

PATENT SPECIFICATION

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H1D 4A4 4A7 4B2 4B3A 4B3Y 4B4 4C1 4CY 4K4 4K7D
4K7Y 4K8(54) MAGNETIC CORRECTION DEVICE FOR A
CATHODE RAY TUBE

(71) We, PHILIPS ELECTRONIC AND ASSOCIATED INDUSTRIES LIMITED, of Abacus House, 33 Gutter Lane, London, E.C.2., 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 magnetic correction device for correcting the paths of electron beams produced in a cathode ray tube, which device comprises a support made of a non-magnetic material, securing means for securing the support on the neck of a cathode ray tube, a pair of coaxial rings having magnetic poles distributed about their peripheries, which rings are mounted on the support and are rotatable about their common axis in opposite relative directions.

Such correction devices are used, for example, in colour television display tubes for correcting the paths of the electron beams so that firstly each beam impinges on only that part of a phosphor pattern provided on the display screen of the tube which luminesces in the correct colour (colour purity) and secondly the three beams intersect at the correct location (convergence). Such a device is described for example, in re-issued United States Patent Specification Re. 27,209. A present trend in the design of television receivers is to reduce the receiver depth to a minimum. This depth is substantially exclusively determined by the length of the display tube, one of the factors which govern this length being the axial dimensions of the correction device. Hence it is desirable for this dimension to be as small as possible.

The invention provides a magnetic correction device of the type described in the opening paragraph in which one of the rings has an inner diameter which is greater than the outer diameter of the other ring, the smaller ring being concentrically

mounted within the larger ring, the outer ring being an internally toothed ring whilst the inner ring is an externally toothed ring, at least one pinion which is rotatably mounted on the support about an axis parallel to the common axis of the rings being located in a space provided between the two rings and meshing with the teeth on both rings. Preferably the inner and outer rings have an equal number of teeth, causing them to rotate through equal and opposite angles.

For the purpose of corrective adjustment the rings and/or the support preferably have lugs which radially project to the exterior.

An embodiment which enables the correction device to be readily mounted on the tube neck and the support to be readily rotated for adjusting the desired correction has the securing means for securing the support on the neck of a cathode ray tube which comprises an intermediate ring whose inner diameter is such that it may be coaxially mounted on the tube neck, the intermediate ring forming a spindle about which the support may be rotatably mounted.

An embodiment of the invention will now be described by way of example with reference to the accompanying diagrammatic drawings, in which:

Figure 1 is a schematic side elevation of a cathode ray tube provided with a correction device according to the invention.

Figures 2a to 2c illustrate the corrections to be effected by means of the correction device according to the invention.

Figure 3 is a front elevation of a support which carries a pair of rings and forms part of the correction device according to the invention.

Figure 4 is a longitudinal sectional view of the support and the ring pair shown in Figure 3.

Figure 5 is an exploded perspective view

of the correction device according to the invention,

Figure 6 is a side elevation of the correction device shown in Figure 5 when assembled,

Figure 7 is a developed view of a portion of the thrust ring which forms part of the device shown in Figures 5 and 6, and

Figures 8a and 8b are a longitudinal sectional view and a cross-sectional view respectively of an extension for use with the device shown in Figures 5 and 6.

Referring now to Figure 1, there is schematically shown a cathode ray tube which comprises a cylindrical neck 1 and flared part 3 which at the front carries a display screen 5. The neck contains three electron guns 7 which are arranged side by side, only one of them being shown (in broken lines), and are capable of producing three electron beams which extend side by side in a horizontal plane. A known deflection system 9 is provided for deflecting these electron beams so that they scan the entire display screen 5, which system surrounds the tube at the junction of the neck 1 and the flared part 3. A magnetic correcting device 11 is mounted on the tube neck for correcting directional errors of the three electron beams produced by the electron guns 7. The corrections to be performed by means of such a device are illustrated in Figures 2a, to 2c. In these Figures the three electron beams are designated 13, 15 and 17 respectively. The display screen 5 is provided with a pattern of vertical stripes of phosphor which when struck by an electron beam luminesce in one of the colours red, green and blue (not shown). A colour selection electrode (shadow mask) 19 (shown in broken lines in Figure 1) serves to ensure that each electron beam can impinge on phosphor stripes of one colour only. The beam 13 is to strike the red phosphor, the beam 15 the green phosphor, and the beam 17 the blue phosphor. Owing to inevitable inaccuracies in manufacturing the tube and the deflection system deviations from the ideal situation are found to occur in practice. These deviations will be readily apparent when a cross hatch pattern of horizontal and vertical white lines is displayed on the display screen 5. In actual fact such a grid comprises three exactly registering grids of red, green and blue lines respectively. The first error which may occur could be that the electron beams do not always impinge on the phosphor stripes of the correct colour alone, i.e. part of, for example, the green beam may strike the green phosphor and part may strike the red phosphor. This error can be corrected by shifting the beams in a horizontal direction, for example by producing a magnetic field the lines of force of which

extend in the vertical direction at the location of the beams, i.e. centrally of the tube neck 1. This may be effected, for example in the manner shown in Figure 2a, by means of a magnetic ring 21 having two diametrically opposed magnetic poles. Magnetic lines of force 23 cause horizontal shifting of the beam 15 (and also of the beams 13 and 17) in the direction indicated by arrows 25. The strength of the magnetic field and hence the magnitude of the shift 25 can be rendered controllable by rotating in known manner two rings 21 in opposite directions. Rotation of both rings through 180° enables the shift to be varied from extreme right through zero to extreme left. This correction is referred to as colour purity correction.

A second possible error is that the three guns (which after the colour purity correction each have the correct colour) are not in register. This error (convergence error) can be corrected in two steps. First (see Figure 2b) the red and blue guns are made to register by shifting the beams 13 and 17 in opposite directions. For this purpose a quadrupolar magnetic field is produced (in known manner) by means of a magnetic ring 27 which has four poles distributed about its periphery. At the locations of the beams 13 and 17 lines of force 29 of the magnetic field produced by the ring 27 always extend in opposite directions so that the lines 31 and 33 along which the beams are moved, also have opposite directions. The strength of the quadrupolar field can be controlled, in the same manner as that of the bipolar field of the colour purity ring 21, by rotating two rings 27 in opposite directions. The directions of the arrows 31 and 33 can be controlled by jointly rotating the two rings 27 in the same direction. Figure 2b shows further that the ring 27 does not produce a magnetic field at the location of the middle beam 15 and hence this beam is not displaced.

After the red and blue beams have been superimposed on one another in the manner described, the resulting combined beams must be brought into register with the green beam of the shadow mask. For this purpose the beams 13 and 17 are to be shifted in the same direction through equal distances, as is shown in Figure 2c. This can be obtained by means of a sextupolar magnetic field which is produced by a magnetic ring 35 having six magnetic poles distributed about its periphery. As Figure 2c shows, magnetic lines of force 37 then have the same direction at the locations of the beams 13 and 17, so that the shift at 39 and 41 respectively of these beams is identical. In complete analogy with the situation illustrated by Figure 2b: the magnitude and the direction of the shifts are adjustable by rotating the two rings 35 first

in opposite sense and then in the same sense. In this case also, the resulting magnetic field strength at the location of the green beam 15 is zero.

5 From the above it will be obvious that for each possible correction a pair of rings having magnetic poles distributed about their peripheries are required which are to be rotatable in opposite senses and, in many cases, also jointly in the same sense. To enable the axial length of the correction device 11 yet to be reduced to a minimum pairs of rings 43, 45 are designed so that one of the rings (43) has an inner diameter which is greater than the outer diameter of the other ring (45). As Figures 3 and 4 show, the smaller ring 45 is mounted concentrically within the larger ring 43. The two rings 43 and 45 are disposed on a similarly ring-shaped support 47 which can be mounted on the tube neck so as to be rotated together with the ring pair about the axis of the tube. The support 47 has a protruding rim 48 along its inner circumference for the purpose of centering the ring pair. In order to enable the two rings 43 and 45 to be rotated in opposite directions the outer ring 43 is provided with teeth 49 along its inner periphery whilst the inner ring 45 is provided with teeth 51 along its outer periphery. In the space between the inner toothed ring 45 and the outer toothed ring 43 a pinion 53 is mounted which meshes with both sets of teeth 49 and 51. The pinion 53 is arranged to revolve about a spindle 55 formed on the support 47 and extending parallel to the axis of the ring pair. In order to drive the two rings 43 and 45 the outer ring 43 only has to be rotated, the inner ring 45 then being automatically rotated in the opposite sense through the pinion 53. For this purpose the outer ring 43 is provided with radially projecting lugs 57, four in the present embodiment. Adjustment of the magnetic field strength will be easiest if the two rings 43 and 45 always rotate in opposite senses through equal angles. This is obtained by using equal numbers of teeth 49 and 51. If desired, two or more pinions 53 may be used which may be distributed about the space between the two rings 43 and 45. In order to facilitate rotation of the support 47 this is also provided with a radially projecting lug or lugs 59 (one in the present case).

A correction device comprising three supports 47 each carrying a ring pair 43, 45 is shown in an exploded perspective view in Figure 5 and in side elevation in Figure 6. The three supports 47 are secured one behind the other to an intermediate ring 61 having an inner diameter such as to fit around the tube neck with a small amount of clearance. In order to enable the intermediate ring 61 to be clamped to the tube neck its

inner diameter increases towards one end (the right-hand end in Figure 5; this increase is not visible in the drawings), a tapered clamping ring 63 fitting within this end. The tapered clamping ring 63 has a gap 64 which progressively closes as the ring is axially thrust into the flaring part of the intermediate ring 61. As a result the inner diameter of the tapered clamping ring 63 is decreased so that it firmly encloses the tube neck. To increase the friction between clamping ring 63 and the glass of the tube neck 1 the ring is internally provided with rubber strips 65. To enable axial pressure to be exerted on the clamping ring 63 a ring 67 is provided which by means of radial inward projections 69 which engage behind a collar 71 formed on the intermediate ring 61 and has inclined rim sections 73 which cooperate with inclined rim sections 75 of the tapered clamping ring 63, so that rotation of the ring 67 results in axial displacement of the clamping ring 63. To facilitate rotation of the ring 67 it is provided with a radially protruding lug 77.

The outer diameter of the intermediate ring 61 is such that it fits with a small amount of clearance in each support 47 and hence can be used as a spindle for rotation of the supports. As has been set out with reference to Figures 2a, the colour purity correction may in some cases be effected by causing two diametrically magnetised rings to revolve in opposite senses without the need for joint rotation. In this case the support 47 for the colour purity rings may be locked against rotation about the intermediate ring, which may have advantages, as will be set forth hereinafter. For efficient manufacture of the support 47 it is desirable to use supports of a single type only for all the corrections which are capable of being mounted on the intermediate ring 61 so as to be either rotatable or locked. For this purpose the protruding rim 48 along the inner periphery of the support 47 is formed with one or more gaps 79, a corresponding number of projections 81 being formed on the intermediate ring 61. When a support 47 is placed on the intermediate ring 61 so that a projection 81 is received in a gap 79, the support is locked against rotation. The supports 47 which are mounted in front of or behind the projections 81 are freely rotatable. In the embodiment shown in Figures 5 and 6 the middle support 47 (which carries diametrically magnetised rings 43 and 45) is locked and is flanked on either side by a rotatable support. One of these rotatable supports carries rings 43 and 45 which each have four magnetic poles distributed about their peripheries for effecting the correction described with reference to Figure 2b, the other rotatable support carrying rings which each have six poles distributed about their

peripheries for performing the correction described with reference to Figure 2c. Because the locked support is interposed between the two rotatable supports, rotation of one of the rotatable supports is prevented from being transmitted to the other by friction.

Thus the rotary movements of the rotatable supports are entirely independent of one another. To prevent a corrected condition from being incidentally upset, preferably means are provided to lock the supports and possibly the rings against further rotation around the intermediate ring. For this purpose each support 47 is provided on its major surfaces with knurled areas 83 located on raised portions which also serve to center the outer ring 43. When the set of supports 47 is axially compressed, these knurled areas ensure mutual locking. Because the middle support is locked against rotation by the projection 81, the outer supports also are locked against rotation. Axial compression of the set of supports is performed by means of a thrust ring 85 mounted for rotation around the intermediate ring 61. This thrust ring near its inner periphery has a portion 87 the thickness of which varies in the peripheral direction. Figure 7 shows the developed portion 87. This portion is located between a radial projection 89 formed on the intermediate ring 61 and the left-hand support 47. The various component parts are proportioned so that the projection 89 and the left-hand support 47 are spaced from one another by a distance intermediate between the smallest thickness x and the largest thickness y of the portion 87 of the thrust ring 85. Thus on rotation of the thrust ring 85 the portion 87 acts as a wedge which axially clamps the central supports. To facilitate this rotation the thrust ring 85 is provided with radially projecting lugs 91. To prevent undue rotation of the thrust ring 85 the portion 87 has a knurled surface 92. In the embodiment shown the support 47 can only be locked against rotation. Obviously the rings 43 and/or 45 may also be provided with knurled areas which can engage corresponding knurled areas on the support 47, enabling these rings also to be locked. Other locking means may be used, for example a braking block adapted to be forced against the rims of the supports 47 and the outer rings 43, which block and which rims may also be knurled.

When the lugs 57 and 59 of the rings 43 and the support 47 respectively are in substantially equal angular positions, it may be difficult to move one lug by hand without unintentionally moving the other. Hence these lugs are preferably adapted to be axially extended for example by means of a simple extension 93 which is shown in cross

section in Figure 8a and comprises a cavity 95 adapted to be slipped onto the lugs 57, 59 and a handle 97. A section in the direction 6-6 of Figure 8a is shown in Figure 8b.

In the embodiment described the correction device comprises three supports each carrying ring pairs for effecting the corrections described with reference to Figure 2. Obviously, if desired, a higher or lower number of supports may be used and furthermore the number of magnetic poles of each ring and their distribution about the periphery of each ring may be matched to the respective requirements. Thus, the correction device according to the invention is suitable for solving many different correction problems, also in cathode ray tubes of types different from that shown in Figure 1 where the three electron guns are arranged side by side.

For manufacturing the correction device, as far as possible material of low magnetic permeability, or of a synthetic material, is used to prevent the stray field at the rear of the deflection system 9 from influencing the electron beams via the correction device. This also applies to the rings 43, 45, which may be made of a low-permeability magnetic material, as is the case in the embodiment described, or of a synthetic material, in which case magnets are locally secured to them, for example by means of an adhesive.

WHAT WE CLAIM IS:—

1. A magnetic correction device for correcting the paths of electron beams produced in a cathode ray tube, which device comprises a support made of a non-magnetic material, securing means for securing the support to the neck of a cathode ray tube, and a pair of coaxial rings having magnetic poles distributed about their peripheries, which rings are mounted on the support and are rotatable about their common axis in opposite relative directions, one of the rings having an inner diameter which is greater than the outer diameter of the other ring, the smaller ring being concentrically mounted within the larger ring, the outer ring being an internally toothed ring whilst the inner ring is an externally toothed ring, at least one pinion which is rotatably mounted on the support about an axis parallel to the common axis of the rings, being located in a space provided between the two rings and meshing with the teeth on both rings.

2. A correction device as claimed in claim 1, in which the teeth on the inner and outer rings are equal in number.

3. A correction device as claimed in claim 1 or 2, in which the outer ring is provided with a radially externally projecting lug.

4. A correction device as claimed in claim

peripheries for performing the correction described with reference to Figure 2c. Because the locked support is interposed between the two rotatable supports, rotation of one of the rotatable supports is prevented from being transmitted to the other by friction.

Thus the rotary movements of the rotatable supports are entirely independent of one another. To prevent a corrected condition from being incidentally upset, preferably means are provided to lock the supports and possibly the rings against further rotation around the intermediate ring. For this purpose each support 47 is provided on its major surfaces with knurled areas 83 located on raised portions which also serve to center the outer ring 43. When the set of supports 47 is axially compressed, these knurled areas ensure mutual locking. Because the middle support is locked against rotation by the projection 81, the outer supports also are locked against rotation. Axial compression of the set of supports is performed by means of a thrust ring 85 mounted for rotation around the intermediate ring 61. This thrust ring near its inner periphery has a portion 87 the thickness of which varies in the peripheral direction. Figure 7 shows the developed portion 87. This portion is located between a radial projection 89 formed on the intermediate ring 61 and the left-hand support 47. The various component parts are proportioned so that the projection 89 and the left-hand support 47 are spaced from one another by a distance intermediate between the smallest thickness x and the largest thickness y of the portion 87 of the thrust ring 85. Thus on rotation of the thrust ring 85 the portion 87 acts as a wedge which axially clamps the central supports. To facilitate this rotation the thrust ring 85 is provided with radially projecting lugs 91. To prevent undue rotation of the thrust ring 85 the portion 87 has a knurled surface 92. In the embodiment shown the support 47 can only be locked against rotation. Obviously the rings 43 and/or 45 may also be provided with knurled areas which can engage corresponding knurled areas on the support 47, enabling these rings also to be locked. Other locking means may be used, for example a braking block adapted to be forced against the rims of the supports 47 and the outer rings 43, which block and which rims may also be knurled.

When the lugs 57 and 59 of the rings 43 and the support 47 respectively are in substantially equal angular positions, it may be difficult to move one lug by hand without unintentionally moving the other. Hence these lugs are preferably adapted to be axially extended for example by means of a simple extension 93 which is shown in cross

section in Figure 8a and comprises a cavity 95 adapted to be slipped onto the lugs 57, 59 and a handle 97. A section in the direction 6—6 of Figure 8a is shown in Figure 8b.

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For manufacturing the correction device, as far as possible material of low magnetic permeability, or of a synthetic material, is used to prevent the stray field at the rear of the deflection system 9 from influencing the electron beams via the correction device. This also applies to the rings 43, 45, which may be made of a low-permeability magnetic material, as is the case in the embodiment described, or of a synthetic material, in which case magnets are locally secured to them, for example by means of an adhesive.

WHAT WE CLAIM IS:—

1. A magnetic correction device for correcting the paths of electron beams produced in a cathode ray tube, which device comprises a support made of a non-magnetic material, securing means for securing the support to the neck of a cathode ray tube, and a pair of coaxial rings having magnetic poles distributed about their peripheries, which rings are mounted on the support and are rotatable about their common axis in opposite relative directions, one of the rings having an inner diameter which is greater than the outer diameter of the other ring, the smaller ring being concentrically mounted within the larger ring, the outer ring being an internally toothed ring whilst the inner ring is an externally toothed ring, at least one pinion which is rotatably mounted on the support about an axis parallel to the common axis of the rings, being located in a space provided between the two rings and meshing with the teeth on both rings.

2. A correction device as claimed in claim 1, in which the teeth on the inner and outer rings are equal in number.

3. A correction device as claimed in claim 1 or 2, in which the outer ring is provided with a radially externally projecting lug.

4. A correction device as claimed in claim



3, in which the support is also provided with a radially externally projecting lug.

5. A correction device as claimed in claim 3 or 4, in which the lug or lugs is/are each further extensible by means of an extension adapted to be slipped on the lug.

6. A correction device as claimed in any of claims 1 to 5, in which the securing means for securing the support to the neck of a cathode ray tube comprise an intermediate ring whose inner diameter is such that it may be coaxially mounted on the tube neck, the intermediate ring forming a spindle about which the support may be rotatably mounted.

7. A correction device as claimed in claim 6, in which the first mentioned and a second support are rotatably mounted on the intermediate ring, each of the rings carried by the first support having four magnetic poles distributed about its periphery, whilst each of the rings carried by the second support has six magnetic poles distributed about its periphery.

8. A correction device as claimed in claim 7, in which a third supported is provided between said first and second supports which third support is secured to the intermediate ring so as to be locked against rotation, each of the rings carried by the third support having two diametrically arranged magnetic poles.

9. A correction device as claimed in claims 6, 7 or 8, in which means are provided for locking the supports against rotation about the intermediate ring after the desired correction has been effected.

10. A correction device as claimed in claim 9 when dependent on claim 8, in which the locking means comprise knurled

areas provided on both the first and second supports which are capable of engaging corresponding knurled areas provided on the third support.

11. A correction device as claimed in claim 10, in which the knurled areas are located on the major surfaces of each support, thrust means being provided for exerting an axial force on the three supports.

12. A correction device as claimed in claim 11, in which the thrust means comprises a thrust ring which is secured to the intermediate ring and is rotatable about the intermediate ring which acts as a spindle for said thrust means, the thickness of the thrust means varying in the peripheral direction at least near the inner periphery, the portion of varying thickness being located between at least one radial projection formed on the intermediate ring and one of the supports, the arrangement being such that the spacing between the projection and the said support is greater than the smallest thickness and smaller than the greatest thickness of the said portion of the thrust ring.

13. A correction device as claimed in any of claims 6 to 12, in which a conical clamping ring is provided for securing the intermediate ring to the neck of a cathode ray tube.

14. A magnetic correction device substantially as herein described with reference to the drawings.

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