Description

The invention relates to a visual display tube, especially for television, being a colour tube of auto-convergent type having three coplanar electron beams.

The expression "tube" is understood herein to refer to the system constituted by the tube per se, the deflector and the electron beam generators.

It is known that in television or, in a more general way, in visual display, the colour images are customarily obtained by means of a screen coated with luminescent substances of three basic colours, generally red, green and blue, which are excited by three electron beams, one for each colour. These beams converge on the screen and are displaced along lines from left to right and from top to bottom.

The screen is formed of triads, that is to say of sets of three points, of luminescent substances of the three colours. The luminous intensity (luminance) and the colour of each point of the image to be reproduced are obtained by the intensity of excitation of each of the elements of the triad.

In order that each electron beam should reach only the points of the colour to which it is allocated, on the one hand the three beams have different directions and, on the other hand, a perforated mask is disposed in front of the screen.

The displacement of the beams along lines, which is referred to as scanning, is produced by two variable magnetic fields which deflect the beams, one in the horizontal direction and the other in the vertical direction. These magnetic fields are created by electric currents of variable intensity flowing in coils referred to as deflectors.

In order that the three beams should converge at all the points of the screen, it is necessary that the magnetic field traversed by these beams should have, in space, a particular configuration, which is non-uniform and which is associated, in particular, with the rectangular and substantially planar shape of the screen

and with the coplanar arrangement of the beams.

When the convergence is obtained exclusively by the configuration of the magnetic field, the tube is referred to as autoconvergent.

This autoconvergence is obtained principally by virtue of the shape of the coils of the deflector. However, the conformation of these coils is not, in general, sufficient: there are usually convergence errors. One of the latter is the error referred to as coma, which is reflected, in a tube having coplanar beams, by dimensions of the image produced by the central beam (in general the green) which differ from the dimensions of the image produced by the lateral beams (red and blue). This error is measured by the distance separating two adjacent vertical edges of the green and red-blue images and by the distance separating two adjacent horizontal edges of these images.

In order to correct the coma error, it is known, for example from the French Patent 2,425,146, to provide behind the deflector, that is to say on the same side as the electron guns, elements of high magnetic permeability of arrangements and configurations such that the magnetic field produced by the deflector is modified to an extent which is sufficient to effect the correction.

The invention aims at the case where the coma error is of small amplitude, that is to say of the order of one millimetre or less, and of different senses in the horizonal (east-west) and vertical (north-south) directions, the (green) image produced by the central beam being, for example, wider than the image produced by the lateral beams (red-blue) but of smaller height than that of this image produced by the lateral beams.

The invention results from the finding that the magnetic parts for coma correction which are known up to the present time are not suitable for the correction of this type of error.

In particular in the French Patent 2,425,146 mentioned hereinabove, the magnetic elements are constituted by magnetic plates applied to the base of a cup

constituting an output electrode of the electron guns, and which thus exhibit three apertures for the passage of the beams, two of these plates having the shape of crowns or washers surrounding the apertures provided for the lateral beams, two other plates being elongate vertical bars disposed on either side of the aperture for the green central beam. These magnetic elements are suitable for coma errors of large amplitude, for example 5 mm, but for errors of smaller amplitude they impart a correction which is of an excessively high value, which gives rise to an error in the opposite sense.

Moreover, the US Patent 4,142,131 contains a description of a television colour tube in which the coma error correction elements comprise four small plates of rectangular shape and the plane of which is perpendicular to the axis of the tube, these small plates being disposed above and below each of the lateral beams, together with, in addition, perpendicular small plates, of plane parallel to the axis of the tube on each side of the central beam. Such a configuration also does not permit the correction of the coma error of small amplitude, of the order of one millimetre or less and of differing senses in the horizontal and vertical directions.

The tube according to the invention is characterized in that the magnetic coma correction elements, which are likewise flat plates, of plane perpendicular to the direction of the beams, are exclusively constituted by four rectangular plates, preferably all identical, which are associated with the lateral beams, two of these plates being below these respective beams and the other two plates above these same beams, the length and the width of each plate being selected as a function of the respective values of the coma errors in the vertical and horizontal direction to be corrected.

The correction of error is thus achieved in a particularly simple manner. Moreover, the means (or process) of correction is readily adaptable from one type of tube to another, since the length of each rectangular element is a direct function of the height of the coma

29

error to be corrected and, likewise, the width of each element is a direct function of the magnitude of the coma error in the horizontal direction.

Furthermore, the sensitivity of the horizontal scanning is increased since, with the magnetic correction elements of the invention, the horizontal deflection magnetic field is increased especially for the lateral beams, while the correction elements known up to the present time diminish the sensitivity of the horizontal scanning, that is to say require a stronger power supply to the deflectors.

Other features and advantages of the invention will become evident with the description of some of its embodiments, this description being made with reference to the accompanying drawings, in which:

- Figure 1 is a diagrammatic cross-section of a television colour tube of the perforated-mask type,
- Figure 2 is a diagram showing the effect of the coma error on the screen of the tube of Figure 1,
- Figure 3 shows elements for correcting the error of Figure 2,
- Figure 4 is a cross-section on the line 4-4 of Figure 3,
- Figure 5 is a diagram similar to that of Figure 3, but on a larger scale, showing the effect of the correction elements on the deflection magnetic fields, and
- Figure 6 is a graph showing the effect on the coma error of the dimensions of the correcting elements of Figure 3.

In the example, the television colour tube 10 is of the type incorporating a perforated mask 11 disposed within the tube in front of the screen 12 and incorporating electron guns 13 producing three coplanar beams 14, 15 and 16. The central beam 14 is, in this example, the one which is intended to excite the green phosphor on the screen, while the lateral beams 15 and 16 excite the blue and red phosphors respectively.

The displacement of these beams, in order to scan

the screen 12, is effected by supplying horizontal and vertical deflection coils 17 which produce magnetic fields permitting the displacement of the three beams 14, 15, 16 respectively in horizontal and vertical directions.

The guns 13 are disposed behind the tube within the cylindrical part 18 referred to as the neck. The deflection coils 17 are disposed in part around the neck 18 and in part around the flared section 19 connecting the neck 18 to the plate 20 exhibiting the screen 12.

The deflector 17 is such that it in practice ensures the autoconvergence, that is to say the convergence of the three beams 14, 15, 16 on the entire screen. However, there nevertheless subsists the coma error, which is reflected on the screen (Figure 2) by differing dimensions of the images produced by the three beams. Thus, the green central beam V14 produces a rectangular image 21, while the blue B and red R lateral beams produce an image 22, which is likewise rectangular, which is narrower and higher than the image 21. The vertical sides of the image 22 are therefore between the vertical sides of the image 21, the distance d between two adjacent vertical sides of the images 21 and 22 being, in the example (tube of which the screen diagonal measures 51 cm), of the order of 0.3 mm and the horizontal sides of the image 21 are between the horizontal sides of the image 22, the distance h between two adjacent horizontal sides being, in the example, of the order of 0.8 mm.

In order to correct the coma errors, modification takes place of the magnetic field behind the deflector 17, that is to say on the same side as the guns 13. To this end, use is made of plates or small plates of high magnetic permeability which are supported by the last electrode 23 (Figures 3 and 4) of the guns, that is to say the electrode turned towards the screen 12. This electrode 23 has a cup shape with a cylindrical edge 25 and base 24 which is perpendicular to the axis 26 of the tube. This base is pierced by three holes or apertures of coplanar axes which are situated in a plane passing

through the horizontal axis of the screen. The central hole 27 is intended to transmit the green beam 14, while the lateral holes 28 and 29 transmit the blue beam 15 and the red beam 16. The magnetic elements are welded to the base 24 of the cup 23. They are constituted by small plates made of an iron-nickel alloy.

According to the invention, four rectangular small plates 30, 31, 32, 33 (made of "anhyster" containing 48 % of nickel) are provided above and below the apertures 28 and 29. The rectangular small plate 30 is above the aperture 28 with its major side 30_1 horizontal, the centre of this major side 30_1 being on a line perpendicular to the axis of the hole 28 intended to transmit the beam to excite the blue phosphors. In other words, the mid-perpendicular of the side 30_1 passes through the centre of the hole 28. The small plate 31 is below the hole 28, in a position of the small plate 30 which is symmetrical in relation to the centre of the hole 18.

The small plate 32 is disposed in relation to the hole 29 as is the small plate 30 in relation to the hole 28. Likewise, the small plate 33 is disposed in relation to the hole 29 as is the small plate 31 in relation to the hole 28.

In the example, the axis of the hole 27 is distant by 5.1 mm from the axis of the hole 28 or 29 and the thickness of the small plates is 0.25 mm. The length A of each of the latter, that is to say the dimension in the horizontal direction, is 3.8 mm, while its width, that is to say the dimension in the vertical direction, is L = 1.75 mm.

As shown by Figure 5, the lines 40 of the vertical deflection magnetic field Vx are spaced from one another around the holes 28 and 29. The vertical deflection magnetic field is therefore attenuated for the blue-red image. On the other hand, the vertical deflection field lines 41 are, around the hole 27, brought close to one another: the vertical deflection magnetic field is therefore increased for the beam 14 to excite the green. What is thus obtained is the correction in the selected

32

sense: increasing of the vertical deflection for the green and diminution of the vertical deflection for the blue and the red.

Figure 5 likewise shows that the horizontal deflection Hy field lines 42 are brought close to one another around the holes 28 and 29. These horizontal deflection field lines are likewise brought close to one another around the hole 27, but to a lesser extent. The horizontal deflection magnetic field is therefore increased for the three excitation beams, but it is more greatly increased for the blue and red phosphors than for the green. The desired result is likewise obtained, that is to say a relative diminution of the horizontal deflection for the green in relation to the horizontal deflection for the blue and the red.

It has been found that the height (h, Figure 2) coma error correction was dependent principally upon the dimension A of the small plates and that the width (d, Figure 2) coma error correction was dependent principally upon the dimension L. For a determined deflector giving given errors d and h, it is therefore easy to select the dimensions A and L of the small plates 30, 31, 32, 33.

For the selection of the dimensions A and B, it is possible to enlist the aid of the nomograms of Figure 6. The diagram of this Figure 6 shows plotted on the abscissae the dimension A of a small plate, and on the ordinates the coma errors Δ (d or h).

The curves 45, 46 and 47 are curves of variation of the coma horizontal error d as a function of the dimension A of three dimensions L, of values L_0, L_1 and L_2 respectively.

The curves 48, 49 and 50 are similar to the curves 45, 46, 47 respectively, but for the vertical coma error h.

As the horizontal deflection magnetic field Hy is increased for the set of the three beams and more particularly for the two lateral beams, the small plates according to the invention permit the diminution of the supply power of the horizontal deflection coils. In other

words, in contrast to the earlier constructions, the correction is not made to the detriment of the sensitivity of horizontal scanning.

Although, in the example described hereinabove, the major side of the small plates 30 to 33 is horizontal, it should be noted that, in a variant, these major sides may have other directions, that is to say be oblique in relation to the horizontal. Moreover, these major sides are not necessarily all parallel to each other.

Preferably, the elements 30 to 33 are simple small plates without extension along the axis 26.

Claims

1. Television colour tube of autoconvergent type having three coplanar electron beams (14, 15, 16) comprising magnetic coma error correction elements behind the deflector (17), characterized in that, the coma errors being of small amplitude, of the order of 1 mm or less in each direction, and of opposite senses in the horizontal and vertical directions, the correction elements are exclusively constituted by four small plates (30, 31, 32, 33) of rectangular shape and the plane of which is perpendicular to the axis (26) of the tube, these small plates being disposed above and below each of the lateral beams (15, 16), the centre of one side of each small plate lying on a line perpendicular to the corresponding lateral beam, one dimension (A) of each of the small plates affecting the amplitude of the correction in one direction and the other dimension (L) affecting the coma correction in the other direction.

2. Tube according to Claim 1, characterized in that, the coma error being such that the image (21) produced by the central beam is wider and of less height than the image (22) produced by the lateral beams, the rectangular small plates have their major dimension (A) in the horizontal direction.

3. Tube according to Claim 1 or 2, characterized in that the small plates (30, 31, 32, 33) are all identical.

4. Tube according to Claim 2, characterized in that, the horizontal coma error being of the order of 0.3 mm and the vertical coma error of the order of 0.8 mm, the horizontal dimension of one small plate is of the order of 4.5 mm and its vertical dimension of the order of 1.25 mm, the distance separating the two adjacent beams prior to their deflection being of the order of 5.1 mm.

5. Tube according to any one of the preceding claims, characterized in that the small plates are, in a manner known per se, rigidly affixed to the last electrode (23) of the electron guns (13).

6. Tube according to Claim 1, characterized in that the rectangular small plates have their major dimensions

oblique in relation to the horizontal direction.

7. Tube according to Claim 6, characterized in that the major dimensions of the rectangular small plates are not parallel to each other.

* C L M S *

36

As printed

Revendications

1. Tube de télévision en couleurs du type autoconvergent à trois faisceaux d'électrons (14, 15, 16) coplanaires comportant à l'arrière du déviateur (17) des éléments magnétiques de correction de défauts de coma, caractérisé en ce que les défauts de coma étant de faible amplitude, de l'ordre de 1 mm ou moins dans chaque direction, et de sens opposés en directions horizontale et verticale, les éléments de correction sont constitués exclusivement par quatre plaquettes (30, 31, 32, 33) de forme rectangulaire et dont le plan est perpendiculaire à l'axe (26) du tube, ces plaquettes étant disposées au-dessus et au-dessous de chacun des faisceaux latéraux (15, 16), avec le milieu d'un côté de chaque plaquette au droit du faisceau latéral correspondant, une dimension (A) de chacune des plaquettes affectant l'amplitude de la correction dans une direction et l'autre dimension (L) affectant la correction de coma dans l'autre direction.

2. Tube selon la revendication 1, caractérisé en ce que le défaut de coma étant tel que l'image (21) produite par le faisceau central est plus large et de plus faible hauteur que l'image (22) produite par les faisceaux latéraux, les plaquettes rectangulaires ont leur plus grande dimension (A) en direction horizontale.

3. Tube selon la revendication 1 ou 2, caractérisé en ce que les plaquettes (30, 31, 32, 33) sont toutes identiques.

4. Tube selon la revendication 2, caractérisé en ce que le défaut de coma horizontal étant de l'ordre de 0,3 mm et le défaut de coma vertical de l'ordre de 0,8 mm la dimension horizontale d'une plaquette est de l'ordre de 4,5 mm et sa dimension verticale de l'ordre de 1,25 mm, la distance séparant, avant leur déviation, deux faisceaux voisins étant de l'ordre de 5,1 mm.

5. Tube selon l'une quelconque des revendications précédentes, caractérisé en ce que les plaquettes sont, de façon en soi connue, solidaires de la dernière électrode (23) des canons à électrons (13).

6. Tube selon la revendication 1, caractérisé en ce que les plaquettes rectangulaires ont leurs plus grandes dimensions obliques par rapport à la direction horizontale.

7. Tube selon la revendication 6, caractérisé en ce que les plus grandes dimensions des plaquettes rectangulaires ne sont pas parallèles entre elles.

Patentansprüche

1. Farbfernsehröhre vom autokonvergenten Typ, mit drei coplanaren Elektronenstrahlen (14, 15, 16), mit magnetischen Coma-Fehlerkorrekturelementen hinter der Ablenkeinheit (17), dadurch gekennzeichnet, dass bei Coma-Fehlern kleiner Grösse in der Grössenordnung von 1 mm oder weniger in jeder Richtung und von entgegengesetztem Sinn in Horizontalrichtung und Vertikalrichtung die Korrekturelemente ausschliesslich durch vier Plättchen (30, 31, 32, 33) von rechtwinkliger Form gebildet sind, deren Ebene senkrecht zur Achse (26) der Röhre liegt, wobei diese Plättchen oberhalb und unterhalb jedes der seitlichen Strahlen (15, 16) angeordnet sind, wobei die Mitte jeder Seite jedes Plättchens in der Senkrechten des entsprechenden seitlichen Strahls liegt, wobei weiterhin eine Abmessung (A) jedes Plättchens die Grösse der Korrektur in

einer Richtung und die andere Abmessung (L) die Coma-Korrektur in der anderen Richtung beeinflusst.

2. Röhre nach Anspruch 1, dadurch gekennzeichnet, dass der Coma-Fehler dergestalt ist, dass das durch den zentralen Strahl erzeugte Bild (21) breiter und von geringerer Höhe als das Bild (22) ist, welches durch die seitlichen Strahlen erzeugt wird, wobei die rechtwinkligen Plättchen ihre grosse Abmessung (A) in Horizontalrichtung aufweisen.

3. Röhre nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass die Plättchen (30, 31, 32, 33) untereinander völlig gleich sind.

4. Röhre nach Anspruch 2, dadurch gekennzeichnet, dass der horizontale Coma-Fehler in der Grössenordnung von 0,3 mm liegt und der vertikale Coma-Fehler in der Grössenordnung von 0,8 mm liegt, wobei die Horizontalabmessung eines Plättchens in der Grössenordnung von 4,5 mm und seine Vertikalabmessung in der Grössenordnung von 1,25 mm liegt, wobei der Abstand zwischen zwei benachbarten Strahlen vor ihrer Ablenkung in der Grössenordnung von 5,1 mm liegt.

5. Röhre nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, dass die Plättchen in an sich bekannter Weise fest mit der letzten Elektrode (23) der Elektronenkanonen (13) verbunden sind.

6. Röhre nach Anspruch 1, dadurch gekennzeichnet, dass die rechtwinkligen Plättchen ihre grösseren Abmessungen schräg zur Horizontalrichtung aufweisen.

7. Röhre nach Anspruch 6, dadurch gekennzeichnet, dass die grösseren Abmessungen der rechtwinkligen Plättchen nicht untereinander parallel sind.

Claims

1. Television color tube of autoconvergent type having three coplanar electron beams (14, 15, 16) and magnetic coma error correction elements behind the deflector (17), characterized in that the coma errors being of small amplitude, in the order of 1 mm or less in each direction, and of opposite senses in the horizontal and vertical directions, the correction elements are exclusively constituted by four small plates (30, 31, 32, 33) of rectangular shape the plane of which is perpendicular to the axis (26) of the tube, these small plates being located above and below each of the lateral beams (15, 16), the center of one side of each small plate lying on a line perpendicular to the lateral corresponding beam, one dimension (A) of each of the small plates affecting the amplitude of the correction in one direction and the other dimension (L) affecting the coma correction in the other direction.

2. Tube according to claim 1, characterized in that, the coma error being such that the image (21) produced by the central beam is wider and of less height than the image (22) produced by the lateral beams, the rectangular small plates have their major dimension (A) in the horizontal direction.

3. Tube according to claims 1 or 2, characterized in that the small plates (30, 31, 32, 33) are all identical.

4. Tube according to claim 2, characterized in that the horizontal coma error being in the order of 0,3 mm and the vertical coma error in the order of 0,8 mm, the horizontal dimension of one small plate being of the order of 4,5 mm and its vertical dimension in the order of 1,25 mm, the distance separating two adjacent beams prior to their deflection being of the order of 5,1 mm.

5. Tube according to any of the preceding claims, characterized in that the small plates are, in a manner known per se, rigidly affixed to the last electrode (23) of the electron gun (13).

6. Tube according to claim 1, characterized in that the rectangular small plates have their major dimensions oblique with respect to the horizontal direction.

7. Tube according to claim 6, characterized in that the major dimensions of the rectangular small plates are not parallel to each other.