

PATENT SPECIFICATION

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(54) COLOUR TELEVISION DISPLAY TUBE

(71) We, PHILIPS ELECTRONIC AND ASSOCIATED INDUSTRIES LIMITED, of Abacus House, 33 Gutter Lane, London, EC2V 8AH, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a colour television display tube having a device for the correction of the static convergence for a colour television display tube.

A colour television display tube having a device for the correction of the static convergence is described in an article in "Philips Product Information Electronic Components and Materials", No. 58, entitled "20 AX for 110° colour television". A similar construction is to be found in the publication of Valvo "Spezielle Bauelemente für das 20 AX-System", "Technische Daten", April, 1974.

German Auslegeschrift 22,26,335 discloses a colour television display tube operating with three beams and having a correction device which is arranged around the neck of said colour television display tube. Said Auslegeschrift shows separately adjustable magnets in combination with field-conductive pole shoe constructions, the magnets being situated outside the display tube and the pole shoes being situated partly within the neck of the tube.

Furthermore in our British Patent Specification No. 1,507,122 there is described both a method of manufacturing a static convergence device and such a convergence device in a colour television display tube, in which magnetisable rings are used which may be arranged outside or inside the neck of the colour television display tube. Specification No. 1,507,122 describes a magnetisable ferrite ring which is arranged inside the neck, so in a vacuum. As is described in the further specification of the magnetisation device, said ferrite ring may be magnetised multipolarly at its circumference but preferably prior to the

provision thereof in the tube. However, this impedes a directed and accurate adjustment of the required correction field. As a matter of fact, due to its high coercive field strength, a ferrite ring can be magnetised only by very strong magnetic fields. However, such strong magnetic fields are difficult to produce from without through the glass in a ferrite ring provided in a vacuum. In addition, when no other measures are taken, the danger exists in a ceramic ferrite ring provided in the vacuum of the tube that the cathodes of the electron gun are poisoned and become useless.

However, it is suggested in Specification No. 1,507,122 to provide the permanent magnets as close as possible to the electron beams to be deflected so that on the one hand the pole shoes conducting the magnetic flux can be avoided and on the other hand the magnetic field need no longer be so large because it is provided very close the deflection plane because as a matter of fact the stray field losses become considerably smaller.

According to the invention there is provided a colour television display tube comprising a neck, an electron gun means disposed in said neck for generating a plurality of electron beams, a display screen disposed opposite said gun, and means disposed within said neck for correcting static convergence, said correcting means comprising at least one permanent magnet capable of being magnetized from outside said tube to provide multipoles or combination of multipole magnetic properties, said magnet having average values of coercive field strength of 5 to 40 kA/m and average values of remanent induction of 500 to 1500 mT.

The permanent magnet for correcting static convergence may comprise a ring having an air gap at the circumference thereof and which comprises a resilient material. The cross-sectional shape of the ring may be generally circular or flat. The magnetic properties of the material of the permanent magnets may be adjusted

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accurately to within small tolerances by a directed thermal treatment. The ring may be magnetised at the circumference with six or twelve poles with a strength which is the same or differs for each pole pair.

5 If desired more than one magnetic ring may be provided, however in the case where there is only one magnetic ring then this may be disposed on the electron gun means at a distance of at least 15 mm from the display screen end of the electron gun. It is generally favourable to provide the ring at the level of the third grid that is grid (3) because the strongest deflection effect can be obtained at that area with the least possible effort.

10 The first-mentioned ring and/or a second ring may be provided at the level of the third grids on the electron gun means and/or on the contact lugs at the end of the electron gun facing the display screen and/or in the centering sleeve of the said gun.

25 Alternatively, a second magnetic ring may be provided, each of the rings comprising six-pole magnetised permanent magnetic rings juxtaposed with respect to each other, one of which is rotationally offset by 30° with respect to the other for generating with its magnet poles a twelve-pole field at the circumference.

30 The correcting means is able to function because in the known electron guns there is sufficient space for accommodating the or each ring. The advantage of the air gap in the or each ring is that the ring can easily be bent apart so that it can be slid over that part of the said gun which has the largest radial dimension. When the rings are constructed from a material having a generally flat cross-sectional shape, another field distribution can in some cases better be realised. The use of materials for the metallic permanent magnets with a comparatively low coercive field strength has the advantage that magnetisation and then directed demagnetisation can be carried out with comparatively small field strengths, namely from the outside in the otherwise fully assembled tube. The magnetic fields required for magnetisation and demagnetisation thus are effective through the glass of the neck of the tube and two to twelve-pole magnetic polarisations can be adjusted at the circumference of the permanent magnetic ring(s) or ribbon(s).

55 The invention will now be described, by way of example, with reference to the accompanying drawings, in which:

60 Figure 1 is a side elevation of an electron gun for a colour display tube made in accordance with the invention,

65 Figure 2 is a partial side elevation, perpendicular to that shown in Figure 1 of

the electron gun shown in Figure 1, the centering sleeve having been omitted,

Figure 3 is a plan view of an electron gun shown in Figure 1 taken on the line III—III in Figure 1,

Figure 4 shows a magnetisation device for the magnetisation and the directed demagnetisation of a permanent magnetic ring,

Figure 5 shows a deflection diagram to explain the operation of the correction of the static convergence, and

Figure 6 shows a colour display tube in accordance with the invention.

Reference numeral 1 in Figure 1 denotes a tube socket of compressed glass through which the individual electrodes for the electron gun are passed, the gun being denoted by the common reference numeral 2. Such an electron gun is known *per se* and need not be described in detail. Shown in Figure 1 approximately centrally of the axial dimension of the electron gun is the grid which is denoted by reference numeral 3. At the level of the grid 3 is provided one multipolarly magnetisable wire ring 4 which has an air gap at its circumference and consists of the resilient permanent magnetic material having a generally circular cross-sectional shape. The ring 4 serves for the correction of the static convergence. At the end of the electron gun facing the display screen, centering springs 5 are situated and a second multipolarly magnetisable wire ring 6 is provided around said centering springs 5. Said magnetisable permanent magnetic ring 6 for further correction of the static convergence may alternatively be provided in the centering sleeve 27. It may engage said sleeve in a clamping manner from within, as is denoted by 28 in Figure 1. In the illustrated embodiment the wire forming the rings has a diameter of for example 1.5 mm.

The operation of the permanent magnetic ring 6 is such that after its accurate adjustment, the subsequent adjustments for a dynamic convergence can also be carried out with less effort and may in some cases be omitted entirely.

The outside diameter of the rings is approximately 31 mm and their inside diameter is 28 mm. The rings preferably consist of the material "Vicalloy" having the alloy components Fe, Co, V, Cr of an alloy which is particularly suitable for drawing operations and with which wires can be manufactured with a maximum density of magnetic energy ($B \cdot H_{max}$) of 15.9 to 23.9 kJ/m³ kilojoules per cubic meter and with a remanence B_r of 1000 to 1200 mT and a coercive field strength H_c of 24 to 32 kA/m.

The electron gun shown in Figure 1 is the

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gun which is used for a so-called in-line-tube, which means that the electron guns are situated in the same plane, that is the plane which is shown in Figure 1 at right angles to the plane of the drawing. Figure 2 shows the elevation at right angles thereto but omits the centering sleeve 27. This figure shows the three grids 3 of the three electron guns for red, green and blue, at the level of which the magnetisable permanent magnetic ring for correcting the static convergence is provided. The magnetic ring is disposed at least 15 mm from the display screen end of the guns. So Figure 2 is an elevational view of the three electron guns.

Figure 3 is a plan view of the electron gun taken on the line III—III of Figure 1. This plan view again shows the three electron guns which need not be described further. Said plan view also shows the air gap which is denoted by 7 and which is situated at the circumference of the magnetisable permanent magnetic ring 4. The air gap 7 may be approximately 1 mm.

Figure 4 shows a magnetisation device corresponding generally to that shown in Figure 3 in our Specification No. 1,507,122. The permanent magnetic rings 4 and 6, respectively, are thus clamped on the electron gun as is shown in Figures 1 and 2 and 3, respectively, such that there is a space between the rings and the inner wall of the neck 8 of the tube. After assembly and evacuating the tube, a magnetisation device can now be slid from the rear over the neck of the tube, which device is denoted by the common reference numeral 9. It consists of an iron ring around which the individual coils 11 are wound. Such a current can be passed through said coils that poles are formed on the inwardly projecting limbs 12 so that the permanent magnetic ring at its circumference is multipolarly magnetized, so in this case with six poles, and alternately north and south poles are formed therein. The magnetisation device is constructed so that the individual pole pairs need not be equal to each other because the magnetisation current is adjusted in a directed manner, as is described in detail in Specification No. 1,507,122. Dependent upon the adjusted convergence need, the permanent magnetic ring is, for example, magnetised with six poles by accurately adjusted current pulses through the coils 11. The current pulses may be different for each individual coil as regards direction and value. However, it is alternatively possible in a first process step to magnetise the wire-shaped ring by a strong current pulse with six poles to saturation with the correct polarity. In a subsequent adjusting process step the wire-shaped ring is then demagnetised by directed reverse current pulses so strongly

that the convergence correction is optimum. The demagnetisation may also be carried out with a 50 Hz alternating field slowly with an amplitude increasing to the optimum value.

The embodiment shown in Figure 4 shows a device for a six-pole magnetisation; a corresponding device for eight-pole, twelve-pole or four-pole magnetisation then has a correspondingly different subdivision. In principle, however, this is not essentially different from the device shown.

Figure 5 shows the realised deflection. The plane 13 is the cathode plane, the plane 14 is the plane of the grid 3 for the correction of the static convergence, the plane 15 is the centering plane for the further correction of the static convergence and the plane 16 is the deflection plane, hence the plane in which the deflection coils are situated namely for the frame and line deflection. Reference numeral 17 finally denotes the plane of the display screen. An electron beam might have for example, the following variation: It is assumed that two errors occur. It would be ideal if the electron beam would directly land on point 20 from point 19 but because the system shows an undesired parallel shifting, the electron beam is to land on point 21. This can be achieved by means of the ring for the correction of the static convergence in the plane of the grid 3, namely in the plane 14. By means of the ring 4 a magnetic field is generated which deflects the electron beam in the plane 14, hence in point 22, in such manner that it lands correctly on point 21. It then has the variation denoted by 23. However, said electron beam is not yet fully corrected. In the deflection plane, namely in the plane denoted at 16, the magnetic field of the deflection coils is operative which deflects the electron beam again from the correct landing position in the outermost zones of the screen. Fewer dynamic convergence errors would occur when the electron beam traverses the plane 16 at right angles. However, it would then go from point 24 at right angles to point 21. Therefore, an over-compensation in the plane 14 must take place by means of the ring 4, in order that the electron beam land in the plane 15 on point 24 and if no correction takes place the beam would land on point 25 in the picture display plane 17. However, the ring 6 serves for the second correction. It deflects the electron beam back again so that it then traverses the paths which are denoted by 26 in Figure 5 at right angles and hence passes through the deflection plane 16 also at right angles.

Figure 6 is a diagrammatic sectional view of a colour display tube in accordance with

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the invention. Inside a glass envelope 31, which is composed of a conical part 32, a display window 33 and a neck 34, and in front of the screen 36 which consists of a large number of triplets of phosphor stripes luminescing in three different colours which are at right angles to the plane of the drawing, is situated the shadow mask 35 which has a very large number of apertures 37 which are rectangular in the direction of the phosphor stripes. The electron beams 38, 39 and 40 from the electron gun 41 pass through said apertures 37, said electron beams being situated in the plane of the drawing and being deflected by the system 42 of deflection coils. The tube has been found to have a good static convergence when the rings 4 and 6 are used.

In a non-illustrated embodiment of the invention, there are two 6-pole juxtaposed rings, the poles of one ring being offset by 30° relative to the other ring to provide a 12-pole magnet.

WHAT WE CLAIM IS:—

1. A colour television display tube comprising a neck, an electron gun means disposed in said neck for generating a plurality of electron beams, a display screen disposed opposite said gun, and means disposed within said neck for correcting static convergence, said correcting means comprising at least one permanent magnet capable of being magnetized from outside said tube to provide multipoles or combination of multipole magnetic properties, said magnet having average values of coercive field strength of 5 to 40 kA/m and average values of remanent induction of 500 to 1500 mT.

2. A colour television display tube as claimed in Claim 1, wherein in that the material of the permanent magnet can be adjusted at accurately determined magnetic properties with small tolerances by means of a directed thermal treatment.

3. A colour television display tube as claimed in Claim 1 or 2, wherein the permanent magnet for correcting static convergence comprises a ring having an air gap at the circumference thereof and which comprises a resilient material.

4. A colour television display tube as claimed in Claim 3, wherein the cross-sectional shape of the ring material is generally circular.

5. A colour television display tube as claimed in Claim 3, wherein the cross-

sectional shape of the ring material is generally flat.

6. A colour television display tube as claimed in Claim 3, 4 or 5, wherein the ring is magnetised at the circumference with six poles or twelve poles with a strength which is the same or different for each pole pair.

7. A colour television display tube as claimed in any one of Claims 3 to 6, wherein the ring is disposed on the electron gun means at an axial distance of at least 15 mm from the display screen end thereof.

8. A colour television display tube as claimed in any one of Claims 3 to 6, wherein the electron gun means has three grid-levels and the permanent magnetic ring is clamped on the electron gun at the third grid level.

9. A colour television display tube as claimed in any one of Claims 3 to 6, wherein the electron gun means has contact lugs at the end thereof and the permanent magnetic ring is clamped on the contact lugs at the end of the electron gun means facing the display screen.

10. A colour television display tube as claimed in any one of Claims 3 to 6, wherein the electron gun means has a centering sleeve and the permanent magnetic ring is provided in the centering sleeve.

11. A colour television display tube as claimed in any one of Claims 3 to 10, further comprising a second magnetic ring mounted on the electron gun means at a position spaced from the first-mentioned magnetic ring.

12. A colour television display tube as claimed in any one of Claims 3 to 10, further comprising a second magnetic ring, each of the rings comprising a six-pole magnetised permanent magnet juxtaposed with respect to each other, one of which is provided so as to be shifted over an angle of 30° with respect to the other to generate with its magnet poles a twelve-pole field at the circumference.

13. A colour television display tube substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

R. J. BOXALL,
Chartered Patent Agent,
Berkshire House,
168—173 High Holborn,
London, WC1V 7AQ,
Agent for the Applicants.

the invention. Inside a glass envelope 31, which is composed of a conical part 32, a display window 33 and a neck 34, and in front of the screen 36 which consists of a large number of triplets of phosphor stripes luminescing in three different colours which are at right angles to the plane of the drawing, is situated the shadow mask 35 which has a very large number of apertures 37 which are rectangular in the direction of the phosphor stripes. The electron beams 38, 39 and 40 from the electron gun 41 pass through said apertures 37, said electron beams being situated in the plane of the drawing and being deflected by the system 42 of deflection coils. The tube has been found to have a good static convergence when the rings 4 and 6 are used.

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5. A colour television display tube as claimed in Claim 3, wherein the cross-

sectional shape of the ring material is generally flat.

6. A colour television display tube as claimed in Claim 3, 4 or 5, wherein the ring is magnetised at the circumference with six poles or twelve poles with a strength which is the same or different for each pole pair.

7. A colour television display tube as claimed in any one of Claims 3 to 6, wherein the ring is disposed on the electron gun means at an axial distance of at least 15 mm from the display screen end thereof.

8. A colour television display tube as claimed in any one of Claims 3 to 6, wherein the electron gun means has three grid-levels and the permanent magnetic ring is clamped on the electron gun at the third grid level.

9. A colour television display tube as claimed in any one of Claims 3 to 6, wherein the electron gun means has contact lugs at the end thereof and the permanent magnetic ring is clamped on the contact lugs at the end of the electron gun means facing the display screen.

10. A colour television display tube as claimed in any one of Claims 3 to 6, wherein the electron gun means has a centering sleeve and the permanent magnetic ring is provided in the centering sleeve.

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