

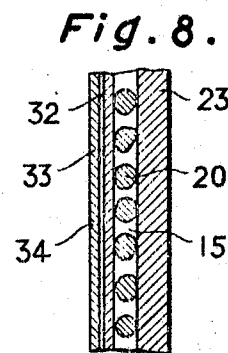
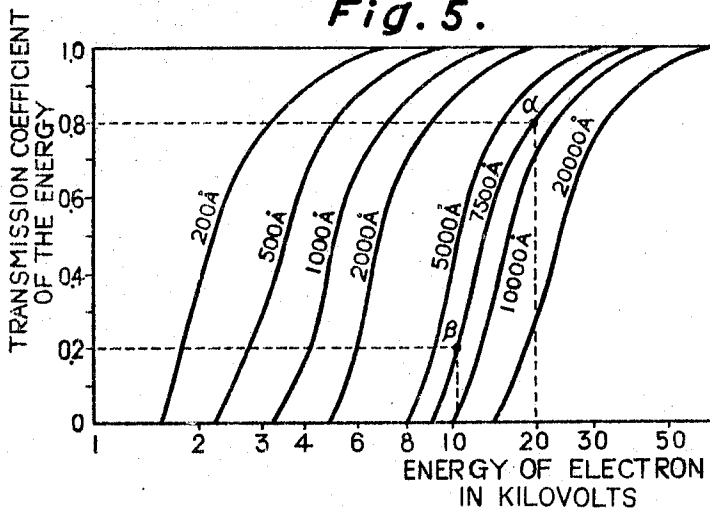
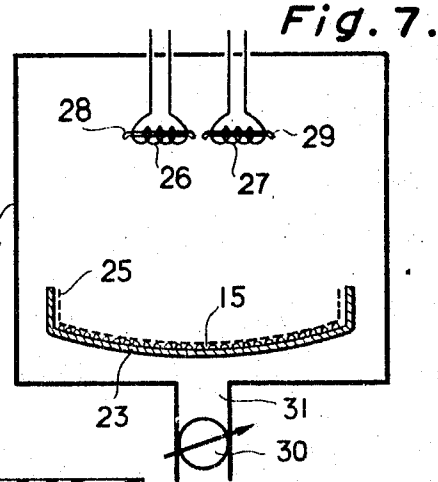
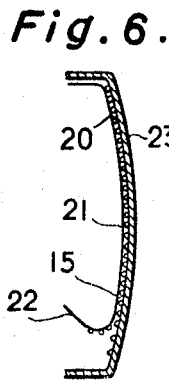
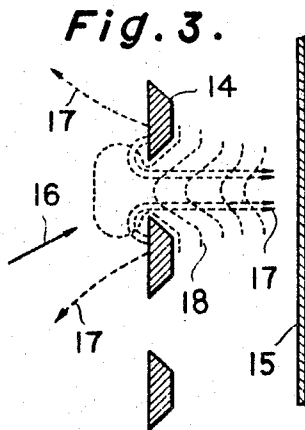
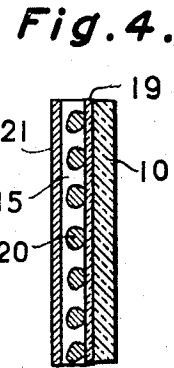
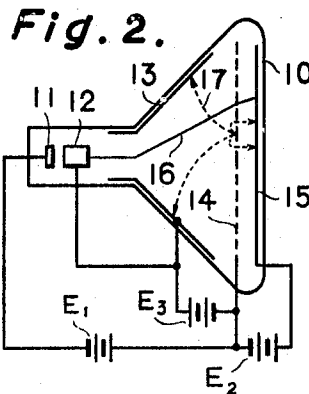
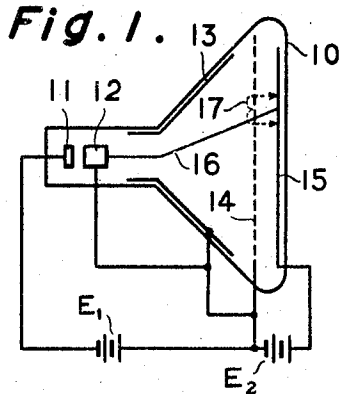
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3,454,808

COLOR TELEVISION PICTURE TUBE HAVING A FLUORESCENT SCREEN WITH
A METAL BACK OF THICKNESS TO PASS INCIDENT ELECTRONS AND TO
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3,454,808

COLOR TELEVISION PICTURE TUBE HAVING A FLUORESCENT SCREEN WITH A METAL BACK OF THICKNESS TO PASS INCIDENT ELECTRONS AND TO LIMIT THE PASSAGE OF SECONDARY ELECTRONS

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U.S. Cl. 313—92

3 Claims

ABSTRACT OF THE DISCLOSURE

A color television picture tube of the after acceleration and focusing type comprising: a fluorescent face provided with a metal back, an electron gun and a focusing perforated electrode for accelerating and focusing electron beams emitted from the electron gun onto the fluorescent face. The metal back has a thickness through which at least 80 percent of the incident electron beams emitted from the electron gun pass and no more than 20 percent of the incident secondary electron beams generated by the bombardment of the electron beams emitted from the electron gun against the electrode pass.

This invention relates to a color television picture tube, and more particularly to a color television picture tube having a focusing electrode.

Such color television picture tubes sometimes use a grid type focusing electrode comprising a plurality of lead wires provided in parallel with each other vertically or horizontally (such as of a Chromatron tube), or a plate type focusing electrode comprising an iron plate having a plurality of circular holes (such as of a shadow mask type picture tube). These color television picture tubes, however, have defects which remarkably deteriorate the contrast of the picture, the color purity and picture quality. Among other things, the deterioration occurs because the electron beam emitted from the electron gun is impacted on the focusing electrode. As a result, the secondary electrons are emitted from the electrode and pulled to the fluorescent panel of high electric potential. The fluorescent dots on the fluorescent panel are radiated responsive to the secondary electrons, that radiation is overlapped upon the picture radiated by said electron beam. This invention overcomes such defects of the conventional picture tube.

A main object of this invention is to provide a color television picture tube which can improve the contrast of the picture and the color purity.

Another object of this invention is to provide a color television picture tube which can prevent the picture deterioration due to the secondary electrons emitted from the focusing electrode, etc.

A further object of this invention is to provide a color television picture tube wherein the thickness of the metal back provided on the fluorescent layer of the tube is made so as to pass most of the electron beam emitted from the electron gun and stop the secondary electrons emitted from the focusing electrode.

Other objects and advantages of this invention will become apparent from the following description when considered in conjunction with the accompanying drawing wherein:

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FIGS. 1 and 2 are longitudinal sectional schematic side views of conventional color television picture tubes;

FIG. 3 is a fragmental, longitudinal, sectional schematic side view of a focusing electrode portion of a conventional color television picture tube;

FIG. 4 is a fragmental, longitudinal, sectional side view of a face plate of one embodiment of a color television picture tube according to this invention;

FIG. 5 is a diagram showing a transmission coefficient of the electron beam concerning energy of electron beam with aluminum film;

FIG. 6 is a longitudinal, sectional schematic side view of a face plate of a conventional color television picture tube;

FIG. 7 is a schematic view of a manufacturing apparatus for making a face plate of a color television picture tube according to this invention; and

FIG. 8 is a fragmental, longitudinal, sectional side view of a face plate portion of another embodiment of a color television picture tube according to this invention.

FIGS. 1 and 2 show conventional color television picture tubes, each of which comprises a housing 10 made of glass, a cathode 11 of an electron gun, anodes 12 and 13, a focusing electrode 14, a fluorescent face 15, an electron beam 16, and a deflecting coil for deflecting the electron beam etc. (not shown). The dotted lines 17 show the secondary electron emitted from the focusing electrode 14 by the impacting of the electron beam 16 against the focusing electrode. The batteries E_1 and E_2 are electric sources, the electric potential of E_2 being decided higher than the electric potential of E_1 .

As stated above, the potential of the fluorescent face 15 is higher than the potential of the focusing electrode 14. An electron lens results from the electric field made in holes or clearances of focusing electrode 14, as well known, and a focusing operation of the electron beam may result.

The electron beam 16 emitted from the cathode 11 of the electron gun impacts the fluorescent face 15 and thus the fluorescent dots radiate. However, as said electron beam also impacts the focusing electrode 14, positioned in the front of the fluorescent face 15, the secondary electrons are emitted from said electrode 14 and pulled to the fluorescent panel by the high electric potential. Thus, the fluorescent dots on the fluorescent panel are radiated, and the bad influences described above are generated in the picture. To obviate said defect, the anode potential of the anodes 12 and 13 is maintained a little higher than the potential of the focusing electrode 14. This higher potential is produced by inserting an electric source E_3 between the focusing electrode 14 and the anodes 12 and 13 as shown in FIG. 2. Hence, a portion of the secondary electrons 17 emitted from the focusing electrode 14 is pulled on the anode 13. The fewer number of secondary electrons 17 which reach to the fluorescent face 15 can be reduced to some extent.

However, there is a substantial distance between the focusing electrode 14 and the anode 12. If the anode is not maintained at an electric potential higher enough than that of the focusing electrode 14, the electric potential distribution near the focusing electrode is varied and the secondary electrons can not be pulled on the anode so that equipotential layers 18 are formed, as shown in FIG. 3. These layers appear as an electric potential distribution near the focusing electrode 14. As said electric potential layers are spread, so as to protrude against the electron gun, only a portion of the secondary

electrons are collected by the anode 13. Perfect collection of the secondary electron can not be achieved where these layers appear.

In this invention, the above defects of the conventional picture tube can be obviated by determining the thickness of the metal back on the fluorescent face so as to absorb unrequired secondary electrons into said metal back.

FIG. 4 shows a fragmental longitudinal sectional side view of a face plate having a fluorescent face. Element 10 is a housing of a color television picture tube, 15 is a fluorescent face, and 19 is a transparent conductive electrode such as Nesa for applying a voltage when fluorescent dots 20 are made by a conventional well-known electron beam printing process. The electrode 19 is unnecessary if the electron beam printing process is not used. Layer 21 is a metal back, for example, made of aluminum etc. formed on said fluorescent face 15 by a conventional well-known evaporating process. The thickness of the metal back is such that most of the electrons in the beam emitted from the electron gun can pass as they are, and most of the secondary electrons emitted from the focusing electrode can not pass through the metal back in a post acceleration focusing type color television picture tube shown in FIGS. 1 and 2 as described in detail hereinafter.

Generally, when the electron beam impacts said metal back 21, the ratio of the energy after passing through the metal back to the original energy of the electron beam, that is, the transmission coefficient is a function of an acceleration voltage of the electron beam and the thickness of the metal back 21 as shown in FIG. 5.

The relationship shown in FIG. 5 explains (as a parameter) the thickness of the metal back where it is made of aluminum. Accordingly, in the post acceleration focusing type color television picture tube, a transmission coefficient of the electron beam emitted from the electron gun α is determined by the electric potential of the fluorescent face ($E_1 + E_2$, in the case shown in FIG. 1) and the thickness of the metal back. A transmission coefficient of the secondary electron emitted from the focusing electrode β is determined by the electric potential difference between the fluorescent face and the focusing electrode (E_2 , in the case shown in FIG. 1) and the thickness of the metal back.

The values of the potential of the fluorescent face $E_1 + E_2$ and the potential difference between the fluorescent face and the focusing electrode E_2 may be determined by the operating conditions of the color television picture tube as described above, so that when the thickness of the metal back is determined suitably as described later, α of more than 0.8 and β of less than 0.2 may be obtained.

In the embodiment of this invention, the electric potential of the fluorescent face ($E_1 + E_2$) is equal to 20,000 v., and the electric potential of the focusing electrode E_1 is equal to 8,000 v. so that the potential difference E_2 between of the fluorescent face and focusing electrode is equal to 20,000 minus 8,000, i.e. 12,000 v.

However, in most conventional picture tubes, the thickness of the metal back is less than 1,000 A., so that almost all the primary and secondary electrons are passed through the metal back and the secondary electron is not stopped at all as apparent from the curves shown in FIG. 5.

On the other hand, in the embodiment of this invention when the thickness of the metal back is 7,500 A., α for the primary electron becomes about 0.8 and β for the secondary electron becomes about 0.2 as shown in FIG. 5. Therefore the influence of the secondary electrons on the fluorescent face can be restrained to one fourth, as compared with the case where the thickness of the metal back is less than 1,000 A.

In this embodiment, the most suitable value of the thickness of the metal back is about in the range of 7,000 A.-15,000 A. But in the conventional method, the thickness of the metal back producible in one time is

about 4,000 A., and there is a possibility that the metal back thicker than 4,000 A., may be exfoliated. A method of manufacturing picture tube according to this invention will be explained hereinbelow.

A face plate has been manufactured heretofore as follows. The face plate is dried after coating with fluorescent materials, and then the face plate is coated again with an interlayer made of nitrocellulose and with a film of aluminum of predetermined thickness by evaporating in a vacuum evaporating apparatus, and then the face plate is taken out of the coating apparatus and the interlayer is evaporated by burning in a furnace. In the above method, if the thickness of the film on the metal back is about more than 4,000 A., the end portion 22 of the metal back 21 is exfoliated as shown in FIG. 6, when the face plate is burning in the above process.

In this invention, a television picture tube having a metal back of large thickness, difficult to exfoliate, can be obtained by a process as described hereinafter. The thickness of the film of the aluminum metal back is formed by vacuum-evaporating at a time to a thickness less than 5,000 A., and the film of the aluminum formed by vacuum evaporating is then exposed to air. Thus, an oxide film is produced on the surface. Then a film less than 5,000 A. in thickness is formed again by vacuum-evaporating, and repeated a suitable number of times so that the above formations of the aluminum film and the oxide film are provided as the occasion demands.

FIG. 7 is a schematic view of vacuum evaporating apparatus for evaporating a film of aluminum on a face plate of a television picture tube. Box 24 is a housing of the apparatus having therein a face plate coated with an interlayer 25 made of fluorescent materials and nitrocellulose. Filaments 26 and 27 are for evaporating the aluminum pieces 28 and 29, respectively.

Valve 30 is a cock provided in a pipe 31 communicating with a vacuum pump (not shown) for exhausting air from the housing 24 to make a vacuum. Or, in another position the valve 30 delivers air or oxygen into the housing 24 according to the rotary positions of the cock. In this process, after creating a vacuum in the housing 24 by the vacuum pump, the aluminum 28 is evaporated by applying a voltage to the filament 26. The first film 32 of aluminum of less than about 5,000 A. in thickness is formed on the interlayer 25 by evaporating. Then air or oxygen is delivered into the housing 24 by rotating the cock 30, and a very thin film 33 of aluminum oxide is formed on the first film of aluminum 32 as shown in FIG. 8. Further, by rotating valve 30, the air in the housing 24 is again exhausted by the vacuum pump for creating a vacuum in the housing. The aluminum 29 is evaporated by applying a voltage to the filament 27, and the second film 34 of aluminum of less than about 5,000 A. in thickness is formed on the aluminum oxide film 33.

The vacuum evaporation may be repeated a suitable number of times by using a number of filaments and repeating said evaporating and oxidizing processes reciprocally as the occasion demands.

Thus a metal back of large thickness, difficult to exfoliate, from the fluorescent face, can be obtained in such a way that the metal back is formed by a plurality of layers, of which one layer is smaller than the others in thickness.

What we claim is:

1. A color television picture tube comprising a housing having a transparent face plate with a coating of fluorescent material thereon, one side of said fluorescent material being visible through said face plate, a metal back formed on the opposite side of said fluorescent material, an electron gun mounted in said housing for emitting an electron beam toward said face plate, and means comprising an electrode mounted parallel and adjacent to said metal back for focusing and deflecting said electron beam on said face plate, said metal back having a thickness which passes at least 80 percent of the incident

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electrons in the beam emitted from said electron gun and no more than 20 percent of the electrons given off by secondary emission when the electron beam strikes a focusing electrode.

2. A color television picture tube according to claim 1 in which the metal back formed on the fluorescent material comprises three layers of aluminum, aluminum oxide, and aluminum in the named sequence.

3. A color television picture tube according to claim 1 in which said metal back formed on the fluorescent material comprises a plurality of layers which are alternately aluminum and aluminum oxide.

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