

July 7, 1942.

H. W. WEINHART
ELECTRIC DISCHARGE DEVICE

2,289,156

Filed Nov. 18, 1939

FIG. 1

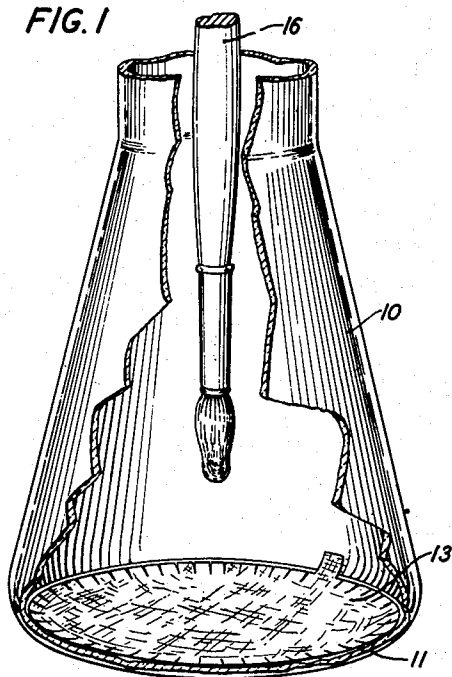


FIG. 2

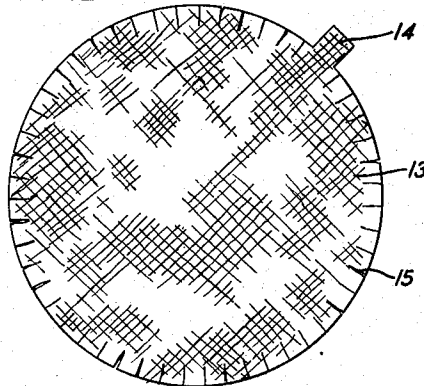


FIG. 3

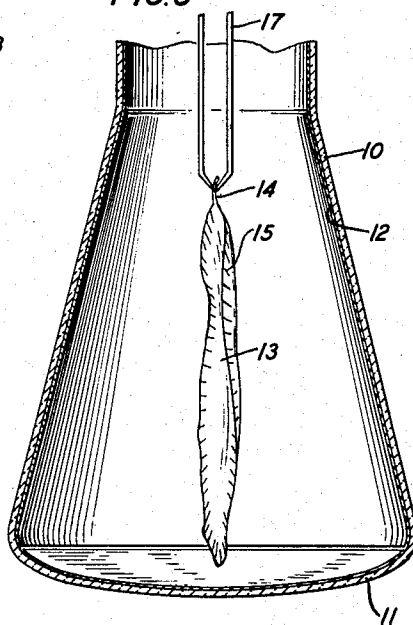


FIG. 4

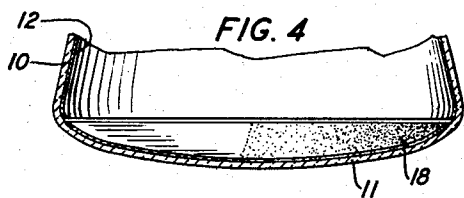


FIG. 6

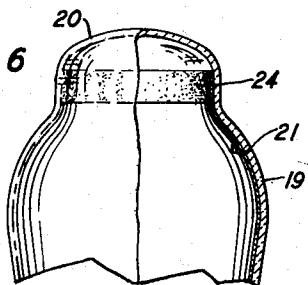


FIG. 5

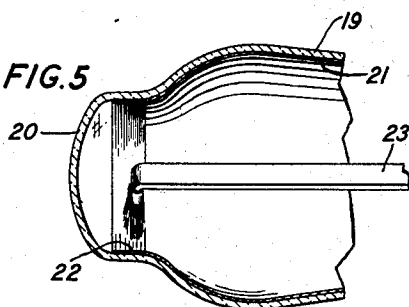
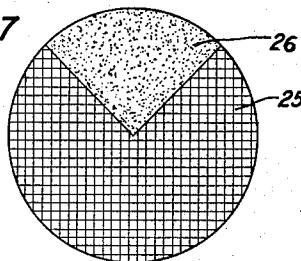


FIG. 7



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2,289,156

ELECTRIC DISCHARGE DEVICE

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Application November 18, 1939, Serial No. 305,071

10 Claims. (Cl. 117-18)

This invention relates to the manufacture of electric discharge devices and more particularly to electronic and television devices.

In the development of electronic and television devices, it has been found desirable to apply a conducting or shielding coating or layer to the internal wall of the device to eliminate reflection from the screen and also to utilize the coating as a continuous accelerating electrode for the projection of the electronic beam toward the screen. This coating is usually applied after the screen coating and it is necessary to heat the shielding coating to a high temperature to remove the solvents and impurities and also bind the material of the coating to the glass wall. While the heat treatment is beneficial with respect to the shielding layer, it impairs the composition of the fluorescent screen either by the absorption of impurities given up by the shielding layer or by decomposition of the screen material. Since the efficiency of the screen material depends on its sensitivity to fluoresce under electron bombardment, it is evident that any poisoning of the screen due to oxidation or decomposition materially reduces the probable value of the device in the electronic and television arts.

An object of this invention is to overcome these difficulties and effect the application of fluorescent materials to the screen area to produce a highly efficient device.

Another object of the invention is to facilitate the production of large surface screens having a uniform distribution of fluorescent material.

A further object of the invention is to improve the formation of the screen area in discharge devices regardless of the contour of the vessel or the confining limits for the screen.

In accordance with one aspect of this invention, as applied to the usual type of cathode ray device, a graphite or other conducting coating may be applied to the inner side wall of the vessel and fired to a suitable temperature to remove the binder material and fix the coating to the wall. The screen area is then prepared by forming a masking disc, membrane or sheet of a porous fabric which is cut to the form of the screen and preferably provided with a serrated edge to fit the curved contour of the screen. A binder substance may be applied to the disc so that it penetrates through the fabric and is deposited uniformly over the screen surface. The disc is removed and the fluorescent material may be dusted over the binder layer to provide an

adequate screen coating. The device is then baked at a low temperature to volatilize the binder and produce adherence of the fluorescent material to the glass surface.

The porous mask provides a diffusion medium for spreading the binder layer uniformly over the area of the screen which is a particular advantage on a surface of revolution since it prevents the binder from collecting in a pool at the lowest point of the surface with attendant lack of binder at the higher points of the surface. Furthermore, the density of the binder layer is more uniform and the tackiness thereof is preserved more readily since the mask fibers and the absorbed material therein form a blanket over the binder to eliminate air or other drying media which would deteriorate the layer if exposed.

A feature of the invention relates to the facility with which large diameter screens may be prepared to insure a uniform thickness layer of a binder substance on the screen area. This is realized by forming the mask to fit the screen area and proceeding with the impregnation of the mask with a fluid binder. The amount of binder which penetrates to the screen surface is limited by the texture of the mask so that no excess binder collects on the screen. If desired, the mask may be impregnated with a binder material prior to the application of the mask to the screen. In this method the transfer of binder material to the screen will result in a uniform layer which is prevented from flowing on the surface after the mask is removed.

Another feature of this method is the preservation of the binder layer in its applied state without deteriorating effect. The fluid seal produced by the binder impregnated mask on the screen, protects the under layer of binder material on the screen for long periods so that a quantity of cathode ray devices or other similar type vessels may be prepared as a group. When it is desired to inject the fluorescent powder material into the vessel to form the screen, the mask may be removed from each screen area individually to allow the fresh binder layer to receive the powder. This arrangement avoids the necessity of applying the fluorescent powder as soon as the binder layer is applied.

These and other features of the invention will be more clearly understood from the following detailed description taken in connection with the accompanying drawing:

Fig. 1 is a perspective view of a portion of a vessel of the cathode ray type, partly broken

away to show the preliminary step in the coating method of this invention;

Fig. 2 illustrates the form of mask or applicator of this invention used in the device of Fig. 1;

Fig. 3 is a cross-sectional view of the vessel showing the removal of the mask and the binder coating on the screen area;

Fig. 4 is a view in cross-section of a portion of the vessel in which a fluorescent layer is superimposed on the binder coating;

Fig. 5 illustrates in cross-section a different form of vessel in which a binder coating is applied to a ring mask on the dome portion of the vessel;

Fig. 6 shows a vessel with a ring fluorescent screen made in accordance with the method of Fig. 5; and

Fig. 7 illustrates another form of screen produced in accordance with this invention in which a segmental screen is formed in an area having the remaining portion non-fluorescent.

Referring to the drawing, the method of this invention may be practiced in one form of device, such as a cathode ray oscillograph, having a flared cylindrical section 10 and a spherical or ellipsoidal section end wall 11, the latter section forming the screen area of the device. The flared surface is coated with a conducting layer 12, for instance, graphite, to form an opaque covering for the glass side wall to reduce reflection losses from the screen and to serve as an accelerating influence for the electronic beam projected toward the screen. The graphite coating which is applied in the form of an aqueous solution may be injected into the vessel to form the coating in accordance with the method disclosed in my U. S. Patent 2,096,416, issued October 19, 1937. The extent of the coating along the glass wall is from the vicinity of the electron gun, not shown, to the boundary of the screen area on the end surface of the vessel.

As shown in the above patent, the graphite coating is applied after the formation of the fluorescent screen, and it has been found that the subsequent heat treatment of the opaque coating to produce stable adherence must be performed at such a high temperature that the fluorescent coating is impaired and resultant light efficiency is greatly reduced.

In accordance with this invention, the conducting coating 12 may be applied and heated to the proper temperature, which is approximately 400° C., prior to the formation of the fluorescent coating so that the high temperature necessary for proper adherence of the coating to the glass may be performed without any deleterious effects. This high temperature will remove water vapor and other impurities given up by the coating and they may be removed from the vessel. After the above treatment is completed, the screen coating is formed by placing a porous mask or applicator 13 over the surface defining the screen area. Since the dome portion of the vessel represents a surface of revolution, it is necessary to employ a mask of flexible material contiguous with the curved surface of the screen. A convenient form of mask is a fibrous or textured fabric, such as a linen disc as shown in Fig. 2, which is shaped to cover the screen diameter and provided with a tab 14 extending from the periphery. The mask is also provided with a serrated edge 15 to conform to the curvature of the outer boundaries of the glass surface of the screen area.

A fluid binder substance having a viscous or tacky characteristic, such as a plasticizing lacquer or cellulosic solution, for instance, cellulose nitrate and amyl acetate may be painted on the mask by the use of a soft camel-hair brush 16 beginning at the center and progressively wetting the mask out to the periphery thereof. The function of the mask is to distribute the binder substance uniformly over the screen area of the glass and prevent the collection of an excess of binder substance at the lowest point of the screen. This is accomplished by the woven texture of the disc which permits the binder fluid to penetrate or percolate through the pores and form minute droplets on the glass surface, the absorbent character of the mask removing excess fluid from all portions of the screen area. The applicator is carefully removed by long tweezers 17 engaging the tab 14 on the disc to peel the disc off the screen area without smearing the minute droplets of binder material on the screen surface. The limp character of the impregnated disc facilitates the easy removal of the disc from the vessel without contacting the graphite coating. After the removal of the disc a fluorescent material, such as calcium tungstate or other suitable composition in fine powder form, may be dusted over the tacky binder surface on the screen to form a fluorescent coating 18 over the screen area. The excess powder may be removed by tipping the vessel on end and the graphite coating may be cleaned with a camel-hair brush to remove particles of powder in contact therewith. The screen area is then treated by air drying in vacuum, or heating in nitrogen or air to a temperature between 180° and 300° C., or to a temperature that will not affect the fluorescent properties of the powder, to volatilize the binder and fix the fluorescent powder to the screen area.

The advantages of this method are particularly concerned with the uniform thickness of the binder film or layer on the screen area to receive the fluorescent powder and the ability of the mask or applicator in its wet condition to form a blanket over the viscous binder in contact with the glass surface. Another advantage applicable to this method is the facility with which the binder coating is applied so that a number of vessels may be treated with the binder coating successively and the masks left in place until the operator is ready to inject the fluorescent powder, whereupon the disc may be removed as each vessel is processed. The porous mask also facilitates the coating of very large surfaces of the order of several square feet with a uniform layer or film of the binder substance for the reception of the fluorescent powder or mosaic coating material without the difficulty of the occurrence of flow in the binder coating. This method also overcomes repeated washing and recoating, as was heretofore necessary before a satisfactory screen was obtained.

The method is also applicable to a type of device such as a volume indicator, shown in Figs. 5 and 6, in which a pear-shaped vessel 19 is provided with a dome portion 20 and a shield coating 21 is provided on the pear-shaped portion of the vessel. In this device, the fluorescent screen takes the form of a cylindrical band or ring in the dome portion of the vessel and is coaxial with the axis of the vessel. In this form the mask 22 is a strip engaging the inner wall of the dome portion and the binder substance may be applied to the strip by a brush 23 having the bristle

end bent at an angle with respect to the shaft. After the removal of the strip mask, a fluorescent powder may be dusted in the dome portion to form the fluorescent screen 24 as shown in Fig. 6. In either form of the invention, the mask or applicator may be impregnated with the binder material prior to insertion in the vessel so that a film or coating of binder substance may be transferred to the screen area for causing adherence of the fluorescent powder to the screen surface.

The porous mask may assume various configurations depending on the surface of the glass which is to serve as the fluorescent screen. As shown in Fig. 7, the screen is in the form of a segment of the circle and, of course, the mask would assume the same configuration for the production of the fluorescent screen portion of the vessel. It should also be noted that this screen portion 26 may be formed after the coating 25, of graphite or other conducting material, is applied to the remaining portion of the glass surface.

While the invention has been described in connection with the production of multiple coatings in a discharge vessel of the cathode ray or television type, it is, of course, understood that the invention is also applicable to other devices in which the conductive coating is omitted and particularly in such devices having a large screen diameter. According to this aspect, the porous mask greatly facilitates the formation of a uniform screen area so that a high light efficiency is obtained. Similarly, other modifications may be made in the elemental steps of the process or method as herein disclosed and such modifications are intended to be within the scope of the appended claims.

What is claimed is:

1. The method of coating a surface in an electronic discharge device which comprises, distributing a binder substance over the whole end surface of a vessel to be coated with the aid of a binder saturated thin pliable mask placed in contact with the whole area of said surface, removing the mask, and applying a coating material to the binder layer.

2. The method of coating the screen surface in an electronic discharge device which comprises, laying a dry porous pliable mask on said surface, brushing a binder material on the mask for infiltration to the surface, removing the mask, and affixing an active coating material to the binder and surface.

3. The method of applying an electronically active material to the whole end surface of a vessel which comprises, inserting a fibrous single thickness membrane into the vessel to cover said surface to form a screen area, impregnating said membrane with a fluid binder, removing said membrane, and dusting the active material on the residue of binder associated with said surface.

4. The method of coating a cathode ray discharge device which comprises, applying a porous flexible mask to a screen area having a surface of revolution, progressively coating said mask with a tacky material from the center to the periphery thereof, allowing said material to penetrate said mask to be deposited on said area,

peeling said mask from the area without smearing the deposited layer, dusting a fluorescent powder over the treated area, and heating the screen area to decompose said tacky material.

5. The method of coating a cathode ray discharge device which comprises, applying a thin fabric disc to the whole end surface of a vessel forming an internal circular screen area, saturating said disc with a fluid binder substance, removing said disc after said substance has penetrated the disc to form a film on said area, injecting powdered fluorescent material into said vessel to adhere to said binder film, and treating said coating to dry said binder and fix said material to said area.

6. The method of forming a uniform thickness fluorescent screen in a vitreous vessel having a surface of ellipsoidal section which comprises, applying a fabric disc having a serrated edge to said surface with said edge conforming to the curvature of the peripheral portion of said surface, impregnating said disc with a viscous fluid, allowing said fluid to penetrate to said surface and adhere thereto, removing said disc in such a manner that an immiscible layer of fluid droplets persist on said surface, dusting a fluorescent powder over said layer, removing the excess powder, and heating said surface to dissipate said fluid and fix said powder to said surface.

7. The method of producing a fluorescent screen area on a cylindrical wall of a vessel which comprises, applying a fibrous strip to said wall to form a complete cylinder, brushing a fluid binder material through said strip, removing said strip, and dusting a fluorescent powder over the binder coating adhering to the treated area.

8. The method of coating cathode ray discharge devices which comprises, applying a conductive film on the inner side wall of the vessel, heating said film, covering the inner screen end of the vessel with a porous disc to fit the contour thereof, wetting said disc with a fluid material to form a tacky layer on said screen, removing said disc, and covering said tacky layer with fluorescent particles.

9. The method of coating cathode ray discharge devices which comprises, applying a conductive film on the inner side wall of the vessel, heating said film, covering the inner screen end of the vessel with a porous disc to fit the contour thereof, wetting said disc with a fluid material to form a tacky layer on said screen, removing said disc, dusting a fluorescent powder on said tacky layer, and heating said screen end at a lower temperature than said first heating.

10. The method of reducing deterioration of the fluorescent screen material in a cathode ray discharge device which comprises, coating the side wall of a vessel with a graphite solution, baking said coating to remove the liquid carrier, applying a dry fabric disc to the whole end screen area of the vessel, wetting said disc with a viscous binder to form a tacky film on said screen area, removing said disc, coating said film with a fluorescent compound, and heating said screen area to vaporize said binder film and affix said compound to the screen area.

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