas for a 17″ tube a charge of 150 mg. is recommended.

What is claimed is:

1. A cathode-ray tube comprising an electron-receiving, phosphor screen, means for producing and directing an electron beam at said phosphor screen to impinge on a surface thereof, and a layer of exposed silica on said surface of the screen and directly impacted by the beam to enhance the production of secondary electrons, said silica-coated screen having a secondary emission coefficient in excess of unity.

2. A cathode-ray tube comprising an electron-receiving, phosphor screen, means for producing and directing an electron beam at said phosphor screen to impinge on a surface thereof, and a uniform layer of finely-divided silica exposed on said surface of the screen and directly impacted by the beam to enhance the production of secondary electrons, said silica-coated screen having a secondary emission coefficient in excess of 1.5.

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