

[54] EXPOSURE DEVICE FOR
MANUFACTURING COLOUR PICTURE
TUBES

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[52] U.S. Cl. 95/1

[51] Int. Cl. G03b 27/16

[58] Field of Search 95/1

[56] References Cited
UNITED STATES PATENTS
3,279,340 10/1966 Ramberg..... 95/1

2,568,448 9/1951 Hansen 95/1
3,601,018 8/1971 Lange 95/1

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Chittick, Thompson & Pfund

[57] ABSTRACT

In an exposure device for manufacturing a colour picture tube of the type comprising a source of light, and a correction lens having an effective surface divided into a plurality of discontinuous regions surrounded by boundary lines and disposed between the panel of the tube and the source of light whereby the photosensitive film coated on the inner surface of the panel is exposed to the light emanating from the source and transmitted through the correction lens to form a fluorescent screen, there is provided means for the correction lens for restricting the light transmitted through the discontinuous regions thereby uniformly exposing the photosensitive film.

7 Claims, 6 Drawing Figures

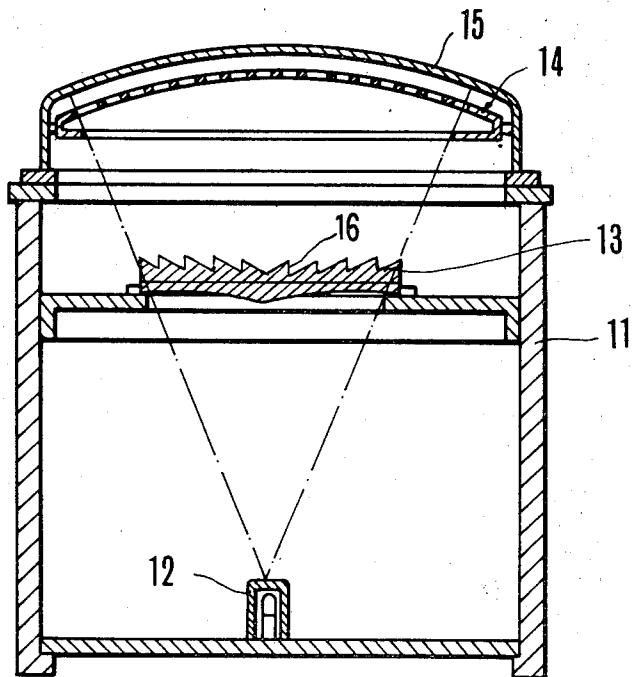


FIG. 1

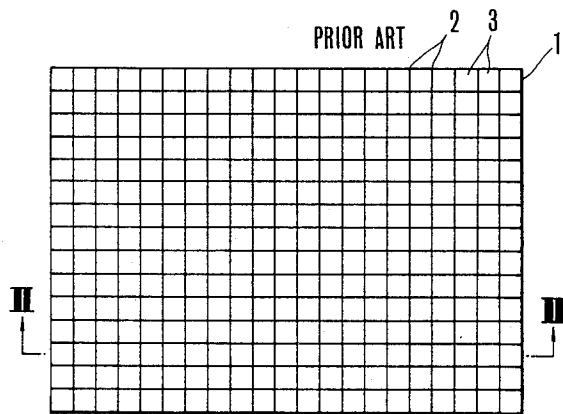


FIG. 2

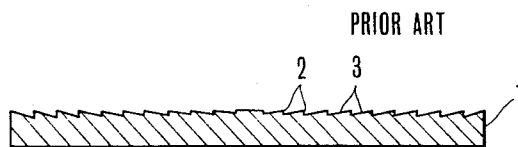


FIG. 3

PRIOR ART

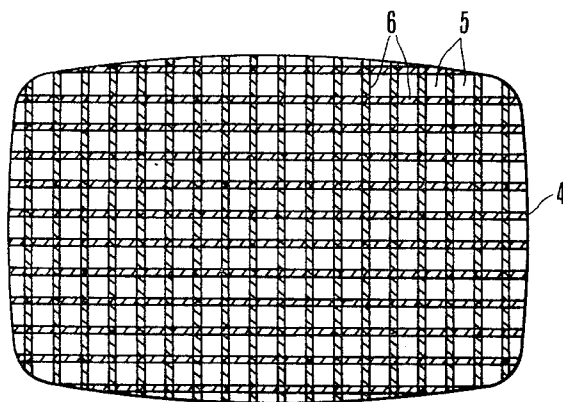


FIG. 4

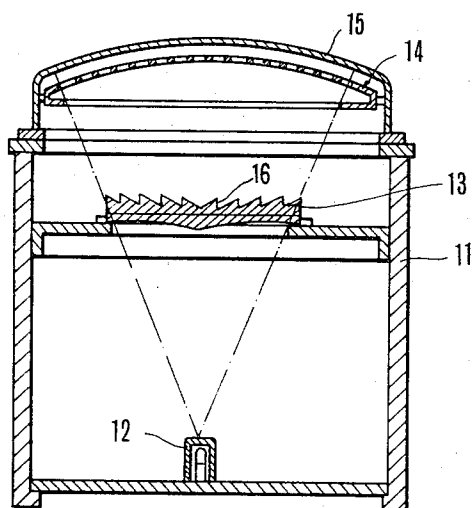


FIG. 5

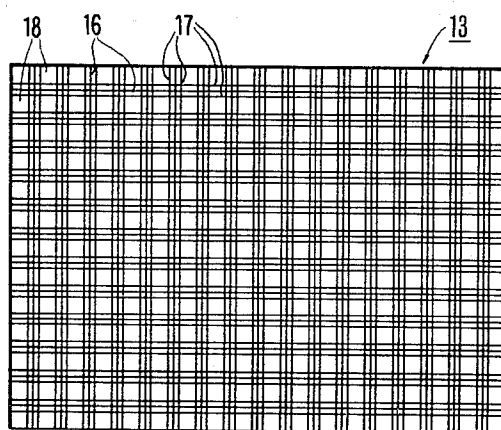
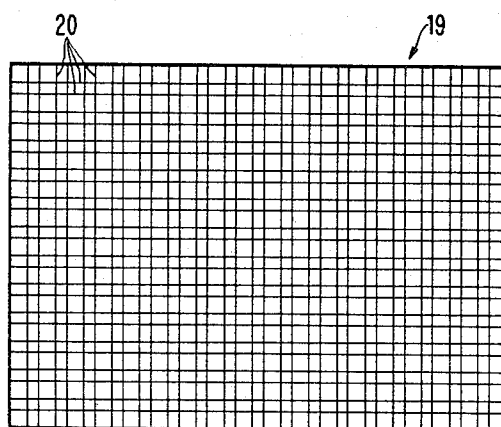


FIG. 6



EXPOSURE DEVICE FOR MANUFACTURING COLOUR PICTURE TUBES

BACKGROUND OF THE INVENTION

This invention relates to an exposure device utilized to form a fluorescent screen of a colour picture tube and more particularly to an improved correction lens system.

Generally the fluorescent screen of a colour picture tube is manufactured by applying in a regular pattern a plurality of trios of phosphor dots of three colours on the inner surface of the face plate or panel of the tube by photographic technique.

When forming the phosphor dots by photographic technique a correction lens having an extremely complicated curved surface is used for the purpose of causing the locus of the exposure light emanating from a source of light to approximate the locus of the electron beam prevailing in the completed tube.

As most of the conventional correction lenses have a continuously curved surface, with such lenses it has been impossible to perfectly approximate the locus of the exposure light with that of the electron beam. For this reason, it has been impossible to perfectly approximate the phosphor dots and the electron beam spots over the entire inner surface of the panel. As a consequence, the colour picture tube having a fluorescent screen formed with such a correction lens having a continuously curved surface has an inherent drawback of accompanying the problem of colour shading and hence poor quality of the reproduced picture.

To solve this problem, an improved correction lens has been proposed. FIG. 1 of the accompanying drawings shows a plan view of such a correction lens, FIG. 2 the cross-section thereof and FIG. 3 the panel having a fluorescent screen formed with the correction lens shown in FIGS. 1 and 2 and viewed from the exterior of the tube.

As shown by FIG. 1, the upper or effective surface of the correction lens is divided into a plurality of small rectangular regions 3 partitioned by grid shaped boundary lines 2. As shown in FIG. 2, the surface of each region is a flat or slightly curved surface inclined to the bottom surface of the lens 1 so that the upper or effective surface of the lens is a discontinuous surface and the boundary lines 2 or the portions interconnecting adjacent regions form steep vertical side surfaces. Since the flat or slightly curved surfaces and the vertical side surfaces manifest different transmission characteristics to the light transmitting through the correction lens, (boundary lines have smaller transmissibility than the rectangular regions) the fluorescent screen formed on the panel 4 with this correction lens has portions 5 corresponding to flat regions 3 and grid shaped portions 6 corresponding to boundary lines 2, portions 5 and 6 having been exposed to light of different intensities. Such grid shaped pattern caused by non-uniform exposure is seen from outside of the tube whether it is operating or not, thus degrading the quality of the reproduced picture.

SUMMARY OF THE INVENTION

It is an object of this invention to provide an improved exposure device capable of uniformly exposing the photosensitive film coated on the inner surface of the panel of a colour picture tube thereby providing a colour picture tube capable of reproducing pictures of

excellent quality even when the photosensitive film is exposed to the light transmitting through a correction lens having a surface divided into a plurality of regions by means of boundary lines having smaller transmissibility than the divided regions.

According to this invention there is provided an exposure device for manufacturing a colour picture tube of the type comprising a source of light and a correction lens having an effective surface divided into a plurality of discontinuous regions surrounded by boundary lines and disposed between the panel of the tube and the source of light whereby the photosensitive film coated on the inner surface of the panel is exposed to the light emanating from the source and transmitted through the correction lens to form the dot pattern of a fluorescent screen, characterized in that means is associated with the correction lens for restricting the light transmitted through the discontinuous regions thereby uniformly exposing the photosensitive film.

The means for restricting the light may be comprised by a check pattern of opaque substance applied on the discontinuous regions of the correction lens or on the surface of a transparent substrate combined with the correction lens.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings;

FIG. 1 shows a plan view of a prior art correction lens utilized in the exposure device;

FIG. 2 shows a cross-sectional view of the correction lens shown in FIG. 1 taken along a line II — II;

FIG. 3 shows a front view of the panel of a colour picture tube having a fluorescent screen formed by using the correction lens shown in FIGS. 1 and 2;

FIG. 4 shows a longitudinal sectional view of one example of the exposure device embodying the invention;

FIG. 5 is a plan view of a correction lens utilized in the exposure device shown in FIG. 4 and

FIG. 6 shows a plan view of a filter utilized in a modified exposure device.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 4 shows one example of the exposure device 11 embodying the invention. As shown, the exposure device 11 comprises a source of light 12, and a correction lens 13 utilized for the purpose of causing the locus of the light emanating from the source of light 12 and transmitted through the correction lens 13 to approximate the locus of the scanning electron beam of the completed colour picture tube. The panel 15 of the tube provided with a shadow mask 14 is mounted on the upper end of the exposure device 11. The inner surface of the panel 15 is coated with photosensitive film which is exposed to the light emanating from the source of light and transmitting through the correction lens 13 and the shadow mask 14 so as to form the dot pattern of a fluorescent screen of a prescribed pattern.

In accordance with this invention, in addition to the boundary lines 16 which correspond to the boundary lines 2 shown in FIG. 1, there are formed a plurality of lines 17 of opaque substance which are drawn horizontally and vertically in parallel with the grid shaped boundary lines 16. Thus, an opaque grid shaped pattern is distributed uniformly over the effective surface of the correction lens.

When the photosensitive film coated on the inner surface of the panel 15 is exposed to the light transmitted through regions 18 of this improved correction lens, the dark portions formed by the opaque lines 17 on the correction lens 13 and the dark portions formed by the boundary lines 16 between the divided rectangular regions will be distributed uniformly across the entire area of the exposed photosensitive film, thus making substantially uniform the intensity of the exposure light. Thus, it is possible to eliminate dark stripes corresponding to the dark boundary lines of the prior art correction lens shown in FIG. 3. In this manner, with the exposure device of this invention it is possible to uniformly expose the photosensitive on the panel thereby producing a colour picture tube of uniform appearance and capable of reproducing pictures of excellent quality.

FIG. 6 shows a plan view of a filter 19 utilized in a modified embodiment of this invention. The filter 19 comprises a transparent substrate of glass or the like on which are applied a plurality of longitudinal and transverse lines 20 of opaque substance which intersect at right angles to form a check pattern. The filter is combined with the conventional correction lens shown in FIGS. 1 and 2 to form a correction lens system which is used to expose the photosensitive film coated on the inner surface of the panel. It will be clear that this correction lens system operates in the same manner as the correction lens shown in FIG. 5.

Although in the foregoing embodiments the check patterns were formed by applying a plurality of longitudinal and transverse lines of opaque substance on the surface of the correction lens or filter, it should be understood that the same object can also be accomplished by forming straight lines that restrict transmission of light on the surface of the correction lens or filter as by applying lines of translucent substance or cutting straight grooves in the form of a check pattern.

As above described, the invention provides an improved exposure device that can uniformly expose the photosensitive film on the face plate of a colour picture tube thereby reproducing pictures of excellent quality.

Although the invention has been shown and described in terms of some preferred embodiments thereof it will be clear that many changes and modifications will be obvious to one skilled in the art without departing from the true spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. In an exposure device for manufacturing a colour

picture tube of the type comprising a source of light, and a correction lens having an effective surface divided by boundary lines in the form of steep surface discontinuities into a plurality of discontinuous regions surrounded by said boundary lines, said lens disposed between the panel of said tube and said source of light whereby the photosensitive film coated on the inner surface of said panel is exposed to the light emanating from said source and transmitted through said correction lens to form the dot pattern of a fluorescent screen, the improvement which comprises line means associated with said correction lens and positioned on opposite sides of each of said boundary lines and spaced therefrom for restricting the light transmitted through said discontinuous region to thereby substantially uniformly expose said photosensitive film.

2. The exposure device according to claim 1 wherein the surface of said corrective lens is divided into a plurality of rectangular regions by means of grid shaped boundary lines having smaller light transmissibility than said rectangular regions and wherein said line means comprises a check pattern displaced from said grid shaped boundary lines.

3. The exposure device according to claim 2 wherein said check pattern comprises a plurality of lines of opaque substance applied on the surface of said rectangular regions and intersecting each other at right angles in said regions.

4. The exposure device according to claim 2 wherein said check pattern comprises a plurality of straight grooves formed on the surface of said rectangular regions and intersecting each other at right angles in said regions.

5. The exposure device according to claim 2 wherein said line means comprises a filter combined with said correction lens, said filter including a transparent substrate and said check pattern formed and positioned on said transparent substrate for restricting the light transmitted through said transparent substrate and through said rectangular regions of said correction lens.

6. The exposure device according to claim 5 wherein said check pattern comprises a plurality of lines of opaque substance applied on the surface of said substrate and intersecting each other at right angles.

7. The exposure device according to claim 5 wherein said check pattern comprises a plurality of straight grooves formed on the surface of said substrate and intersecting each other at right angles.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,788,200 Dated January 29, 1974
Inventor(s) Eiichi Yamazaki, Koichi Maruyama,
Toshio Ueda

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In "[75] Inventors:" correct the spelling of the name "Eiich" to -- Eiichi --.

Column 1, line 66, "photensensitive" should be
-- photosensitive --.

Column 3, line 14, after "photosensitive" insert -- film --.

Column 4, line 15, "region" should be -- regions --.

Signed and sealed this 24th day of September 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

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