

SPECIFICATION

Colour display tube and screen therefor

The invention relates to a display window for a colour display tube and to a colour display tube.

- 5 Generally a colour display tube comprises in an evacuated envelope means to generate at least one electron beam and a display screen comprising a large number of elements luminescing in different colours and surrounded by
10 a light-absorbing coating, the display screen being coated with a metal film.

- The luminescent elements usually constitute a large number of triplets of phosphor dots or lines, the elements of each triplet each representing the
15 three basic colours red, green and blue. Present between the lines or dots is the light-absorbing coating which is sometimes termed matrix coating and which usually consists of black-coloured manganese oxide and/or iron oxide so that the
20 contrast of the image obtained by the luminescing phosphor dots or lines is increased. Before the display screen, a colour selection electrode is positioned which has a very large number of circular or slot-shaped apertures which are
25 positioned with respect to the triplets in such manner that the electron beam associated with one basic colour also impinges only on the phosphor elements of said colour. The light-absorbing coating possibly absorbs the electrons
30 not impinging on the phosphor regions and serves as a landing area therefor. A thin metal film, for example an aluminium film, is usually provided over the luminescent elements and the light-absorbing coating, which film serves as an
35 electrode and also contributes to the image brightness due to its light reflection.

- Such a colour display tube is disclosed in United States Patent Specification 3,890,527 in which a thin metal film which adheres to the
40 phosphor elements is provided over the whole display screen.

- As is known, first a lacquer solution, for example a collodion solution, is provided over the luminescent elements and the matrix coating prior
45 to providing the metal film. After a drying process, an even film of lacquer is obtained. In the so far known display tubes, particles of the luminescent elements project more or less through said film of lacquer. After vapour-depositing the metal film
50 and removing the film of lacquer by heating, the metal film adheres to the luminescent elements. Since the luminescent elements project at least partly through the metal film and interrupt same and make it irregular, the light reflection decreases
55 at the areas where the adhesion of the metal film to the luminescent elements takes place. This effect does not occur uniformly all over the display screen so that the picture brightness is not even throughout the display screen.

- 60 Measurements have demonstrated that the light reflection of an aluminium film provided in this manner was not optimum and in addition was not equally strong throughout the display screen.

According to one aspect of the present

- 65 invention there is provided a display window for a colour display tube, comprising an optically transparent member having on one surface thereof a plurality of elements which luminesce in different colours, the elements being separated by
70 a light absorbing coating having a thickness at least $3\mu\text{m}$ greater than that of the luminescent elements, and a metal film convering the elements and the light absorbing coating, which metal film adheres mainly to the light absorbing coating.

- 75 According to another aspect of the invention there is provided such a colour display tube comprising in an evacuated envelope, means to generate at least one electron beam, a display screen comprising a large number of elements
80 luminescing in different colours and surrounded by a light-absorbing coating, the elements and the light absorbing coating being covered with a metal film, wherein the thickness of the light-absorbing coating is at least $3\mu\text{m}$ larger than the thickness of
85 the luminescent elements which metal film adheres mainly to the light absorbing coating.

- In the present specification and claims by "thickness" is to be understood to mean the average thickness. By the metal film adhering
90 mainly to the light-absorbing coating, the above-mentioned effects which are detrimental to the reflection do not occur and the overall brightness and the uniformity of the brightness are increased.

- The light-absorbing coating may be composed
95 of a material containing grains, at least 50% by weight of said grains having a diameter exceeding $15\mu\text{m}$. The diameter of a grain is to be understood to mean in the present specification and claims always the average diameter, which
100 means that the diameter of a given grain is equal to the diameter of a spherical grain of the same material and the same weight. In the known tubes of this type the grains always used had a diameter of approximately $1\mu\text{m}$. By using coarse grains it
105 proves to be easier to provide a light-absorbing coating which is at least $3\mu\text{m}$ thicker than the thickness of the luminescent elements as compared to using the usual grains having a diameter of approximately $1\mu\text{m}$. Another
110 advantage of the use of larger grains is that they will not readily penetrate into cracks and pits which may be present in the luminescent elements. The penetration of the light-absorbing material in cracks and pits in the luminescent
115 elements causes disturbing black stripes and dots in the displayed picture.

- The display screens are manufactured by means of known photographic or electrophotographic methods. It is possible first to
120 provide the light-absorbing coating, for example in the form of a pattern of lines and then to provide the luminescent elements therebetween. It is alternatively possible first to provide the luminescent elements and only then the light-absorbing coating.

- 125 The present invention will now be explained and described, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view, partly broken away,

of a colour display tube,

Fig. 2 is an elevation of a part of the display screen and the colour selection electrode,

Fig. 3 is a diagrammatic sectional view of a part of a display screen having a thicker light absorbing coating, and

Fig. 4 is a diagrammatic sectional view of a part of a known display screen.

Fig. 1 is a perspective view of a colour display tube. A glass envelope 1 comprising a display window 2, a conical part 3 and a neck 4, includes three electron guns 5, 6 and 7 to generate three electron beams 8, 9 and 10. The electron beams pass through apertures 11 in a colour selection electrode 12 and impinge upon a large number of triplets of phosphor lines 14, 15 and 16 together constituting the display screen. The red (R) phosphor line 14, the green (G) phosphor line 15 and the blue (B) phosphor line 16 are separated in this illustrated embodiment case by a black light-absorbing coating 17 of a mixture of manganese oxide and iron oxide. An 0.3 μm thick aluminium film 13 is provided over said coating and the phosphor lines in the usual manner by vapour deposition. The aluminium film 13 adheres mainly to the light-absorbing coating 17 which, as already described, contributes to a great brightness and uniformity of the displayed television picture. How the coating 17 makes this contribution will be described hereinafter with reference to the following figures. The three electron beams 8, 9 and 10 make a small angle with each other, the so-called colour selection angle, and thus each impinge only on phosphor lines of one colour. For example, the electron beam 10 always impinges only on phosphor lines 14. The deflection of the electron beams takes place in the usual manner by means of deflection coils (not shown).

Fig. 2 shows a part of the display window 2 with display screen and a part of the colour selection electrode 12. A part of the 0.3 μm thick aluminium film 13 has been omitted so that the phosphor lines 14, 15 and 16 with the inbetween the light-absorbing coating 17 consisting of manganese oxide and iron oxide are visible. In this embodiment the phosphor lines are approximately 10 μm thick and 200 μm wide and the light-absorbing coating 17 is approximately 15 μm thick and 70 μm wide and is composed of coarse grains. The coarse grains ensure a sufficiently thick coating. The smaller grains ensure a filling of the spaces between the coarse grains. It will be obvious that the phosphor lines and paths of light-absorbing coating may also have different widths or may vary in width over the display screen.

Fig. 3 is a diagrammatic sectional view of a part of a display screen as used in a colour display tube. In this embodiment the 0.3 μm thick aluminium film adheres mainly to the light-

absorbing coating 17 and does not adhere or adheres hardly to the phosphors 14, 15 and 16.

The light-absorbing coating 17 in this case consists mainly of manganese oxide and iron oxide grains, the diameter of 50% by weight of the grains exceeding 15 μm .

Fig. 4 is a diagrammatic sectional view of a part of a known display screen. For clarity, the same reference numerals are used in Fig. 4 for corresponding components as in Fig. 3. In the display screens used so far the matrix coating was substantially equally as thick as or less thick than, the phosphor lines, as appears, for example, from the already mentioned United States Patent Specification 3,890,527. As a result of this the aluminium film 13 adheres mainly to the phosphors. This adhesion involves that unevennesses 18 in the phosphors project through the aluminium film 13. A consequence thereof is that a part of the light generated in the phosphors is lost since it is not reflected by the aluminium foil. This adhesion is not uniform throughout the display screen so that a picture is formed which is not equally bright everywhere.

By using a thicker matrix coating (Figure 3) the metal film mainly adheres to the light-absorbing coating and thereby said detrimental effects are avoided.

90 CLAIMS

1. A display window for a colour display tube, comprising an optically transparent member having on one surface thereof a plurality of elements which luminesce in different colours, the elements being separated by a light absorbing coating having a thickness at least 3 μm greater than that of the luminescent elements, and a metal film covering the elements and the light absorbing coating, which metal film adheres mainly to the light absorbing coating.

2. A display window as claimed in Claim 1, wherein the light absorbing coating is a granular material and at least 50% by weight of the grains have a diameter exceeding 15 μm .

3. A display window substantially as hereinbefore described with reference to and as shown in Figure 3 of the accompanying drawings.

4. A colour display tube comprising in an evacuated envelope, means to generate at least one electron beam, a display screen comprising a large number of elements luminescing in different colours and surrounded by a light-absorbing coating, the elements and the light absorbing coating being covered with a metal film, wherein the thickness of the light-absorbing coating is at least 3 μm larger than the thickness of the luminescent elements, which metal film adheres mainly to the light absorbing coating.

5. A colour display tube as claimed in Claim 4, wherein the material from which the light-absorbing coating is composed comprises grains,



of a colour display tube.

Fig. 2 is an elevation of a part of the display screen and the colour selection electrode,

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Fig. 4 is a diagrammatic sectional view of a part of a known display screen.

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By using a thicker matrix coating (Figure 3) the metal film mainly adheres to the light-absorbing coating and thereby said detrimental effects are avoided.

90 CLAIMS

1. A display window for a colour display tube, comprising an optically transparent member having on one surface thereof a plurality of elements which luminesce in different colours, the elements being separated by a light absorbing coating having a thickness at least 3 μm greater than that of the luminescent elements, and a metal film covering the elements and the light absorbing coating, which metal film adheres mainly to the light absorbing coating.

2. A display window as claimed in Claim 1, wherein the light absorbing coating is a granular material and at least 50% by weight of the grains have a diameter exceeding 15 μm .

3. A display window substantially as hereinbefore described with reference to and as shown in Figure 3 of the accompanying drawings.

4. A colour display tube comprising in an evacuated envelope, means to generate at least one electron beam, a display screen comprising a large number of elements luminescing in different colours and surrounded by a light-absorbing coating, the elements and the light absorbing coating being covered with a metal film, wherein the thickness of the light-absorbing coating is at least 3 μm larger than the thickness of the luminescent elements, which metal film adheres mainly to the light absorbing coating.

5. A colour display tube as claimed in Claim 4, wherein the material from which the light-absorbing coating is composed comprises grains,



at least 50% by weight of the said grains having a diameter exceeding $15\text{ }\mu\text{m}$.

6. A colour display tube substantially as

hereinbefore described with reference to and as shown in Figure 1 to 3 of the accompanying drawings.

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