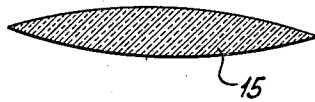
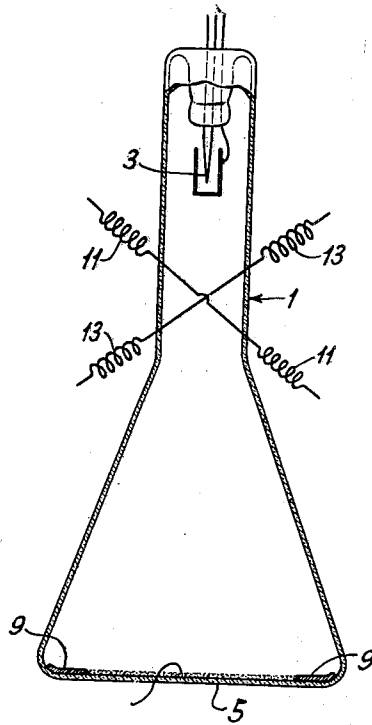


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ELECTRON DISCHARGE DEVICE

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ELECTRON DISCHARGE DEVICE

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This invention relates to cathode ray tubes such as are employed for the re-constitution of a picture for television purposes. Usually, the envelope of a tube of this kind is made from relatively thin glass, and in order to mask the unused portion of the fluorescent screen and for the purpose of defining the picture area the outer surface of the tube is provided with a mask painted or otherwise applied thereto. In some cases the picture produced by the fluorescent screen is projected on to a screen and since with this arrangement it is necessary to employ a lens for projecting the image on to the screen, it is desirable that the end wall of the tube on which the fluorescent screen is formed should be flat, otherwise difficulties are encountered when projecting the image.

In the usual type of cathode ray tube the end wall on which the fluorescent screen is formed is convex for the purpose of withstanding the high degree of vacuum necessary for the proper operation of the tube, but in tubes in which the re-constituted picture is projected onto a screen and it is necessary to make the end wall flat, it is consequently essential that the walls of the tube be substantially thickened in order to withstand the required degree of vacuum. Owing to the thickening of the end wall it is found that if the mask is applied to the outer surface of such wall the outline of the mask when projected results in an ill-defined or feathery edge bounding the edges of the projected image instead of a desirable sharply defined boundary. Where the wall of the tube is of relatively thin glass this difficulty does not arise since it is usual to view the image directly from the end of the tube, but in the so-called projection type of cathode ray tube since it is necessary to make the end wall thicker so that such end wall can be maintained flat the difficulty above mentioned is encountered.

It is the chief object of the present invention to provide an improved construction of cathode ray tube of the projection type in which the difficulty above-mentioned is overcome. According to the invention, a cathode ray tube of the projection type is provided in which the mask is applied on the same side and to the same surface as that on which the fluorescent screen is formed. In such a construction the projected image will be bounded by a sharply defined edge corresponding in outline to the shape of the said mask. This is due to the fact that both the mask and the picture can be sharply focused simultaneously by a suitable lens system such as will be employed for the purpose in view.

As illustrated in the drawing, schematically one embodiment of my invention is as follows:

A cathode ray tube 1 having a planar end wall 5 has mounted within the tube an electron beam forming system 3. A deflecting coil system 11 and 13 are provided for deflecting the beam in accordance with the predetermined pattern over the end wall 5. Internally of the envelope, there is deposited luminescent screen material 7 which is adapted to emit light under the bombardment of the projected cathode ray beam. The mask 9 is likewise mounted internally of the tube on the end wall 5 to define the boundary of the luminescent screen. The thickness of the mask 9 is substantially equal to the depth of the luminescent material deposited. An optical system 15 is provided for focusing the luminescent image produced upon a screen 17.

The mask in most cases must be formed of such a material or must be of such a nature that it can resist the temperatures encountered during the process of evacuation such temperatures usually being in the neighborhood of 300-550° C. Tubes of the projection type are sometimes made by securing a conical portion of the envelope to a flat plate of optical glass which constitutes the end wall of the tube on which the fluorescent screen is formed and the mask may be applied to such end piece either before or after the sealing or securing of the end plate to the conical portion of the tube. If the mask is applied prior to the securing of the end plate to the conical portion the nature of the material of the mask must be such as to withstand the temperatures incidental to the securing operation. Suitable materials for this purpose include opaque vitreous enamels and metallic suspensions known under the trade name of "Liquid Silver". In such cases the mask may be painted or otherwise applied to the end plate and thereafter such end plate is sealed to the conical portion of the tube. Alternatively, the mask may be applied after the end plate is sealed to the body portion of the tube and at the same time as the application of the metallic coating to the other portions of the tube such metallic coatings usually comprise a deposit of silver which is employed as one of the anodes of the tube. Such a coating may be applied by the use of suitable chemical silvering solutions such as those used in the manufacture of mirrors, or, instead of employing a silvering solution other chemical methods of depositing conductive coatings may be used; for example, a conducting coating of lead sulphide or copper may be employed, or, alternatively, the required

coating may be obtained by the evaporation or sputtering of metals in vacuum. One or other of these methods may be employed for coating the inner wall of the tube and the end plate and then the conducting layer so formed may be removed from that area of the end plate on which the fluorescent screen is to be deposited, leaving a sharply defined surrounding mask.

In some cases it may be difficult or laborious to remove the applied coating from the end of the tube and to avoid such an operation the area of the tube on which the fluorescent screen is subsequently formed may be covered during the coating operation with a sheet or plate of suitable material that can be readily removed after the coating operation, removal of the sheet or plate likewise removing the coating applied thereto during the coating operation, leaving the area of the end of the tube free for the application of the fluorescent screen. For example, a sheet of flexible material cut out to the required shape and coated on one side with a thin layer of low melting point wax or similar material can be readily and firmly fixed into the required position by melting the wax and allowing it to solidify. In order to remove the sheet the wax is again melted, the sheet removed and benzene or other solvents thereafter used, to remove any wax adhering to the surface of the glass, or in some cases the sheet of flexible material may itself be formed of a material soluble in a suitable medium. Alternatively, a nitrocellulose or other suitable lacquer may be applied to the surface of the glass prior to the depositing operation, such lacquer being subsequently removed in any known or suitable manner.

In some cases the area on which the fluorescent screen is to be formed may be defined by arranging that the surface of the screen be slightly lower or higher than the surrounding glass to facilitate the application of the protecting coating or material particularly in the case where the protective coating is initially in liquid form, the liquid conforming in such cases more readily to the limits required.

Where the conducting coating is employed as a mask and is formed from a liquid the required mask or the area of the screen can be defined without the use of a protective layer, if the tube during the application of the conducting coating is held at such an angle, for example about 45°, that the liquid is raised to such a level that one side of the mask is formed, the liquid level being then reduced and the tube rotated about its axis

for 90° and the liquid level again increased to the required level so that another side of the mask is formed and so on.

In a modification of the invention the fluorescent screen is formed on a plate suspended within the envelope of the cathode ray tube the plate being made of some transparent material such as glass or mica or of some opaque and preferably conductive material such as aluminum. Where the screen is transparent, the screen is viewed from the opposite side to that bombarded by the cathode ray beam, whilst in the case where the screen is opaque, it will be viewed from the same side as the side bombarded by the beam. In both cases the mask is applied to the plate so that it is coplanar with the fluorescent screen, the mask being applied before or after the plate is fixed within the envelope of the tube.

The shape of the mask will in most cases be of rectangular shape but other configurations may be employed if required.

Having described our invention, what we claim is:

1. A luminescent screen comprising a support member, a layer of luminescent material of predetermined thickness area and boundary deposited upon the support member, and a layer of opaque material of a thickness substantially equal to the predetermined thickness of luminescent material deposited upon the support member contiguously with the predetermined boundary of the luminescent material.

2. A luminescent screen comprising a support member, a layer of luminescent material of predetermined thickness area and boundary deposited upon the support member, and an annular layer of opaque material of predetermined configuration and of a thickness substantially equal to the predetermined thickness of the luminescent material deposited upon the support member contiguously with the predetermined boundary of the luminescent material.

3. A cathode ray tube having a conical body closed by an end wall, a luminescent screen comprising a layer of luminescent material of predetermined thickness covering only a predetermined portion of the end wall, and a layer of opaque material having a thickness substantially equal to the predetermined thickness of the luminescent material deposited upon the end wall on those portions not covered by the luminescent material.

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