

PATENT SPECIFICATION

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(54) EXPOSURE DEVICE FOR THE MANUFACTURE OF
 DISPLAY SCREENS OF COLOUR TELEVISION DISPLAY
 TUBES AND DISPLAY TUBE MANUFACTURED BY MEANS
 OF SUCH A DEVICE

(71) We, PHILIPS ELECTRONIC
 AND ASSOCIATED INDUSTRIES
 LIMITED, of Abacus House, 33 Gutter Lane,
 London, EC2V 8AH, a British Company, do
 hereby declare the invention, for which we
 pray that a patent may be granted to us, and
 the method by which it is to be performed,
 to be particularly described in and by the
 following statement:—

The invention relates to an exposure device
 for the manufacture of display screens of
 colour television display tubes, comprising a
 light source for exposing a photosensitive
 layer on a support for the display screen and
 a filter for correcting the light distribution on
 the support, said filter being discontinuous
 and consisting of a transparent plate which
 is provided with a large number of discrete
 opaque regions.

The display screen of a colour television
 display tube can be manufactured by provid-
 ing a layer of a photosensitive phosphor sus-
 pension on the inside of a glass face plate
 portion and exposing said layer via a mask
 according to a given pattern. After develop-
 ing the exposed layer, a pattern of phosphor
 regions is formed. This method is then re-
 peated at least once to provide a pattern of
 phosphor regions which luminesce in a
 different colour.

In such a method, an exposure device is
 used which comprises a suitable light source
 and on which the face plate portion with the
 photosensitive layer is accommodated. Such
 an exposure device comprises generally also a
 correction lens to correct the virtual position
 of the light source with respect to the face
 plate portion, as well as a filter to correct the
 light intensity distribution on the face plate
 portion. Without the use of a filter, the light
 intensity distribution on the face plate portion
 will not be such that in any place the phos-
 phor regions have the correct dimensions and
 adhere sufficiently to the support. In general

the light intensity distribution should be uni-
 form, although certain deviations from said
 uniformity are necessary in order to be able
 to vary the dimensions of the phosphor regions
 dependent on the place on the display screen.
 The transmission characteristic of the filter
 therefore depends on the requirements which
 are imposed upon the display screen, on the
 properties of the light source and on the cor-
 rection lens used. In general the transmission
 characteristic of the filter will be non-uniform.

An exposure device of the kind mentioned
 in the first paragraph is known from German
 Offenlegungsschrift 24.40.575. This discloses
 a filter which consists of a transparent plate
 having a large number of opaque regions of
 small dimensions. The opaque regions are, for
 example, punctiform. The transmission of the
 filter is varied by varying the number of
 opaque regions per surface unit of their dimen-
 sions.

Other known and so far even generally used
 filters consist of a transparent plate having
 a vapour-deposited metal layer the thickness
 of which and hence the light transmission
 varies. The manufacture of such filters, how-
 ever, presents quite a few difficulties in con-
 nection with the required accuracy.

According to the invention, in an exposure
 device of the kind described in the first para-
 graph the discrete opaque regions of the filter
 are formed by a large number of substantially
 parallel linear regions the width of which
 varies.

Such a filter can be simple to manufacture
 because the desired variation of the trans-
 mission of the filter along an arbitrary line
 is known. The variation of the transmission
 along a large number of parallel lines then
 determines directly the width of the linear
 opaque regions of the filter. Of course, the
 pitch between the linear regions should be
 considered.

Particularly good results are obtained when

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the light source is elongate and the smallest angle between the longitudinal direction of the light source and the longitudinal direction of the opaque regions is at least 30° and preferably substantially 90°.

An embodiment of the invention will be described in greater detail by way of example with reference to the accompanying diagrammatic drawing, of which

Figure 1 shows an exposure device and

Figure 2 gives an example of a discontinuous filter.

The exposure device shown in Figure 1 comprises a housing 1 on which a combination 2 of a face plate portion 3 and a shadow mask 4 for a colour television display tube to be manufactured is accommodated. The face plate portion 3 has a layer 5 consisting of a photosensitive phosphor. The layer 5 is exposed via the apertures 6 in the shadow mask 4 to form phosphor regions corresponding to the apertures 6.

Within the housing 1 the exposure device comprises a light source 7, a filter 8 and a correction lens 9. The filter 8 serves to obtain the desired light intensity distribution on the layer 5 and the correction lens 9, as is known, to adapt the virtual position of the light source 7 to the deflection point of the electron beams in the operating colour television display tube.

The filter 8 consists of a transparent glass plate 10 on which a large number of discrete opaque regions 11 are provided. The regions 11 which are shown diagrammatically only in Figure 1 are linear. The longitudinal direction of the regions 11 is perpendicular to the plane of the drawing of Figure 1. The longitudinal direction of the light source 7 is parallel to the plane of the drawing of Figure 1, so that the longitudinal direction of the regions 11 is at right angles to the longitudinal direction of the light source 7. It is not essential that these two directions are at right angles, but preferably the angle between them should be not less than 30 degrees. Alternatively, the light source could, for example, be punctiform.

Figure 2 shows the negative which is used for the manufacture of the filter 8. The required variation of the light transmission of the filter is dependent entirely on the design of the colour television display tube and may differ for each individual case. The variation of the light transmission of the filter chosen as an example appears from the inspection of Figure 2. The pitch or spacing of the lines 11, see Figure 1, is 1 mm. The line width varies from 0.01 mm to 0.90 mm so that the light transmission varies from substantially

100% to 10%. The distance between the filter 8 and the light source 7 is 60 mm. The effectively used length of the light source 7 is 24 mm. As a result of the line structure of the filter 8, a small modulation of light intensity distribution on the layer 5 is obtained. This modulation has a wavelength of approximately 5 mm. Since the difference between the largest and the smallest light intensity as a result of said modulation is only 3% of the average light intensity in a given place, no disadvantage is experienced from said modulation. The data stated relate to the manufacture of display tube having a picture diagonal of 66 cm. If for other tubes said modulation would be disadvantageous, it can simply be halved by halving the pitch of the lines 11.

A filter embodying the invention can be manufactured by means of an optical drawing machine. In such a drawing machine, a numerically controlled light beam describes the desired lines on a photosensitive negative for the filter. The local width of each line follows directly from the pitch of the lines multiplied by the desired local light transmission. A contact print is then made from the negative on a glass plate.

WHAT WE CLAIM IS:—

1. An exposure device for the manufacture of display screens of colour television display tubes, comprising a light source for exposing a photosensitive layer on a support for the display screen and a filter for correcting the light distribution on the support, said filter being discontinuous and consisting of a transparent plate which is provided with a large number of discrete opaque regions, characterized in that the discrete opaque regions of the filter are formed by a large number of substantially parallel linear regions the widths of which vary.

2. An exposure device as claimed in Claim 1, characterized in that the light source is elongate and the smallest angle between the longitudinal direction of the light source and the longitudinal direction of the opaque regions is at least 30°.

3. An exposure device as claimed in Claim 2, characterized in that the longitudinal direction of the light source and the longitudinal direction of the opaque regions cross each other substantially at right angles.

4. An exposure device substantially as herein described with reference to the drawing.

5. A colour television display tube manufactured by means of an exposure device as claimed in any preceding Claim.



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