CATHODE RAY TUBE HAVING METALLIC LAYER OF NON-UNIFORM THICKNESS

Inventors:
Yasumitsu Watanabe
Takaji Inoue

by Kiep Sherman, Baroni, Cross, & Simpson Attys.
ABSTRACT OF THE DISCLOSURE

A cathode ray tube of the post deflecting and focusing type is provided with a metal layer coated on the inner surface of the phosphor screen thereof, which metal layer has a greater thickness at the peripheral portions of the screen than the thickness thereof at the central portion of the screen.

This invention relates generally to a cathode ray tube and more particularly to a post deflecting and focusing (PDF) type cathode ray tube.

In ordinary cathode ray tubes a metallic layer which is over-laid on a fluorescent screen is provided with a uniformity in its thickness. As a result of the thickness uniformity, brightness of the fluorescent screen is substantially constant over the entire area thereof.

However, in cathode ray tubes, such as a chromatron-type cathode ray tube having a grid for post deflecting and focusing action disposed in spaced relation to the screen, some emitted electrons from the electron gun will impinge upon the grid structure causing emission of secondary electrons therefrom. The probability that the emitted electrons will impinge upon the grid increases at the peripheral portions where incidence angles of electron beams are large with respect to the grid structures, and hence, secondary electrons from the grid inevitably increase greatly. Accordingly, when the thickness of the metal back layer on the fluorescent screen has been made uniform, a so-called "color running" occurs at the peripheral portions of the screen. This effect is particularly noticeable at the two sides of a cathode ray tube forming vertical areas of "color running." This means that the contrast ratio is reduced which depends upon the primary electron, namely the scanning electron beam and the secondary electron.

A principal object of this invention is to provide a PDF-type cathode ray tube.

Another object of this invention is to provide a PDF-type cathode ray tube in which the aforementioned "color-running" or "fog" at the peripheral portions of the screen may effectively be avoided.

A further object of this invention is to provide an improved color cathode ray tube.

Other objects, features and advantages of this invention will be apparent from the following detailed description when taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a graph illustrating the transmission factor through a metallic layer in relation to the electron energy and layer thickness;

FIGURE 2 is a sectional side elevational view schematically illustrating a preferred embodiment of a PDF-type cathode ray tube according to this invention; and

FIGURE 3 is a partial sectional view of one corner portion of the cathode ray tube illustrated in FIGURE 1.

Like reference numerals throughout the various views of the drawings are intended to designate the same or similar structures.

FIGURE 1 illustrates a family of curves of electron energy transmission factors, with a thickness d of a metal back layer, for example, an aluminum coating layer, as a parameter. As is readily apparent from FIGURE 1, when the thickness d of the metallic layer is relatively large, the transmission factor is small and a small energy electron beam cannot be transmitted. The present invention is intended to utilize this influence to reduce the effects due to secondary electron emission at the peripheral portions of a screen.

With reference to FIGURES 2 and 3, there is shown one preferred embodiment of the present invention. A PDF-type cathode ray tube, for example, a chromatron-type tube, generally designated with the reference numeral 1 includes a line grid 2 to which switching signals for color selection are supplied as is well known in the art. A phosphor screen 3 of the cathode ray tube 1 includes a repeating array of red, blue and green vertical stripes 4. A metallic layer 5 such as aluminum or the like is coated on the inside surface of the screen. An electron beam source such as for example an electron gun device 6 is disposed for emitting electrons therefrom. The emitted electrons are directed toward the line grid 2 as illustrated by the electron path generally designated with the reference numeral 7.

It is to be understood that in FIGURES 2 and 3, parts which have no direct relationship with respect to the explanation of the present invention, such as for example, an electron beam deflecting device and the like, are omitted for the sake of simplicity.

In the present invention, the thickness of the metallic layer 5 is different at a peripheral portion 5a than that at a central portion 5b thereof. That is, a thickness d1 of the peripheral portion 5a is made greater than a thickness d2 of the central portion 5b. The thickness of the metal back layer 5 increases gradually or with offset toward the peripheral portion thereof from the center axis of the electron beam source 6. That is, the thickness increases directly with the radial distance from the center of the tube to the periphery of the tube.

As a result of this change in thickness dimension, the transmission factor at the peripheral portion 5a of the screen 3 is reduced to prevent the secondary electrons from passing through the metal back layer 5. It must be noted that the energy of the secondary electron is generally smaller than that of the primary electron.

According to the present invention, the transmission factor of the metallic layer 5 corresponding to the peripheral portion of the grid 2 where the secondary electrons are produced at a high rate, can be controlled by varying the thickness of the layer 5. In this case, luminescence due to the secondary electron at the peripheral portion of the screen 3 is reduced, so that the contrast ratio of the primary electron, namely the scanning electron beam vs. the secondary electron at the peripheral portion may be made substantially equal to that at the central portion. Therefore, the "color running", "fog" and the like at the peripheral portion of the screen can be avoided or greatly decreased. Thus, the present invention has great advantages in providing higher quality picture representation.

One example of the present invention includes operating the cathode ray tube with a voltage of approximately 25 kilovolts on the metallic layer and an operating point of the grid at 6 kilovolts. A thickness of approximately 5,000 A, was employed for the dimension d1 and a thickness of approximately 10,000 to 15,000 A, was employed for the dimension d2.

It will be apparent that many modifications and variations may be effected without departing from the scope of the novel concept of this invention.
What is claimed is:

1. A cathode ray tube comprising
   an electron gun,
   a screen portion,
   a fluorescent material on said screen portion,
   a grid located adjacent to but spaced from said screen, and
   a metallic layer overlying said fluorescent material,
   the thickness of the metallic layer at a peripheral portion thereof being larger with respect to the thickness at a central portion thereof.

2. The cathode ray tube of claim 1 including an electron energy source of approximately 25 kilovolts connected to said metallic layer, and the thickness of the peripheral portion and the central portion of the metallic layer being in the range of approximately 10,000 Å to 15,000 Å and approximately 5,000 Å respectively.

3. A cathode ray tube comprising
   an electron gun,
   a screen portion,
   a fluorescent material on said screen portion,
   a grid located adjacent to but spaced from said screen, and
   a metallic layer overlying said fluorescent material,
   the thickness of the metallic layer at two edges thereof being larger with respect to the thickness at a central portion thereof.

4. A cathode ray tube comprising
   an electron gun,
   a screen portion,
   a fluorescent material on said screen portion,
   a grid located adjacent to but spaced from said screen, and
   a metallic layer overlying said fluorescent material, and having a thickness increasing from a central portion to a peripheral portion thereof.

5. In a cathode ray tube having an electron gun, a screen portion, a fluorescent material on said screen portion, and a grid disposed adjacent to and spaced from said screen, the improvement residing therein comprising a metallic layer overlying said fluorescent material having a thickness increasing directly with the radial distance from the center thereof.

References Cited

UNITED STATES PATENTS
2,914,691 11/1959 Evans ____________ 313—78

JOHN W. CALDWELL, Acting Primary Examiner.
T. A. GALLAGHER, R. K. ECKERT, Jr.,
Assistant Examiners.