

1078,986

PATENT SPECIFICATION

DRAWINGS ATTACHED

1078,986



Date of Application and filing Complete Specification: April 21, 1965.
No. 16886/65.

Application made in United States of America (No. 362092) on April 23, 1964.
Complete Specification Published: Aug. 9, 1967.

© Crown Copyright 1967.

Index at acceptance: —H1 D(4A4, 4A7, 4B2, 4B3, 4B4, 4C1, 4C2, 4CY, 4G6, 4GY, 4K4, 4K7, 4K8)
Int. Cl.: —H 01 j 29/54

COMPLETE SPECIFICATION

Magnetic Electron Beam Control in Image Reproducing Devices

We, RADIO CORPORATION OF AMERICA, a Corporation organized under the laws of the State of Delaware, United States of America, of 30, Rockefeller Plaza, City and State of New York, United States of America, 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:—

This invention relates to a magnetic electron beam control arrangement which is particularly useful for effecting electron beam control in a colour image reproducing device.

A widely used form of colour image reproducing device is the tri-gun, shadow-mask colour kinescope. For convergence purposes, there is conventionally associated with the tri-gun colour kinescope a set of beam convergence magnets for effecting adjustment of the respective beam positions prior to their deflection.

To achieve the centre-of-the-screen static beam convergence, it has proved convenient to provide individual adjustment magnets for each beam.

In order to provide ability to correct for all possible misconvergence errors, it is necessary to supplement the three individual beam adjustments in respective radial directions with a fourth adjustment parameter.

It is convenient, and has become customary, to associate the required fourth beam position adjustment parameter with the blue beam, i.e., to provide an adjustment of the blue beam position in a lateral or horizontal direction. In order for the four parameters of beam adjustment to be independent, the lateral adjustment of the blue beam generally should not affect the positioning of the remaining beams; this rule is subject, however, to one exception: movement of the other beams in the opposite lateral direction is readily tolerable and, indeed, desirable, since this accentuates

the desired adjustment of the relative beam positions when controlling this fourth parameter.

The presence of internal pole pieces in conjunction with the blue lateral adjustor has been found to cause serious distortion of the colour purity field when the colour purity and blue lateral adjustors are closely spaced in adjacency on a shortneck kinescope.

The present invention seeks to provide a novel magnetic electron beam control or adjustment arrangement which permits achievement of the desired lateral deflection without need for internal magnetic structures.

In accordance with the present invention, there is provided an electron beam control arrangement in combination with an image reproducing device, the arrangement comprising: a first pair of magnets disposed at first selected positions spaced about the external periphery of a cylindrical neck portion of the device; a second pair of magnets disposed at second selected positions spaced about the external periphery of said neck portion, the peripheral neck region adjacent to said second magnet positions being diametrically opposed to the peripheral neck region adjacent to said first magnet positions; and an adjustable support means by which the proximity of said first and second magnet pairs to the central axis of said neck portion are conjointly adjustable.

The invention will now be described with reference to the accompanying drawings, in which:

FIGURE 1 illustrates diagrammatically the association of lateral deflection controlling magnets with a colour kinescope in accordance with the principles of the present invention;

FIGURE 2 provides, in a cross-sectional view of the kinescope neck, a more complete showing of the magnet arrangement in accord-

ance with an embodiment of the present invention;

FIGURE 3 supplements the cross-sectional view of FIGURE 2, on a larger scale, with a showing of flux lines associated with the respective magnets of the invention embodiment to aid in an explanation of the invention principles;

FIGURE 4 is a vector diagram, demonstrating the combined effects of the respective magnets of the invention embodiment upon the respective beams of the colour kinescope;

FIGURES 5 and 6, in end view (partially in section), and FIGURE 7, in a cross-sectional view, illustrate a mounting and adjusting structure that may be employed to support and adjust a magnet arrangement in accordance with an embodiment of the present invention.

The partial diagrammatic showing of FIGURE 1 is not intended to depict the exact configuration of a magnet arrangement in accordance with the present invention, but shows the general location and direction of movement of magnetic structures pursuant to the invention principles. The neck 11 and initial flared portion 13 of the envelope of a colour kinescope 15 is illustrated in a partially broken away side view. A deflection yoke structure 17 encircles the forward end of the neck 11 and the adjacent segment of the flared envelope portion 13. The deflection yoke structure may, for example, be of the form wherein a common mount not only supports the raster developing deflection yoke but also incorporates at its rear end beam convergence apparatus and support therefor. The details of the deflection and convergence apparatus, being of no concern in explaining the principles of the present invention, have not been illustrated in FIGURE 1.

A colour purity adjusting structure 19, performing a well known function, also encircles the neck 11 of kinescope 15 at a point spaced to the rear of the deflection yoke structure 17. The colour purity adjusting structure may, for example, take the form of a pair of magnetic rings, subject to individual rotational adjustment about the tube axis; but again, since the details thereof are of no concern in describing the principles of the present invention, such details have not been illustrated in FIGURE 1.

A pair of diagrammatically illustrated magnetic structures 21 and 23, respectively, are shown in positions intermediate the deflection yoke structure 17 and the purity adjusting structure 19. One magnetic structure 21 shown at the top of FIGURE 1, has been illustrated as closely spaced to the envelope periphery of the top of neck 11; the other magnetic structure 23, shown at the bottom of the drawing, has been illustrated as more remotely spaced from the envelope periphery

of neck 11 rather than the top magnetic structure 21. As the arrows on FIGURE 1 indicate, each of the magnetic structures 21 and 23 is subject to movement away from its illustrated position, the illustrated movements of direction being mutually opposite (though common in the sense of moving away from the tube axis).

A more complete showing of the intended magnetic structure, diagrammatically shown as structures 21 and 23, is provided in FIGURE 2, where a cross-section of the tube neck is illustrated. As shown in FIGURE 2, the contemplated magnetic structure of the invention embodiment consists of four discrete magnets, arranged in pairs; magnets 21a and 21b positioned near to the top of the envelope, in proximity to the position of the blue beam of the kinescope (designated by the circle labelled B); and a pair of magnets 23a and 23b positioned at the bottom of the neck 11, in proximity to the green and red beam positions (designated G and R), respectively. These four magnets may conveniently be substantially identical in size, shape, material and magnetic strength.

Magnets 21a and 21b are symmetrically located on either side of the blue beam position. Each magnet is in the form of a bar, with each bar being tilted to extend generally perpendicular to a radius extending from tube axis to the bar centre. The acute angle subtended by the respective radii is bisected by the vertical radius that extends through the centre of the blue beam position.

The magnetic bars 23a and 23b, at the bottom of FIGURE 2, are also tilted to be generally perpendicular to the respective radii from the tube axis to the respective magnetic bar centres. The bottom bar magnets 23a and 23b are in vertical registry with the top bar magnets 21a and 21b, respectively. However, the radial distance from the tube axis to each bar centre for the bottom bar pair 23a and 23b is greater than the radial distance from the tube axis for the top bar pair 21a and 21b.

FIGURE 3 illustrates the flux line patterns associated with the respective magnets 21a, 21b, 23a and 23b. The arrows associated with the respective flux lines are in conformance with the convention designating flux flow from the north pole to the south pole. It will be observed that, in the illustrative showings of FIGURES 2 and 3, the poling of the top bar pair 21a and 21b is such that the respective south poles thereof adjoin, whereas the poling of the bottom bar pair 23a and 23b is such that the north poles thereof adjoin.

As FIGURE 3 shows, each of the beam positions B, R and G is intersected by lines of flux from each of the four magnets 21a, 21b, 23a and 23b. The flux line direction at each beam position is different from the flux lines of each magnet, and all differ from

side

the

beam position to beam position. While no attempt has been made to accurately indicate it in FIGURE 3, the flux line strength for the field of each magnet at each beam position varies according to the distance from the beam position to the magnet location.

A more accurate representation of the relative differences in field strength and direction for each magnet's field at each beam position is presented by the vector diagrams of FIGURE 4. These vector diagrams further illustrate the combined effect on each beam of the interacting magnetic field of the four magnets. As the upper vector diagram associated with the blue beam position B shows, the flux lines of the respective magnets 21a and 21b produce a net field that extends upwardly in a vertical direction as shown by the vector V_B . The contributions to this result provided by each of the magnets 21a and 21b are represented by the respective vectors V_{21a} , V_{21b} . It should be observed that the bottom magnets 23a and 23b also contribute a small effect to the net field associated with the blue beam position B. The net effect from these two magnets remote from B and symmetrically disposed on either side thereof is a small component extending in the same direction as the result of vectors V_{21a} , V_{21b} .

Neither of the beam positions G or R is symmetrically located with respect to either of the magnet pairs 21a, 21b or 23a, 23b. The magnet closest to the green beam position G is magnet 23a of the bottom pair. Its field (V'_{23a}) is diagonal to the horizontal and vertical directions. However, the combination of the respective fields of the other three magnets (represented by the vectors V'_{21a} , V'_{21b} and V'_{23b}) is sufficient to overcome the lateral component of the field of magnet 23a, leaving a resultant field, represented by the vector V_G , which is parallel to the vertical axis, although opposite in polarity to the resultant field V_B produced at the blue beam position.

An effect similar to that obtained at the green beam position is provided at the red beam position R. There, the closest magnet, producing the field of greatest strength, is magnet 23b of the bottom pair. Its field is also diagonally related to the horizontal and vertical axes (but is in a different quadrant than the field of magnet 23a at the green beam position). Again, the combined effects of the fields of the three remaining magnets is such as to effectively cancel out the lateral component of this diagonal field, leaving a resultant field, represented by the vector V_R , which is parallel to the vertical axis, and is of the same polarity as the resultant field at the green beam position, and equal in amplitude with the latter.

The effect of the resultant fields indicated in the vector diagram of FIGURE 4 is the desired one: a lateral movement of the blue beam position and smaller lateral movements

of the green and red beam positions in an opposite direction.

As the respective magnet pairs 21a, 21b and 23a, 23b are moved outwardly away from the positions illustrated for them in FIGURE 3, the general result illustrated by the vector diagrams of FIGURE 4 continues to obtain although the resultant fields lessen in magnitude (i.e., the lateral shifts of the beams are of diminished amplitude). However, where the direction of movement of each of the magnets is not along respective radii, but rather, in a common direction such as parallel to the vertical axis, the precise lateral field component cancellation effects illustrated for the green and red beam positions in FIGURE 4 exist at only one position along the path of travel; departures from this position result in incomplete cancellation of the lateral field component, and hence, introduction of a small vertical component of green and red beam movement.

It has been found to be preferable to achieve the optimum lateral field component cancellation effect at the magnet structure adjustment position corresponding to maximum beam shift (i.e., the "close-in" position of the magnets illustrated in FIGURE 3). If this practice is followed, the lateral field component cancellation at the green and red beam positions will become less complete as the magnets travel further away from the tube. This has been found to be quite tolerable since the magnitude of the resultant field at the green and red beam positions rapidly diminishes to a relatively insignificant value as the magnets are moved away from the tube, and the particular direction of beam movement produced accordingly becomes less and less significant.

With the illustrated top location of the magnet pair 21a, 21b and bottom location of the magnet pair 23a, 23b the lateral movement of the blue beam effected by the magnetic structure will only be in one particular direction (with the magnitude of movement in that direction determined by the adjustment of proximity of the magnet pairs to the tube axis). To obtain movement of the blue beam in the opposite direction, the locations of the respective magnet pairs should be exchanged (i.e., magnet pair 23a, 23b in the top position, in proximity to the blue beam location, and magnet pair 21a, 21b in the bottom position). The exchange should be effected so as to maintain the now bottom magnet pair more remote from the tube axis than the now top magnet pair, so that the previously described lateral field component cancellation effect can be retained. Adjustment of the magnitude of the opposite direction movement of the blue beam is achieved in the same manner as previously described, i.e., by conjoint inward or outward movement of both magnet pairs with respect to the tube axis.

FIGURES 5, 6 and 7 illustrate several views of a form of mounting and adjusting structure for the magnet pairs 21a, 21b and 23a, 23b, which structure has been found to be quite satisfactory for achieving the desired blue lateral adjustment in accordance with the principles of the invention discussed above.

FIGURE 5 is an end view of the lateral magnet hold structure (partially in section) in position encircling the kinescope neck (shown in cross-sectional view), with the magnets midway in their range of positional adjustment. FIGURE 6 is a similar view, with the magnets altered from their midway position of FIGURE 5 to a position approaching the "close-in" end of the adjustment range. FIGURE 7 is a side view of the kinescope neck, with the lateral magnet holder structure shown in cross-section.

The holder structure of FIGURES 5, 6 and 7 includes a main cylindrical support member 40 which is adapted to encircle the kinescope neck 11 to provide an outer cylindrical surface eccentrically related to the cylindrical neck. A generally crescent-shaped web or diaphragm member 42 extending within the cylindrical body of member 40 abuts a major portion of the outer surface of the kinescope neck, establishing the eccentricity of the outer cylindrical surface. Proper orientation of this web member 42 with respect to the circumference of the tube neck shifts the axis of the cylindrical surface of member 40 in a downward vertical direction relative to the tube neck axis. The support member 40 is provided at one end with a raised cylindrical flange 41, and at the opposite end with a trio of finger like extensions 44 which extend longitudinally with respect to the tube axis from one end of the main cylindrical body of the support. These fingers abut the outer surface of the kinescope neck, and receive a clamping strap 46, which encircles the tube neck in abutment with the outer surface of the fingers 44. The strap 46 is provided with suitable means (not illustrated) for tightly securing the strap to lock the support member 40 in position on the tube neck.

Surrounding the main cylindrical portion of support member 40 is a generally cylindrical guide member 50. Integral with the main cylindrical portion of the guide member 50 are two raised cage members 52a, 52b attached to the periphery of the cylindrical portion in position 180° apart. Each of the cage members 52a and 52b have respective slots 54 extending longitudinally in the centre of each cage side member, the slots thus extending at right angles to the longitudinal axis of the tube neck 11. The two slots of each cage member are in registry with each other, and are adapted to receive respective end flanges 56 of a magnet holder 58.

Each magnet holder 58 incorporates a pair

of oppositely, inwardly canted magnet receiving grooves, within which are secured (e.g., with glue) individual permanent magnets. The grooves of the magnet holder 58 associated with the cage 52a are shown as receiving the individual bar magnets 21a and 21b, whereas the grooves of the holder 58 associated with cage 52b are shown as receiving the individual bar magnets 23a and 23b. The individual magnets are polarized as shown in FIGURE 2; thus, the poling of the top pair of bar magnets 21a and 21b is such that the respective south poles thereof adjoin, whereas the poling of the bottom bar magnets pair 23a and 23b is such that the north poles thereof adjoin.

The portions of the cylindrical body of guide member 50 bridged by the respective cage members 52a and 52b are cut away, with the exception of lug projections 60, which constitute fingerlike continuations of the main cylindrical body of the guide 50 in line with the centre of each overlying cage. The main cylindrical body of the support member 40 is provided with a pair of slots 62 at its flanged end. The lugs 60 are intended for releasable detention in the slots 62, whereby the guide 50 is alterable between two rotation positions about the support member 40. In one position, the cage 52a, retaining the holder for the south pole adjoining pair of magnets, is positioned at the top of the structure (i.e., in that position permitting close approach of the magnets to the kinescope envelope) while the cage 52b is positioned at the bottom of the structure, more remote from the tube envelope due to the interposition of web member 42. In the second position, the respective cages are reversed, with the cage 52b, retaining the holder of the north pole adjoining magnets, being located at the top of the structure, permitting close approach of this magnet pair to the tube envelope.

Surrounding the periphery of the cylindrical body portion of guide 50, to the rear of the cage locations (as viewed in FIGURES 5 and 6), is a rotatable, disc-like cam member 70. The surface of the cam member 70 adjacent to the cage location is provided with a pair of interleaved spiral grooves 72a and 72b. Each of the magnet holders 58 is provided with a pair of rearwardly projecting pins 59. The pins of the holder retained by cage 52a ride in the spiral groove 72a, while the pins of the holder retained by the cage 52b ride in the groove 72b.

As the cam member 70 is rotated about the bearing surface provided by the cylindrical body of guide 50, the spiral grooves of the cam serve to impart vertical motion to the respective holders 58. The respective grooves 72a and 72b are interleaved so as to cause upward motion of the holder in cage 52b when the holder in cage 52a receives downward motion, and *vice versa*. As the

grooves of the cam 70 force the respective holders upwardly or downwardly, the engagement of flanges 56 with slots 54 provide guiding action restricting the holder to motion in a vertical direction, and retaining the holder pins in the respective grooves of cam 70.

The adjustment motion desired for the four magnets 21a, 21b, 23a and 23b, as discussed in conjunction with FIGURE 2, is thus readily provided by the support and adjustment structure of FIGURES 5, 6 and 7. While not illustrated in complete detail, it may be noted that the guide member 50 is conveniently provided with several turned up detect projections 76 about the periphery of its rearmost edge to act as stops for the rear surface of the cam member 70. Likewise, the main cylindrical body portion of support member 40 is provided with radially outwardly projecting detents (not shown) at the rear edge thereof to serve as stops for the rear edge of the cylindrical body of guide 50. Additionally, the fingerlike projections 44 at the rear of support member 40 are made sufficiently long so as to provide sufficient space along the tube axis between the strap 46 location and the rear wall of the web member 42 to accommodate the purity correcting ring structure 80. The purity rings rotate about a bearing surface provided by the fingers 44; the strap member 46 and the rear wall of web member 42 also serve to fix the location of the purity ring structure 80 longitudinally with respect to the tube neck 11.

WHAT WE CLAIM IS:—

1. An electron beam control arrangement in combination with an image reproducing device, the arrangement comprising: a first pair of magnets disposed at first selected positions spaced about the external periphery of a cylindrical neck portion of the device; a second pair of magnets disposed at second selected positions spaced about the external periphery of said neck portion, the peripheral neck region adjacent to said second magnet positions being diametrically opposed to the peripheral neck region adjacent to said first magnet positions; and an adjustable support means by which the proximity of said first and second magnet pairs to the central axis of said neck portion are conjointly adjustable.

2. An arrangement according to Claim 1, wherein said adjustable support means maintains a given difference in the respective proximities of the first and second magnet pairs to the central axis.

3. An arrangement according to Claim 1, wherein said adjustable support means contains means for establishing a difference between the proximity to the central axis of the

first magnet pair and the proximity to said axis of the second magnet pair.

4. An arrangement according to Claim 1, wherein said adjustable support means comprises an adjustable mounting, including: a support member, having a centrally disposed cylindrical aperture, and comprising a first portion presenting a cylindrical outer surface, and a second portion including a pair of generally U-shaped projections extending outwardly from respective diametrically opposed positions along the periphery of said centrally disposed cylindrical aperture, with the base of each U-shaped projection linking the two sides thereof at a distance from the axis of symmetry of said cylindrical aperture in excess of the distance therefrom of said outer surface of said first portion, and with an elongated slot in each of said projection sides extending in a direction perpendicular to said base; a pair of magnet holders, one holder for each pair of said first and second pairs of magnets, each holder comprising a magnet supporting body disposed between the two sides of a respective one of said U-shaped projections, and projecting lugs at opposing ends of said body, said lugs being received in the slots in said sides; a cam member encircling said first portion of said support member and supported for rotation on said cylindrical outer surface, a surface of said cam member facing toward said U-shaped projections being grooved with a pair of interleaved, spiral grooves; means retained in one of said pair of spiral grooves for supporting the body of one of said pair of magnet holders at a distance from said axis determined by the rotational position of said cam member; and means retained in the other of said pair of spiral grooves for supporting the body of the other of said pair of magnet holders at a distance from said axis determined by the rotational position of said cam member.

5. An arrangement according to Claim 4, further including a second support member having a cylindrical outer surface received within said cylindrical aperture of said first support member and concentric therewith, said first support member being supported for rotation on said cylindrical outer surface of said second support member, and said second support member being pierced by a cylindrical aperture located in eccentric relationship to said cylindrical outer surface of said second support member whereby the distances from the axis of symmetry of said eccentrically located aperture to the respective bodies of said pair of magnet holders differ from each other at all rotational positions of said cam member.

6. An electron beam control arrangement in combination with an image reproducing

grooves of the cam 70 force the respective holders upwardly or downwardly, the engagement of flanges 56 with slots 54 provide guiding action restricting the holder to motion in a vertical direction, and retaining the holder pins in the respective grooves of cam 70.

The adjustment motion desired for the four magnets 21a, 21b, 23a and 23b, as discussed in conjunction with FIGURE 2, is thus readily provided by the support and adjustment structure of FIGURES 5, 6 and 7. While not illustrated in complete detail, it may be noted that the guide member 50 is conveniently provided with several turned up detect projections 76 about the periphery of its rearmost edge to act as stops for the rear surface of the cam member 70. Likewise, the main cylindrical body portion of support member 40 is provided with radially outwardly projecting detents (not shown) at the rear edge thereof to serve as stops for the rear edge of the cylindrical body of guide 50. Additionally, the fingerlike projections 44 at the rear of support member 40 are made sufficiently long so as to provide sufficient space along the tube axis between the strap 46 location and the rear wall of the web member 42 to accommodate the purity correcting ring structure 80. The purity rings rotate about a bearing surface provided by the fingers 44; the strap member 46 and the rear wall of web member 42 also serve to fix the location of the purity ring structure 80 longitudinally with respect to the tube neck 11.

WHAT WE CLAIM IS:—

1. An electron beam control arrangement in combination with an image reproducing device, the arrangement comprising: a first pair of magnets disposed at first selected positions spaced about the external periphery of a cylindrical neck portion of the device; a second pair of magnets disposed at second selected positions spaced about the external periphery of said neck portion, the peripheral neck region adjacent to said second magnet positions being diametrically opposed to the peripheral neck region adjacent to said first magnet positions; and an adjustable support means by which the proximity of said first and second magnet pairs to the central axis of said neck portion are conjointly adjustable.

2. An arrangement according to Claim 1, wherein said adjustable support means maintains a given difference in the respective proximities of the first and second magnet pairs to the central axis.

3. An arrangement according to Claim 1, wherein said adjustable support means contains means for establishing a difference between the proximity to the central axis of the

first magnet pair and the proximity to said axis of the second magnet pair.

4. An arrangement according to Claim 1, wherein said adjustable support means comprises an adjustable mounting, including: a support member, having a centrally disposed cylindrical aperture, and comprising a first portion presenting a cylindrical outer surface, and a second portion including a pair of generally U-shaped projections extending outwardly from respective diametrically opposed positions along the periphery of said centrally disposed cylindrical aperture, with the base of each U-shaped projection linking the two sides thereof at a distance from the axis of symmetry of said cylindrical aperture in excess of the distance therefrom of said outer surface of said first portion, and with an elongated slot in each of said projection sides extending in a direction perpendicular to said base; a pair of magnet holders, one holder for each pair of said first and second pairs of magnets, each holder comprising a magnet supporting body disposed between the two sides of a respective one of said U-shaped projections, and projecting lugs at opposing ends of said body, said lugs being received in the slots in said sides; a cam member encircling said first portion of said support member and supported for rotation on said cylindrical outer surface, a surface of said cam member facing toward said U-shaped projections being grooved with a pair of interleaved, spiral grooves; means retained in one of said pair of spiral grooves for supporting the body of one of said pair of magnet holders at a distance from said axis determined by the rotational position of said cam member; and means retained in the other of said pair of spiral grooves for supporting the body of the other of said pair of magnet holders at a distance from said axis determined by the rotational position of said cam member.

5. An arrangement according to Claim 4, further including a second support member having a cylindrical outer surface received within said cylindrical aperture of said first support member and concentric therewith, said first support member being supported for rotation on said cylindrical outer surface of said second support member, and said second support member being pierced by a cylindrical aperture located in eccentric relationship to said cylindrical outer surface of said second support member whereby the distances from the axis of symmetry of said eccentrically located aperture to the respective bodies of said pair of magnet holders differ from each other at all rotational positions of said cam member.

6. An electron beam control arrangement in combination with an image reproducing



device constructed and operable substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

A. M. & Wm. CLARK
Chartered Patent Agents,
5 Stone Buildings,
Lincoln's Inn,
London, W.C.2.

JR

Leamington Spa: Printed for Her Majesty's Stationery Office by the Courier Press.—1967.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.



* C L M S *