

S P E C I F I C A T I O N

T I T L E

"METHOD OF FORMING A PHOSPHOR SCREEN OF A COLOR CATHODE RAY TUBE"

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates generally to a method of forming a phosphor screen of a color cathode ray tube, and more particularly, is directed to an improvement in method of forming a phosphor screen including a plurality of phosphor portions and a black portion provided between each adjoining pair of the phosphor portions.

Description of the Prior Art

A phosphor screen of a color cathode ray tube is formed to have a plurality of color phosphor dots or stripes of the three primary colors including red phosphor dots or stripes which produce red fluorescence, green phosphor dots or stripes which produce green fluorescence and blue phosphor dots or stripes which produce blue fluorescence. In this connection, there has been proposed such a phosphor screen that a black portion in the form of a black matrix made of carbon or a carbon stripe is provided between each adjoining pair of the color phosphor dots or stripes.

The black portion thus provided on the phosphor screen contributes effectively to improve in contrast color images displayed on the phosphor screen and further to restrict beam landing errors which cause the color phosphor dots or stripes to produce incorrect color fluorescence with an electron beam which is emitted from an

9904690-6

- 1 -

22 SEP 1999

electron gun in the color cathode ray tube to impinge upon deviated positions in the phosphor screen.

When the phosphor screen provided with the black matrix or carbon stripes is formed, first, the black matrix or carbon stripes are affixed to a glass panel constituting a front face portion of a color cathode ray tube, and then, the color phosphor dots or stripes are affixed to portions of the glass panel on each of which the black matrix or carbon stripe is not present.

For example, in case of the phosphor screen provided with the carbon stripes, at the first step, a plurality of carbon stripes each having a predetermined width are affixed to the glass panel at regularly spaced intervals, and at the second step, each of the color phosphor stripes is affixed to a portion of the glass panel between each adjoining pair of the carbon stripes.

A previously proposed method of forming a phosphor screen which includes a plurality of carbon stripes and a plurality of color phosphor stripes on a glass panel will be explained with reference to the steps shown in Figs. 1A to 1D, each of which is a cross sectional view on a plane substantially rectangular to the carbon stripes, as follows.

First, as shown in Fig. 1A, a photoresist such as a solution of polyvinyl alcohol is applied to a glass panel 1 to form a uniform photoresist layer 2 on the glass panel 1. Then, a photomask which is constituted with an aperture grill is attached to the glass panel so as to mask portions of the photoresist layer 2 corresponding to locations where the carbon stripes are to be formed, and the photoresist layer 2 is exposed to light through the photomask.

The exposure of the photoresist layer 2 to the light through the photomask will be explained with reference to Fig. 2 which is a cross

sectional view on a plane substantially parallel to the longitudinal direction (horizontal direction) of the color cathode ray tube and shows the relation between the photoresist layer 2 and an aperture grill 3.

First, the photoresist layer 2 is exposed to light 5R passing through a slit 4 of the aperture grill 3 from a light source arranged at a predetermined position. Next, the photoresist layer 2 is exposed to light 5G passing through the slit 4 of the aperture grill 3 from a light source arranged at a predetermined position. The photoresist layer 2 is exposed to light 5B passing through the slit 4 of the aperture grill 3 from a light source arranged at a predetermined position.

The light 5R, light 5G and light 5B are set to travel along paths corresponding substantially to beam paths of three electron beams in the color cathode ray tube, respectively. Each of the paths of the light 5R, light 5G and light 5B is controlled to be appropriately arranged by an optical lens positioned between the light source and the photoresist layer 2.

The photoresist layer 2 is then developed and washed to remove portions of the photoresist layer 2 from the glass panel 1, each of which has not been exposed to the light having a predetermined intensity. The quantity of the removed photoresist layer 2 can be controlled by a condition of the washing to the photoresist layer 2, for example, a washing time to the photoresist layer 2. Accordingly, only the portions of the photoresist layer 2, each of which has not been exposed to the light having the predetermined intensity, can be surely removed from the glass panel 1 when the condition of the washing to the photoresist layer 2 is determined to be appropriately optimized. The surface of the glass panel 1 is then dried, so that portions of the photoresist layer 2, each of which has been exposed to the light having

the predetermined intensity, remains to form a plurality of photoresist stripes 2' on the glass panel 1, as shown in Fig. 1B.

Next, black material 6, for example, a water glass containing carbon mixed therewith is applied on the photoresist stripes 2' and partial areas of the glass panel 1 where the photoresist stripe 2' is not present, as shown in Fig. 1C, and dried so that the photoresist stripes 2' and the partial areas of the glass panel 1 where the photoresist stripe 2' is not present are covered with the black material 6.

Then, the photoresist stripes 2' covered with the black material 6 are subjected to a periodic acid (HIO_4) treatment or the like and each of the photoresist stripes 2' is removed from the glass panel 1 together with the black material 6 covering it. The black material 6 covering the partial areas of the glass panel 1 remains to form a plurality of carbon stripes 6' on the glass panel 1, as shown in Fig. 1D.

After that, the color phosphor stripes are affixed to the portions of the glass panel 1 between each adjoining pair of carbon stripes 6' to complete the phosphor screen.

Since the width of the carbon stripe 6' is determined by the width of the black material 6 remaining on the glass panel 1, it is necessary for obtaining the carbon stripe 6' with a narrow width to make each of the photoresist stripes 2' formed on the glass panel 1 have a relatively large width. Further, the longitudinally extending edge portion of the carbon stripe 6' is shaped by the longitudinally extending edge portion of the photoresist stripe 2' formed on the glass panel 1 and therefore the longitudinally extending edge portion of the carbon stripe 6' which is superior in linearity can be obtained if each of the photoresist stripes 2' formed on the glass panel 1 has a

superiorly linear longitudinally extending edge portion.

As aforementioned, such characteristic as including the width, linearity of the longitudinally extending edge portion, uniformity and so on of the carbon stripe in the phosphor screen is determined by the processing condition of the photoresist stripes such as the intensity distribution characteristic of light to which the photoresist layer is exposed, condition of development to the photoresist layer and condition of drying to the photoresist layer. The intensity distribution characteristic of light to which the photoresist layer is exposed is usually controlled by means of variations in combination of the shape, position and so on of a light source for exposure on the photoresist layer.

The intensity distribution of light emitted from a fixed light source, to which the photoresist layer is exposed, will be explained as follows.

Light emitted from a light source and passing through a slit of an aperture grill, for example, each of the light 5R, 5G and 5B passing through the slit 4 of the aperture grill 3 as shown in Fig. 2, to which the photoresist layer 2 is exposed, has such light intensity distribution as shown with a curve A1 in Fig. 3.

The light source used for exposure on the photoresist layer 2 is not a perfect line light source but a linear light source having a certain width. Accordingly, each of the light 5R, 5G and 5B emitted from the light source and passing through the slit 4 of the aperture grill 3 has the largest intensity at its center portion to make a peak portion in light intensity distribution and decreases in intensity gradually toward both side portions thereof to make a skirt portion in light intensity distribution. The skirt portion in light intensity

distribution extends beyond the slit 4 of the aperture grill 3 shown in Fig. 2. Consequently, the skirt portion in light intensity distribution of the light 5R and the skirt portion in light intensity distribution of the light 5G are laid to overlap each other and similarly the skirt portion in light intensity distribution of the light 5G and the skirt portion in light intensity distribution of the light 5B are laid to overlap each other. The skirt portions in light intensity distribution thus overlapping each other increase in light intensity. When the skirt portions in light intensity distribution overlapping each other have excessively increased light intensity, portions of the photoresist layer 2 corresponding to the skirt portions in light intensity distribution overlapping each other are exposed to the light with excessive intensity, so that the portions of the photoresist layer 2, which are to be removed from the glass panel 1 by means of washing, remain undesirably to form unnecessary photoresist stripes on the glass panel 1.

It is necessary for avoiding such a problem as mentioned above to reduce sufficiently the light intensity of the skirt portion in light intensity distribution shown with the curve A1 in Fig. 3. This means that a portion with relatively large light intensity of the light intensity distribution shown with the curve A1 in Fig. 3 must be narrowed.

Meanwhile when a widthwise pitch of the slits of the aperture grill is relatively small, such as, for example, 0.3 mm, it is required that the width of the carbon stripe is also so small as to be, for example, equal to or less than $50\text{ }\mu\text{m}$. It is necessary for the carbon stripe reduced in width to make the photoresist stripe, such as the photoresist stripe 2' shown in Fig. 1B, large in width.

However, as shown with the curve A1 in Fig. 3 and explained above, the portion with relatively large light intensity of the light intensity distribution must be narrowed. Therefore, the photoresist layer would be exposed to the light including portions in light intensity distribution having a gentle slope such as at both ends of an exposure width D1 shown in Fig. 3.

In such a case, no problem is raised if the photoresist layer is uniform in thickness and the light distribution is also uniform over the surface of the glass panel. In actual fact, however, there is a substantial problem because the photoresist layer is usually not uniform in thickness and the light distribution is also usually not uniform over the surface of the glass panel. For example, when the light distribution at the central portion of the glass panel is different from that at each of the corner portions of the glass panel, a relatively large difference is raised in the exposure width D1 between the central and corner portions of the glass panel with relatively small variations in light intensity. Such a relatively large difference in the exposure width D1 is also raised due to lack of uniformity in thickness of the photoresist layer on the glass panel.

For the reasons mentioned above, the photoresist stripes 2' shown in Fig. 1B are formed to be not uniform in width over the surface of the glass panel 1. In other words, each of the photoresist stripes 2' formed on the glass panel 1 as shown in Fig. 1B is provided with its longitudinally extending edge portions deteriorated in linearity. The carbon stripes are formed on the portions of the glass panel on each of which the photoresist stripe is not present and therefore each of the carbon stripes formed on the glass panel is provided with its longitudinally extending edge portions deteriorated in linearity.

The aforementioned problem can be theoretically solved by making the light intensity distribution as shown with the curve A1 in Fig. 3 have steep slopes at both ends of the exposure width D1. However, it is required to reduce sufficiently the light intensity of the skirt portion in light intensity distribution shown in Fig. 3, which raises the overlapping problem as described above, and this can not be compatible with making the light intensity distribution shown in Fig. 3 have the steep slopes at both ends of the exposure width D1. Consequently, it is quite difficult to obtain on the glass panel a plurality of carbon stripes each of which is relatively small in width and provided with superiorly linear longitudinally extending edge portions.

OBJECTS AND SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a method of forming a phosphor screen of a color cathode ray tube, by which a phosphor screen including a plurality of color phosphor portions and black portions provided between each adjoining pair of the color phosphor portions is formed, and which avoids the aforementioned disadvantages encountered with the prior art.

Another object of the present invention is to provide a method of forming a phosphor screen of a color cathode ray tube, by which a phosphor screen including a plurality of color phosphor portions and black portions provided between each adjoining pair of the color phosphor portions is formed, and which can obtain the black portions in the form of a plurality of black stripes of carbon on a glass panel, each of which is relatively small in width and provided with longitudinally extending edge portions which are superiorly linear.

According to the present invention, there is provided a method of forming a phosphor screen of a color cathode ray tube, which comprises the steps of forming a photoresist layer on a glass panel, causing a plurality of first positions on the photoresist layer to be exposed to light passing through a photomask in a first direction and another light passing through the photomask in a second direction different from the first direction, causing a plurality of second positions on the photoresist layer to be exposed to light passing through the photomask in a third direction and another light passing through the photomask in a fourth direction different from the third direction, causing a plurality of third positions on the photoresist layer to be exposed to light passing through the photomask in a fifth direction and another light passing through the photomask in a sixth direction different from the fifth direction, causing the photoresist layer exposed to the light to be developed and then removing from the glass panel portions of the photoresist layer where light exposure has not reached a predetermined amount to form a plurality of remaining photoresist portions, applying black material on the remaining photoresist portions and partial areas of the glass panel where the remaining photoresist portion is not present, removing from the glass panel the remaining photoresist portions together with the black material applied thereon to form black portions with the black material remaining on the glass panel, and forming a plurality of color phosphor portions on partitioned portions of the glass panel between each adjoining pair of the black portions.

In the method according to the present invention, the first positions on the photoresist layer formed on the glass panel are exposed at least twice to the light passing through the photomask in the first

direction and the light passing through the photomask in the second direction. The second positions on the photoresist layer formed on the glass panel are exposed at least twice to the light passing through the photomask in the third direction and the light passing through the photomask in the fourth direction. Further, the third positions on the photoresist layer formed on the glass panel are exposed at least twice to the light passing through the photomask in the fifth direction and the light passing through the photomask in the sixth direction.

With the first to third positions on the photoresist layer exposed to the light in each of the first to sixth directions, each of longitudinally extending edge portions of each remaining photoresist portion on the glass panel is shaped with a portion of the photoresist layer which is virtually exposed to light having a steep slope in intensity variations and therefore each of the remaining photoresist portions has its longitudinally extending edge portions superior in linearity. As a result, each of the black portions on the glass panel is provided with longitudinally extending edge portions which are superiorly linear.

Accordingly, with the method according to the present invention, the black portions on the glass panel can be obtained in the form of a plurality of black stripes of carbon, each of which is relatively small in width and provided with longitudinally extending edge portions which are superiorly linear.

The above, and other objects, features and advantages of the present invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1A to 1D are illustrations showing the process of forming carbon stripes in accordance with a previously proposed method;

Fig. 2 is an illustration showing a relation between a photoresist layer and an aperture grill constituting a photomask at a step of exposure in the previously proposed method;

Fig. 3 is an illustration showing intensity distribution of light to which a photoresist layer is exposed in accordance with the previously proposed method;

Figs. 4A to 4F are illustrations showing the process of forming carbon stripes in accordance with a method of the present invention;

Figs. 5A and 5B are illustrations used for explaining the process of exposure in accordance with a method of the present invention;

Fig. 6 is an illustration showing an example of intensity distribution of light to which a photoresist layer is exposed in accordance with the method of the present invention; and

Fig. 7 is an illustration showing another example of intensity distribution of light to which a photoresist layer is exposed in accordance with the method of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment of method of forming a phosphor screen of a color cathode ray tube according to the present invention will be explained below with reference to Figs. 4A to 4F, 5A, 5B, 6 and 7.

In the embodiment, first, as shown in Fig. 4A, a photoresist such as a solution of polyvinyl alcohol is applied to a glass panel 11, which constitutes a face panel portion of a color cathode ray tube, to form a photoresist layer 12 to be uniform on the glass panel 11. Next,

an aperture grill which constitutes a photomask having a plurality of slits is positioned to face the photoresist layer 12. In Figs. 4A to 4F, the aperture grill is omitted. The photoresist layer 12 is then exposed to light corresponding to electron beams in the color cathode ray tube.

In the exposure of the photoresist layer 12 to the light, first, the photoresist layer 12 is exposed to light corresponding to an electron beam which impinges on red phosphor stripes for producing red fluorescence upon excitation by the electron beam in the color cathode ray tube.

For this exposure, a light source is arranged at a first light position for emanating light 15R which passes through a slit 14 of an aperture grill 13 in a first direction to be incident upon a position PR on the photoresist layer 12, as shown in Fig. 5A. With the light 15R thus emitted from the light source, the first exposure of the photoresist layer 12 is carried out and an exposed portion ER1 is formed in the position PR on the photoresist layer 12, as shown in Fig. 4B. The position PR corresponds to a position on which the electron beam for exciting the red phosphor stripes in the color cathode ray tube impinges.

Then, the light source is shifted to be arranged at a second light position for emanating light 15R' which passes through the slit 14 of the aperture grill 13 in a second direction a little different from the first direction to be incident upon the position PR on the photoresist layer 12, as shown in Fig. 5B. The light source can move along the longitudinal direction of the face panel portion of the color cathode ray tube. With the light 15R' thus emitted from the light source, the second exposure of the photoresist layer 12 is carried out and an exposed portion ER2 is formed in the position PR on the

photoresist layer 12 in addition to the exposed portion ER1, as shown in Fig. 4C.

The light 15R' has the angle of incidence to the photoresist layer 12 different from that of the light 15R, and therefore the exposed portion ER2 formed by the light 15R' in the position PR is slightly deviated from and overlapped partially with the exposed portion ER1 formed by the light 15R in the position PR.

Secondly, the photoresist layer 12 is exposed to light corresponding to an electron beam which impinges on green phosphor stripes for producing green fluorescence upon excitation by the electron beam in the color cathode ray tube.

For this exposure, a light source is arranged at a third light position for emanating light 15G which passes through the slit 14 of the aperture grill 13 in a third direction to be incident upon a position PG on the photoresist layer 12, as shown in Fig. 5A. With the light 15G thus emitted from the light source, the third exposure of the photoresist layer 12 is carried out and an exposed portion EG1 is formed in the position PG on the photoresist layer 12, as shown in Fig. 4B. The position PG corresponds to a position on which the electron beam for exciting the green phosphor stripes in the color cathode ray tube impinges.

Then, the light source is shifted to be arranged at a fourth light position for emanating light 15G' which passes through the slit 14 of the aperture grill 13 in a fourth direction a little different from the third direction to be incident upon the position PG on the photoresist layer 12, as shown in Fig. 5B. The light source can move along the longitudinal direction of the face panel portion of the color cathode ray tube. With the light 15G' thus emitted from the light

source, the fourth exposure of the photoresist layer 12 is carried out and an exposed portion EG2 is formed in the position PG on the photoresist layer 12 in addition to the exposed portion EG1, as shown in Fig. 4C.

The light 15G' has the angle of incidence to the photoresist layer 12 different from that of the light 15G, and therefore the exposed portion EG2 formed by the light 15G' in the position PG is slightly deviated from and overlapped partially with the exposed portion EG1 formed by the light 15G in the position PG.

Thirdly, the photoresist layer 12 is exposed to light corresponding to an electron beam which impinges on blue phosphor stripes for producing blue fluorescence upon excitation by the electron beam in the color cathode ray tube.

For this exposure, a light source is arranged at a fifth light position for emanating light 15B which passes through the slit 14 of the aperture grill 13 in a fifth direction to be incident upon a position PB on the photoresist layer 12, as shown in Fig. 5A. With the light 15B thus emitted from the light source, the fifth exposure of the photoresist layer 12 is carried out and an exposed portion EB1 is formed in the position PB on the photoresist layer 12, as shown in Fig. 4B. The position PB corresponds to a position on which the electron beam for exciting the blue phosphor stripes in the color cathode ray tube impinges.

Then, the light source is shifted to be arranged at a sixth light position for emanating light 15B' which passes through the slit 14 of the aperture grill 13 in a sixth direction a little different from the fifth direction to be incident upon the position PB on the photoresist layer 12, as shown in Fig. 5B. The light source can move

along the longitudinal direction of the face panel portion of the color cathode ray tube. With the light 15B' thus emitted from the light source, the sixth exposure of the photoresist layer 12 is carried out and an exposed portion EB2 is formed in the position PB on the photoresist layer 12 in addition to the exposed portion EB1, as shown in Fig. 4C.

The light 15B' has the angle of incidence to the photoresist layer 12 different from that of the light 15B, and therefore the exposed portion EB2 formed by the light 15B' in the position PB is slightly deviated from and overlapped partially with the exposed portion EB1 formed by the light 15B in the position PB.

Although the above described process includes the first and second exposures of the photoresist layer 12 to the light corresponding to the electron beam which impinges on the red phosphor stripes, the third and fourth exposures of the photoresist layer 12 to the light corresponding to the electron beam which impinges on the green phosphor stripes, and the fifth and sixth exposures of the photoresist layer 12 to the light corresponding to the electron beam which impinges on the blue phosphor stripes, such an order of the exposures of the photoresist layer 12 can be changed without any restriction.

The light used for each of the first to sixth exposures of the photoresist layer 12 is controlled to have a predetermined intensity distribution. For example, the light used for each of the first, third and fifth exposures of the photoresist layer 12 is controlled to have such intensity distribution as to obtain a half of the amount of exposure which is obtained by both of the first and second exposures of the photoresist layer 12, both of the third and fourth exposures of the photoresist layer 12 or both of the fifth and sixth exposures of the

photoresist layer 12.

In case of the position PG on the photoresist layer 12, for example, the light 15G which is emitted from the light source arranged at the third position for the third exposure of the photoresist layer 12 is controlled to have its intensity distribution shown with a curve A2 in Fig. 6 and the light 15G' which is emitted from the light source arranged at the fourth position for the fourth exposure of the photoresist layer 12 is controlled to have its intensity distribution shown with a curve A3 in Fig. 6. The amount of exposure obtained by the light 15G and the amount of exposure obtained by the light 15G' are added to each other in the position PG. As a result, in the position PG, the photoresist layer 12 is virtually exposed to light which is controlled to have its intensity distribution shown with a curve A4 in Fig. 6 to form the exposed portions EG1 and EG2.

In case of the position PR or PB on the photoresist layer 12, the amount of exposure is obtained in the same manner as the position PG. That is, in the position PR, the photoresist layer 12 is virtually exposed to light which corresponds to the light controlled to have its intensity distribution shown with the curve A4 in Fig. 6 to form the exposed portions ER1 and ER2, and in the position PB, the photoresist layer 12 is virtually exposed to light which corresponds to the light controlled to have its intensity distribution shown with the curve A4 in Fig. 6 to form the exposed portions EB1 and EB2.

The photoresist layer 12 on which the exposed portions ER1, ER2, EG1, EG2, EB1 and EB2 are formed is then developed and washed to remove portions of the photoresist layer 12 from the glass panel 11, each of which has not been exposed to light having intensity more than a predetermined intensity L_x as shown in Fig. 6. The quantity of the

removed photoresist layer 12 can be controlled by a condition of the washing to the photoresist layer 12, for example, a washing time to the photoresist layer 12. Accordingly, only the portions of the photoresist layer 2, each of which has not been exposed to the light having the intensity more than the predetermined intensity L_x , can be surely removed from the glass panel 11 when the condition of the washing to the photoresist layer 12 is determined to be appropriately optimized. The surface of the glass panel 11 is then dried, so that portions of the photoresist layer 12, each of which has been exposed to the light having the intensity more than the predetermined intensity L_x , remains to form a plurality of photoresist stripes 12' as remaining photoresist portions on the glass panel 11, as shown in Fig. 4D.

Each of the portions of the photoresist layer 12 which remains to form the photoresist stripes 12' on the glass panel 11 in the positions PG on the photoresist layer 12 is a part of the positions PG where the exposed portions EG1 and EG2 overlap each other. This part of the positions PG is shown with its width DX in Fig. 6.

Similarly, each of the portions of the photoresist layer 12 which remains to form the photoresist stripes 12' on the glass panel 11 in the positions PR on the photoresist layer 12 is a part of the positions PR with its width DX where the exposed portions ER1 and ER2 overlap each other, and each of the portions of the photoresist layer 12 which remains to form the photoresist stripes 12' on the glass panel 11 in the positions PB on the photoresist layer 12 is a part of the positions PB with its width DX where the exposed portions EB1 and EB2 overlap each other.

The predetermined intensity L_x is put on a steep slope portion of the curve A4 in Fig. 6, which shows the intensity distribution of

the light used virtually for the exposure of the photoresist layer 12. Therefore, each of the photoresist stripe 12' on the glass panel 11 is formed with its width DX and provided with longitudinally extending edge portions each shaped with the portion of the photoresist layer 12 which is virtually exposed to the light having a steep slope in intensity variations. In addition, each of the part of the positions PR where the exposed portions ER1 and ER2 overlap each other, the part of the positions PG where the exposed portions EG1 and EG2 overlap each other and the part of the positions PB where the exposed portions EB1 and EB2 overlap each other is resulted from the exposures of the photoresist layer 12 carried out twice with the light at the angles of incident different from each other, and therefore the width DX is made larger compared with a case where the exposure of the photoresist layer 12 in each of the position PR, PG and PB is carried out once. Consequently, each of the photoresist stripes 12' on the glass panel 11 is formed with a relatively large width and provided with longitudinally extending edge portions each superior in linearity.

For the exposure of the photoresist layer 12 as described above, it is possible to use, in place of the light controlled to have the intensity distribution shown with the curve A2 or A3 in Fig. 6, a light which is controlled to have intensity distribution shown with a curve A5 provided with shoulder portions in Fig. 7. The exposures of the photoresist layer 12 carried out twice with such a light at the angles of incident different from each other can provide the same effect and advantages as aforementioned.

Next, black material 16, for example, a water glass containing carbon mixed therewith is applied on the photoresist stripes 12' and partial areas of the glass panel 11 where the photoresist stripe 12' is

not present and dried so that the photoresist stripes 12' and the partial areas of the glass panel 11 where the photoresist stripe 2' is not present are covered with the black material 16, as shown in Fig. 4E.

Then, the photoresist stripes 12' covered with the black material 16 are subjected to a periodic acid (HIO_4) treatment or the like and each of the photoresist stripes 12' is removed from the glass panel 11 together with the black material 16 covering it. The black material 16 covering the partial areas of the glass panel 11 remains to form a plurality of carbon stripes 16' as black stripe portions on the glass panel 11, as shown in Fig. 4F.

Since each of the carbon stripes 16' is determined in width by the black material 16 remaining on the glass panel 11, the carbon stripe 16' is provided with a relatively small width. Further, since each of longitudinally extending edge portions of the carbon stripe 16' is shaped with the longitudinally extending edge portion of the photoresist stripe 12', the carbon stripe 16' is provided with superiorly linear longitudinally extending edge portions.

After that, the red phosphor stripes for producing red fluorescence upon excitation by the electron beam, the green phosphor stripes for producing green fluorescence upon excitation by the electron beam and the blue phosphor stripes for producing blue fluorescence upon excitation by the electron beam are affixed to the portions of the glass panel 11 between each adjoining pair of the carbon stripes 16' to complete the phosphor screen.

Each of the red, green and blue phosphor stripes is put between each adjoining pair of the carbon stripes 16' each provided with superiorly linear longitudinally extending edge portions. Accordingly, the phosphor screen of the color cathode ray tube on which clear color

images with superior contrast can be displayed is obtained.

Although, in the embodiment mentioned above, the photoresist layer 12 is exposed in each of the positions PR, PG and PB twice to the light 15R and the light 15R', the light 15G and the light 15G' or the light 15B and the light 15B' passing through the slit 14 of the aperture grill 13 in the different two directions, respectively, it is possible to cause the photoresist layer 12 to be exposed in each of the positions PR, PG and PB more than twice to the light passing through the slit 14 of the aperture grill 13 in more than two different directions, respectively.

Further, although the aperture grill is employed as the photomask in the embodiment mentioned above, the present invention is applicable also to a color cathode ray tube in which a photomask other than the aperture grill, for example, a so-called shadow mask or tension mask is employed.

As described above, with the method according to the present invention, each of longitudinally extending edge portions of each photoresist stripe on the glass panel is shaped with the portion of the photoresist layer which is virtually exposed to the light having the steep slope in intensity variations and therefore the photoresist stripes each having its longitudinally extending edge portions superior in linearity can be obtained by means of such an easy measure as moving the light source for emitting the light to which the photoresist layer is exposed. As a result, each of the black stripe portions formed on the glass panel is provided with longitudinally extending edge portions which are superiorly linear. Accordingly, with the method according to the present invention, a phosphor screen of a color cathode ray tube in which an aperture grill of fine pitch is employed can be formed with

superior uniformity.



WHAT IS CLAIMED IS :

1. A method of forming a phosphor screen of a color cathode ray tube comprising the steps of;

forming a photoresist layer on a glass panel,

causing a plurality of first positions on the photoresist layer to be exposed to light passing through a photomask in a first direction and another light passing through the photomask in a second direction different from the first direction,

causing a plurality of second positions on the photoresist layer to be exposed to light passing through the photomask in a third direction and another light passing through the photomask in a fourth direction different from the third direction,

causing a plurality of third positions on the photoresist layer to be exposed to light passing through the photomask in a fifth direction and another light passing through the photomask in a sixth direction different from the fifth direction,

causing the photoresist layer exposed to the light to be developed and then removing from the glass panel portions of the photoresist layer where light exposure has not reached a predetermined amount to form a plurality of remaining photoresist portions,

applying black material on the remaining photoresist portions and partial areas of the glass panel where the remaining photoresist portion is not present,

removing from the glass panel the remaining photoresist portions together with the black material applied thereon to form black portions with the black material remaining on the glass panel, and

forming a plurality of color phosphor portions on partitioned



portions of the glass panel between each adjoining pair of the black portions.

2. A method according to claim 1, wherein said first positions on the photoresist layer are exposed to the light emitted from a movable light source arranged at a first light source position to pass through the photomask in the first direction and then further exposed to the light emitted from the movable light source having been shifted to be arranged at a second light source position to pass through the photomask in the second direction, said second positions on the photoresist layer are exposed to the light emitted from a movable light source arranged at a third light source position to pass through the photomask in the third direction and then further exposed to the light emitted from the movable light source having been shifted to be arranged at a fourth light source position to pass through the photomask in the fourth direction, and said third positions on the photoresist layer are exposed to the light emitted from a movable light source arranged at a fifth light source position to pass through the photomask in the fifth direction and then further exposed to the light emitted from the movable light source having been shifted to be arranged at a sixth light position to pass through the photomask in the sixth direction.

3. A method according to claim 1, wherein said first positions on the photoresist layer are further exposed to light passing through the photomask in a direction other than the first and second directions.

4. A method according to claim 1, wherein said first positions on the photoresist layer are further exposed to light passing through the



photomask in a direction other than the first and second directions, and said second positions on the photoresist layer are further exposed to light passing through the photomask in a direction other than the third and fourth directions.

5. A method according to claim 1, wherein said first positions on the photoresist layer are further exposed to light passing through the photomask in a direction other than the first and second directions, said second positions on the photoresist layer are further exposed to light passing through the photomask in a direction other than the third and fourth directions, and said third positions on the photoresist layer are further exposed to light passing through the photomask in a direction other than the fifth and sixth directions.