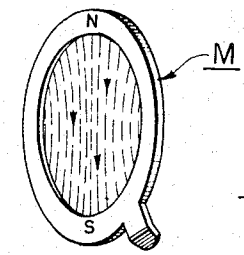
Jan. 9, 1968 J. L. RENNICK 3,363,127

PERMANENT MAGNET BEAM CONTROL APPARATUS FOR A COLOR TELEVISION CATHODE-RAY TUBE

Original Filed June 30, 1965 2 Sheets-Sheet 1

FIG. 1



(PRIOR ART)

FIG. 2

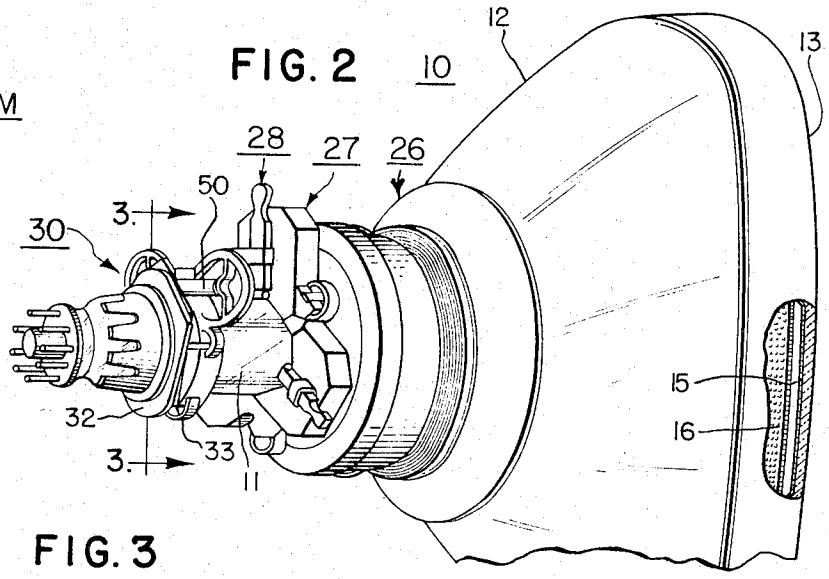


FIG. 3

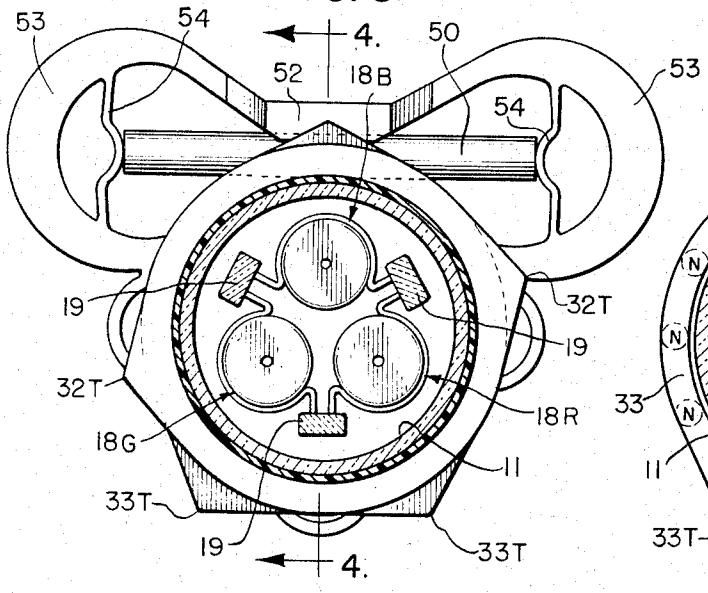


FIG. 3b

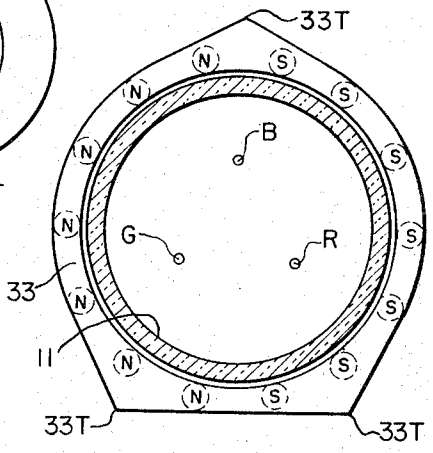


FIG. 3a

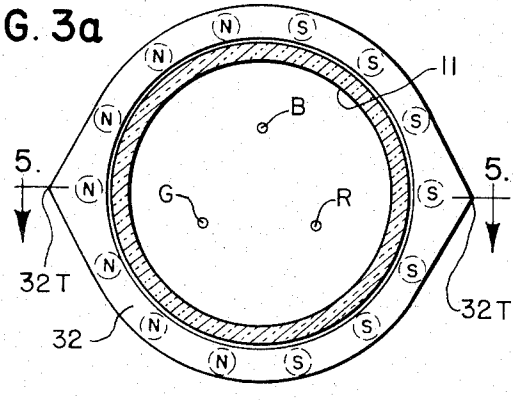
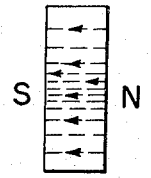


FIG. 3c



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PERMANENT MAGNET BEAM CONTROL APPARATUS FOR A COLOR TELEVISION CATHODE-RAY TUBE

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FIG. 4

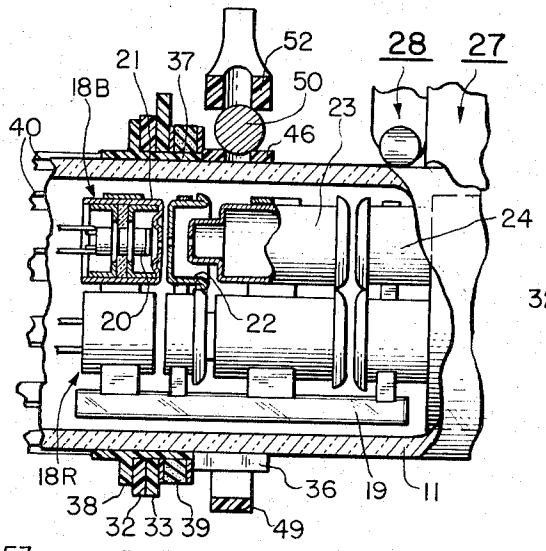


FIG. 5

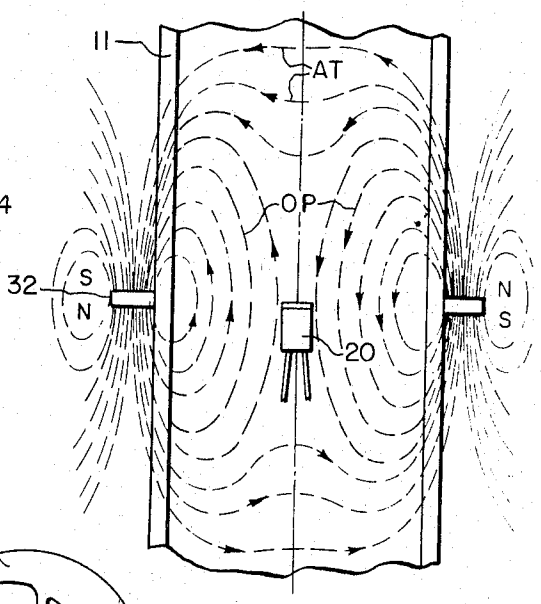


FIG. 7

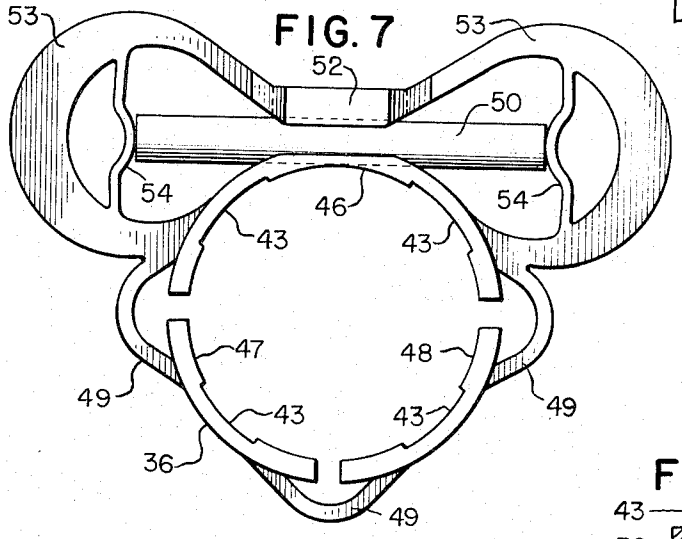


FIG. 8

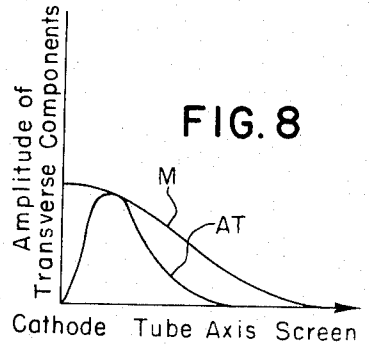


FIG. 6

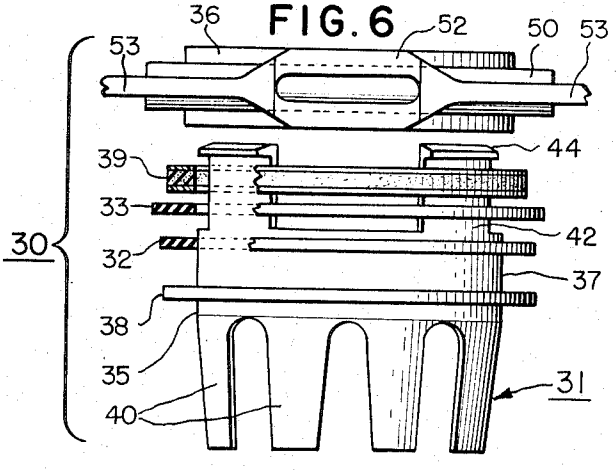


FIG. 6a

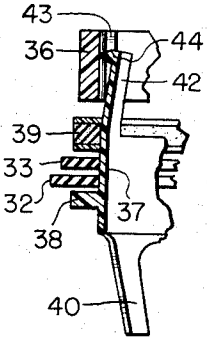
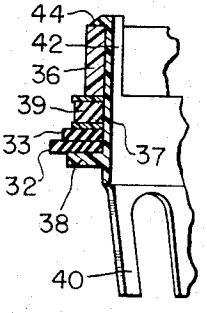


FIG. 6b



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Patented Jan. 9, 1968

3,363,127

PERMANENT MAGNET BEAM CONTROL APPARATUS FOR A COLOR TELEVISION CATHODE-RAY TUBE

John L. Rennick, Elmwood Park, Ill., assignor to Zenith Radio Corporation, Chicago, Ill., a corporation of Delaware

Original application June 30, 1965, Ser. No. 468,254. Divided and this application Oct. 7, 1965, Ser. No. 493,715

10 Claims. (Cl. 313—77)

ABSTRACT OF THE DISCLOSURE

A common insulating support preferably of nylon or the like, is provided for mounting one or more annular purity magnets and a rotatable blue lateral bar magnet in proper orientation relative to the electron gun assembly of a color television picture tube. The blue lateral magnet mount is separately useful and comprises a one-piece non-magnetic member which has a mounting section to engage the tube neck and a bearing section which engages the blue lateral bar magnet. A pair of lobes with resilient webs are provided to stabilize the bar magnet longitudinally.

This application is a division of the co-pending application of John L. Rennick, Ser. No. 468,254, filed June 30, 1965, for Ring Magnetized Across Thickness with Two Diametrically Opposed and Oppositely Oriented Groups of Magnetic Pole Pairs, and is assigned to the same assignee as the present invention.

This invention relates in general to color television receivers and in particular to an electron beam control apparatus for a color reproducing multi-beam cathode-ray tube.

The multi-beam tube currently employed in color television receivers comprises a gun arrangement for generating and projecting three electron beams toward a mosaic type fluorescent screen formed of a myriad of phosphor triads. Each triad, in turn, comprises a red, green and a blue phosphor dot each of which emits a characteristic hue when excited by its assigned electron beam. Disposed immediately adjacent the screen is an aperture mask comprising a like myriad of apertures in registration with the color triads. Initially, this shadow mask serves as a template in forming the screen; thereafter it is mounted within the tube envelope between the beam source and the screen where it functions as a color selector. In this role it "masks" the red and green phosphor dots from the blue beam, the red and blue dots from the green beam and the blue and green dots from the red beam.

In the ideal situation the three electron beams always converge in the plane of the aperture mask and impinge upon only their assigned phosphor dots. However, due to the influence of the earth's magnetic field, as well as to extraneous magnetic fields emanating from circuit apparatus, the beams are laterally displaced from their intended paths. As a result the electron beams have access to color dots other than their assigned target areas and color impurity is introduced. Accordingly, corrective measures must be taken to compensate for the effects of such fields.

A number of schemes have been employed in the past to achieve color purity, one of the most common contemplates the use of a pair of metal rings which are magnetized across their diameters and rotatably mounted upon the neck of the cathode ray tube. Beam repositioning is achieved by rotating the magnets, relative to one another, to establish a compensating magnetic field perpendicular to the beam paths and having the requisite strength and orientation.

The location of the magnets upon the neck of the tube is important since their resultant field will adversely influence the convergence apparatus if they are positioned too far forward. Still another consideration governing the location of the magnet rings is the physically available space which, in the new short-neck wide-deflection angle color tubes, is at a premium. These considerations practically dictate placement of the magnets substantially over the cathodes of the electron gun structure. While diametrically magnetized rings do achieve acceptable purity correction, when such magnets are mounted over the cathode elements the transverse components of the field, being concentrated in the plane of the ring, tend to defocus the beams. This obtains because the beam is soft and readily dispersed at this stage of its development.

Of equal significance in the matter of purity correction is the mounting structure for adjustably supporting the correction magnets. Prior art structures have invariably constituted cumbersome and expensive arrangements. Particularly is this the case in structures which combine ancillary apparatus such as a blue lateral convergence control.

It is therefore an object of the invention to provide an improved electron beam control apparatus.

It is also an object of the invention to provide a novel blue lateral beam positioning device.

It is a further object of the invention to provide an improved mounting structure for supporting a blue lateral convergence magnet.

It is a general object of the invention to provide means for economically and conveniently controlling the trajectories of the electron beam group of a multi-beam color cathode ray tube.

The invention contemplates an electron beam control arrangement for use in conjunction with a color television cathode ray tube of the type having a fluorescent screen comprising a plurality of interspersed similar groups of similar elemental areas, each of which groups comprises a different electron beam responsive phosphor. The tube further includes a neck section containing means for projecting a corresponding plurality of electron beam components emanating from effective points of origin which are symmetrically displaced from the central axis of the tube. In accordance with one aspect of the invention a beam control arrangement for such a tube comprises an annular magnet having transverse field components and a bar magnet polarized normal to its principal axis. The arrangement further includes a support element of non-magnetic material mounted on the neck section of the tube in juxtaposition to the electron beam components projecting means and comprising a first section encircling the neck section for rotatably supporting the annular magnet with the transverse field components of the magnet normal to the central axis of the tube. The support element includes a second section for supporting the bar magnet for rotation about its principal axis and perpendicular to the central axis of the tube and at a fixed spacing from the annular magnet along this central axis. Finally, means are provided for mounting the supporting element upon the neck of the tube.

In accordance with a further aspect of the invention the support for the bar magnet comprises a unitary frame member of non-magnetic material having a mounting section which at least partially encircles the neck section of the tube for mounting the frame member thereon. The frame member further includes a non-magnetic bearing section for supporting the bar magnet for rotation about its longitudinal axis and in a plane that is essentially tangential to the neck section of the tube.

The features of this invention which are believed to

be novel are set forth with particularity in the appended claims. The invention, together with further objects and advantages thereof, may best be understood, however, by reference to the following description taken in conjunction with the accompanying drawings, in the several figures of which like reference numerals identify like elements, and in which:

FIGURE 1 is a perspective view of a prior art color purity correction magnet;

FIGURE 2 is a perspective view of a tri-color cathode ray tube employing the subject invention;

FIGURE 3 is a sectional view taken along lines **3—3** of FIGURE 2;

FIGURES 3*a* and 3*b* are plan views of the ring magnets shown in FIGURE 3 illustrating their pole pair distribution;

FIGURE 3*c* is an impression, in profile, of one of the pole pairs shown in FIGURES 3*a* or 3*b*;

FIGURE 4 is a fragmentary sectional view taken along lines **4—4** of FIGURE 3;

FIGURE 5 is a sectional view of a ring magnet taken along lines **5—5** of FIGURE 3*a* including a schematic representation of the composite magnetic field of the magnet;

FIGURE 6 is an exploded view of a composite purity correction and blue lateral beam control apparatus embodying the invention;

FIGURES 6*a* and 6*b* are fragmentary details illustrating the latching arrangement employed in assembling the beam control apparatus shown in FIGURE 6;

FIGURE 7 is an elevational view of the blue lateral portion of thhe beam positioning device shown in FIGURE 6; and

FIGURE 8 is a comparative plot of the axial distribution of the transverse field components of the purity correction magnet illustrated in FIGURE 3*a* and that of the magnet shown in FIGURE 1.

Before proceeding to a description of the invention, the prior art color purity correction magnet M shown in FIGURE 1, together with a portion of its field pattern, will be considered briefly. Magnet M conventionally comprises an annular stamping of a magnetic material which is magnetized across its diameter to establish a magnetic field having transverse components oriented as shown. These prior art correction magnets are rotatably mounted upon the neck of the cathode ray tube in pairs to permit adjusting the strength of the resultant magnetic field, as well as its orientation relative to the beam paths. However, as previously noted and as will be subsequently demonstrated, the field pattern of these prior art type purity correction magnets can occasion a defocusing of the electron beams.

Referring now to FIGURE 2, the color reproducing cathode ray tube **10** there shown is of the type conventionally employed in a color television receiver. Tube **10** comprises a neck section **11** and a funnel or cone portion **12** which is terminated by a display panel **13**. Panel **13** supports a target assembly comprising a fluorescent screen **15** composed of a plurality of interspersed similar groups of similar elemental areas disposed on the inside surface of panel **13**. Each of these groups comprises a different electron-beam responsive phosphor. Specifically, screen **15** is formed of a group of red phosphor dots, a group of blue phosphor dots and a group of green phosphor dots. These color dots are effectively arranged in groups of three, or triads, each including a red, a green and a blue phosphor dot. An aperture or shadow mask **16** having a multitude of apertures, is fixed in an overlying relation to screen **15** and is so indexed relative thereto as to register an aperture with each color triad.

As best seen in FIGURES 3 and 4, neck section **11** includes means for projecting a plurality of electron beam components from effective points of origin which are symmetrically displaced from the central axis of the tube. More particularly, the neck section contains three electron gun structures **18R**, **18G**, **18B**, only two of which are shown in FIGURE 4, for developing the electron beams R, G and B, respectively. These guns are supported within the neck in a delta array by a plurality of elongated rods **19**. To simplify the presentation of the gun structures only blue gun **18B** will be detailed, it being understood that guns **18R** and **18G** are identical to the blue gun. Accordingly, and as best seen in FIGURE 4, in addition to a cathode **20**, gun **18B** includes a control electrode **21**, a first accelerating electrode **22**, a focusing electrode **23** and a second accelerating electrode **24**, all of which electrodes are preferably formed of a non-magnetic conductive material.

A deflection yoke **26** is mounted upon neck section **11** and in an abutting relation with funnel portion **12** of the tube. Yoke **26** is of conventional construction in that it comprises horizontal and vertical deflection windings which, upon excitation, deflect the electron beams in an ordered fashion to develop a scanning raster.

A radial convergence assembly is also mounted upon the neck of the tube adjacent yoke **26**. This assembly comprises a dynamic convergence system **27** and a static convergence system **28** which, collectively, function to maintain convergence of the electron beams during scansion. Insofar as the subject invention is concerned, the form that the convergence assembly may take is of no consequence. A representative prior art dynamic convergence system, for example, is described in Patent 3,141,109 which issued to James F. Chandler. For present purposes it is sufficient to note that dynamic convergence system **27** is a tripartite structure comprising a plurality of coils which, when energized, develop magnetic fields having transverse components which are shunted across the paths of the electron beams to effect controlled radial displacement of the beams relative to the tube axis.

The static convergence system of assembly **28**, which also is of a known construction, comprises a series of permanent magnets which are symmetrically positioned about the neck of the tube and normal to the paths of their assigned electron beams. Desirably, assembly **28** takes the form of the static convergence apparatus disclosed in my copending application Ser. No. 401,043, filed October 2, 1964, now Patent 3,308,328, which is assigned to the same assignee as the subject invention.

A color purity correction device **30** for use with color tube **10** comprises a support element **31** of non-magnetic material which is mounted upon neck section **11** of the tube in juxtaposition to electron gun structures **18B**, **18R**, and **18G**. Means, including a plurality of magnetic pole pairs, are adjustably mounted on support element **31** effectively in a plane which is substantially tangent to the emitting surfaces of cathodes **20**, see FIGURE 4. The aforesaid pole pairs are disposed on both sides of neck section **11** and with their magnetic axes substantially parallel to the central axis of the tube. More particularly, the aforementioned means comprises first and second independently adjustable ring members **32**, **33** each formed of a magnetizable material and magnetized across its thickness dimension to establish 14 discrete magnetic pole pairs which develop a non-uniform magnetic field. Actually, the number of pole pairs is not critical, a greater or lesser number can be employed so long as specified characteristics of the field are achieved. These characteristics are more fully explained below.

The pole pairs of each ring are circumferentially disposed about the periphery of each of rings **32**, **33** with seven pole pairs on one side of a ring and seven on the opposite side, see FIGURES 3*a*, 3*b*. A detail of one such magnetic pole pair is shown in FIGURE 3*c*. This drawing schematically represents a cross-section taken through either of ring members **32**, **33**. Preferably, ring members **32**, **33** comprise a flexible material, such as rubber or neoprene, which is impregnated with ferrite. Except for a difference in their profiles, due to the asymmetrical ar-

rangement of their respective control tabs 32T, 33T, rings 32, 33 are identical. This tab arrangement assures independent adjustment of the ring members since, irrespective of the relative positions of the rings, at least one tab of each ring is always accessible for adjustment.

As seen in FIGURES 3*a* and 3*b*, the pole pairs on one side of each of respective rings 32, 33, the left hand side, for example, are oriented oppositely relative to the pole pairs on the right hand side. Considering ring 32 as typical and referring to the schematic representation of FIGURE 5, the pole pairs of ring 32 are shown to collectively develop a composite magnetic field having opposing paraxial components OP along the central axis of the tube and aiding transverse components AT at a point forward of cathode 20. There is also, of course, a group of aiding transverse components to the rear of the cathode. It is the forward group of AT components, however, which shunt the beam paths to effect a deflection of the electron beams in a common direction transverse to the central axis of the tube.

Preferably, the magnetic field established by the transverse components is non-uniform, that is to say, a greater degree of field intensity or saturation is desired along a path normal to and across the axis of the neck section than across the periphery thereof. In other words, the saturation at any point in the field varies as a function of that point's perpendicular distance from the polarization axis of the magnet.

A non-uniform field of this type can be achieved by one of several pole pair arrangements. For example, one pole pair arrangement can be established by applying discrete magnetizing forces of different intensities across the thickness of the ring member at equally spaced increments about its periphery, or, by applying constant magnetizing forces at unequally spaced increments. In either case, the desired non-uniformity is achieved by establishing the greatest field saturation in the centermost region of similarly oriented pole pair groups. Moreover, ring magnets 32, 33 are substantially identical so that their respective fields can be made to cancel if little or no purity correction is required.

Referring now to FIGURES 6–7, a more detailed description of support element 31 will be considered. Element 31 is preferably formed of a non-magnetic, resilient, insulating material such as nylon and comprises a sleeve section 35 and a collar 36. Sleeve 35 includes a portion 37 upon which ring magnets 32, 33 are rotatably supported. The ring magnets are captivated upon spindle 37 between an annular flange 38 formed at one end of the bushing and a thrust washer 39, preferably constructed of a yieldable non-magnetic material such as rubber. Thus, when support element 31 is assembled, washer 39 and magnets 32, 33 are subjected to an axial compression sufficient to maintain the magnets in any selected orientation. The sleeve and magnet portion of the assembly are coaxially centered about the neck of the tube by a plurality of inwardly converging fingers 40 extending from one extremity of sleeve 35.

Sleeve 35 is detachably fitted to collar 36 by a series of mounting lugs 42 which project from the other extremity of the sleeve and which are received by a corresponding series of grooves 43 formed in the inner surface of collar 36, see FIGURES 6*a* and 7. As best seen in FIGURES 6*a* and 6*b*, each of lugs 42 is terminated by a tab 44 which engages an end wall of collar 36 to maintain the spindle portion 37 of the sleeve and the collar in an abutting relation. A detachable latching of sleeve 35 with collar 36 is achieved by virtue of the fact that the ends of lugs 42, when sleeve 35 is free of the collar, are biased outwardly to such an extent as to circumscribe a circle having a diameter greater than the inside diameter of collar 36. In this fashion lugs 42, in conjunction with tabs 44, effect a snap fit between sleeve 35 and collar 36.

It is principally collar 36 which serves as the mounting means for the purity correction device 30. To this end, collar 36 comprises an upper section 46, which conforms substantially to the curvature of neck section 11, and two lower sections 47, 48 jointly defining an arc normally having a radius of curvature less than that of the neck section, see FIGURE 7. Three coupling members 49 resiliently connect the upper and lower sections and constitute a biasing means for clamping collar 36 to the neck of the tube at any desired location therealong.

In accordance with one aspect of the invention, support element 31 performs an additional function, that is, it serves as a frame member or holder for a blue lateral convergence magnet 50. Magnet 50 is a ferrite bar or rod comprising a plurality of magnets which are established by magnetizing the rod normal to its longitudinal axis. Further details respecting the composition of magnet 50 as well as its mode of operation are found in my Patent No. 3,308,328.

As best seen in FIGURES 4 and 7, blue lateral convergence magnet 50 is positioned directly above blue gun 18B and rotatably captivated thereat between section 46 and a bridging section 52 which interconnects a pair of mounting ears or lobes 53 integrally formed with collar 36. In this fashion the magnetic field of magnet 50 is maintained in a fixed spatial relation to the fields of purity magnets 32, 33 as well as to cathodes 20. Extending across each of lobes 53 are the resilient bows or webs 54 having inwardly directed ridges which exert axial thrust upon opposite ends of magnet 50. In addition to a support for magnet 50, lobes 53 further serve as finger guides for the technician so that an end of the rod may be easily grasped and rotated to establish a desired orientation of the field of magnet 50 relative to the path of the blue beam.

Prior to discussing the manner in which purity correction device 30 functions to achieve color purity, the manner in which the device is assembled will be dealt with briefly. By resorting to the disclosed bi-partite construction for support element 31, ring magnets 32, 33 and axial thrust washer 39 can be assembled without recourse to straps, clips or other fasteners. Specifically, and with the sleeve and collar portions of support element 31 disassembled as shown in FIGURE 6, the two ring magnets 32, 33 and thrust washer 39 are slipped on to the spindle section 37 of the sleeve, preferably in the order shown. Thereafter, collar 36 is fitted over mounting lugs 42 with the lugs cooperatively received within grooves 43. The sleeve and collar are axially compressed until tabs 44 snap over the end wall of the collar, see FIGURES 6*a* and 6*b*. While samples of the collar and sleeve made from production tools show that there is no difficulty in holding dimension tolerances on lugs 42 and collar 36 to provide a snap fit, it should be noted that if the collar is under size, or the lugs over size, thrust washer 39 will take up any slack thereby assuring a snap fit.

The blue lateral convergence magnet 50 may then be inserted between mounting lobes 53. Actually, it is immaterial whether magnet 50 is mounted upon lobes 53 prior to or after the sleeve and collar are assembled. The assembled correction device 30 is then slipped over the neck of the cathode ray tube and moved forward until ring magnets 32, 33 lie in a plane substantially parallel to the emitting surfaces of cathode 20.

Referring now more specifically to FIGURE 8, there is graphically illustrated the manner in which the amplitudes of the transverse field components of prior art magnet M and like components of magnet 32 vary along the tube axis, progressing from the cathode toward the screen. The curve designated M clearly shows that the distribution of the transverse field components of a prior art type magnet along the central axis of the tube is relatively broad. When magnet M is positioned upon the neck of cathode ray tube, the strongest transverse components of the field influence the beam at or near the cathode, the area in which the beam is relatively "soft" and thus easily influenced. Therefore, in addition to producing a desired

radial displacement of the beams, the field also tends to defocus the beam. The transverse field components attributable to magnet **32**, on the other hand, exert their influence at a point remote from the cathode. This is probably best understood by referring again to FIGURE 5 wherein it is observed that the transverse field components AT of representative ring magnet **32** peak at a point forward of cathode **20**. Accordingly, not only do ring magnets **32, 33** minimize defocusing by exerting their influence forward of the cathode but they are capable of developing a more concentrated magnetic field.

As earlier noted color purity requires that each of electron beams B, R, G, impinge only upon their assigned color dots. There are, of course, other factors which must be considered in order to assure proper color reproduction. Specifically, convergence of the electron beams must first be achieved by apparatus **27, 28**. Static convergence is initially undertaken in order to provide an approximate convergence of the beams in the absence of a deflecting field. Actually, and as described in my copending application Ser. No. 401,043, now Patent 3,308,328, the red and green beams are initially converged. Thereafter the blue beam is brought as near convergence with the red and green beams as possible with the static convergence system. If static convergence is not satisfactory, as determined by observation of the screen, the blue lateral magnet **50** is rotated in order to displace the blue beam in such a direction as to converge it with the red and green beams.

Thereafter, with static and dynamic convergence established, purity correction is undertaken. From a practical standpoint it is desired to perform purity correction by observing the red beam. Accordingly, the blue and green beams are cut-off and the red beam emphasized. The deflection yoke is then moved back along the neck, as far as space permits, to concentrate the illumination attributable to the red beam in the center of the screen. With the deflection yoke thus displaced, the red beam develops a red blob in the center of the screen. Ring magnets **32, 33** are then rotated to develop a transverse field of such intensity and orientation relative to the beam paths as to provide the most substantial presentation of red upon the screen of the tube. The deflection yoke is then moved forward to its normal position abutting the flange of the picture tube and a readjustment, if necessary is made with magnets **32, 33**.

The above purity correction, it is noted, is performed by observing the effect of the correction magnets along the red beam. Since, in the assembly process, the three beams are fixed, relative to one another, their beams should maintain constant relative spacing. The influence of the correction magnets field upon the red beam is communicated, in like fashion, to the blue and green beams so that blue and green color purity is achieved at the same time that the red beam is corrected.

The advantages inherent in the construction of support element **31** apply equally, of course, in the situation in which it is determined that a prior art type ring magnet can render acceptable results. In such an application the mounting and adjustment procedures for the magnets are similar to those described in respect to magnets **32, 33**.

The bi-partite construction of support element **31** not only facilitates assembly of the purity correction magnets but also provides an accurate and fixed spacing of blue lateral magnet **50** relative to the transverse field components of the correction magnets. As clearly demonstrated the simple unified construction of support element **31** not only achieves purity correction and blue lateral convergence but does so with a simple inexpensive construction.

While a particular embodiment of the present invention has been shown and described, it is apparent that changes and modifications may be made therein without departing from the invention in its broader aspects. The aim of the appended claims, therefore, is to cover all such changes and modifications as fall within the true spirit and scope of the invention.

I claim:

1. An electron beam control apparatus for use in conjunction with a color television cathode ray tube of the type comprising a fluorescent screen including a plurality of interspersed similar groups of similar elemental areas, each of which groups of elemental areas comprises a different electron-beam responsive phosphor, and a neck section containing means for projecting a corresponding plurality of electron beam components from effective points of origin symmetrically displaced from a central axis of said tube, said beam control arrangement comprising:

an annular magnet having transverse field components;

a bar magnet polarized normal to its principal axis;

and a support element of non-magnetic material mounted on said neck section of said tube juxtaposition to said electron beam components projecting means and comprising a first section encircling said neck section for rotatably supporting said annular magnet with its transverse field components normal to said central axis of said tube,

a second section for supporting said bar magnet for rotation about its said principal axis and in a plane that is essentially tangential to said neck section and at a fixed spacing from said annular magnet along said central axis,

and means for mounting said support element upon said neck section.

2. An electron beam control apparatus for use in conjunction with a color television cathode ray tube of the type comprising a fluorescent screen including a plurality of interspersed similar groups of similar elemental areas, each of which groups of elemental areas comprises a different electron-beam responsive phosphor, and a neck section containing means for projecting a corresponding plurality of electron beam components from effective points or origin symmetrically displaced from a central axis of said tube, said beam control arrangement comprising:

an annular magnet having transverse field components;

a bar magnet polarized normal to its principal axis;

and a support element of non-magnetic material mounted on said neck section of said tube in juxtaposition to said electron beam components projecting means and comprising a first section encircling said neck section for rotatably supporting said annular magnet with its transverse field components normal to said central axis of said tube,

a second section for supporting said bar magnet for rotation about its said principal axis and perpendicular to said central axis and at a fixed spacing from said annular magnet along said central axis,

and means for mounting said support element upon said neck section.

3. An electron beam control apparatus for use in conjunction with a color television cathode ray tube of the type comprising a fluorescent screen including a plurality of interspersed similar groups of similar elemental areas, each of which groups of elemental areas comprises a different electron-beam responsive phosphor, and a neck section containing means for projecting a corresponding plurality of electron beam components from effective points of origin symmetrically displaced from a central axis of said tube, said beam control arrangement comprising:

an annular magnet having transverse field components;

a bar magnet polarized normal to its principal axis;

and a support element of resilient non-magnetic insulating material mounted on said neck section of said tube in juxtaposition to said electron beam components projecting means and comprising a first section encircling said neck section for rotatably supporting said annular magnet and having biasing means for coaxially centering said annular magnet relative to said central axis of said tube,

a second section for supporting said bar magnet for rotation about its said principal axis and perpendicular to said central axis and at a fixed spacing from said annular magnet along said central axis,

and means for mounting said support element upon said neck section.

4. An electron beam control apparatus for use in conjunction with a color television cathode ray tube of the type comprising a fluorescent screen including a plurality of interspersed groups of similar elemental areas, each of which groups of elemental areas comprises a different electron-beam responsive phosphor, and a neck section containing means for projecting a corresponding plurality of electron beam components from effective points of origin symmetrically displaced from a central axis of said tube, said beam control arrangement comprising:

a pair of annular magnets having transverse field components;

a bar magnet polarized normal to its principal axis;

and a support element of non-magnetic material mounted on said neck section of said tube in juxtaposition to said electron beam components projecting means and comprising a first section encircling said neck section for rotatably supporting said annular magnets with their transverse field components normal to said central axis of said tube,

said first section including integral biasing members tapered to a diameter less than the diameter of said tube neck for coaxially centering said annular magnets about said neck section,

said support element further comprising a second section for supporting said bar magnet for rotation about its said principal axis and perpendicular to said central axis and at a fixed spacing from said annular magnets along said central axis,

said second section including means for mounting said support element upon said neck section.

5. An electron beam control arrangement for use in conjunction with a color television cathode ray tube of the type comprising a fluorescent screen including a plurality of interspersed similar groups of similar elemental areas, each of which groups of elemental areas comprises a different electron-beam responsive phosphor, and a neck section containing means for projecting a corresponding plurality of electron beam components from effective points of origin symmetrically displaced from a central axis of said tube, said beam control arrangement comprising:

a pair of annular magnets having transverse field components;

a bar magnet polarized normal to its principal axis;

and a support element of non-magnetic material mounted on said neck section of said tube in juxtaposition to said electron beam components projecting means and comprising a first section encircling said neck section for rotatably supporting said annular magnets with their transverse field components normal to said central axis of said tube,

said first section including means for coaxially centering said annular magnets about said neck section,

said support element further comprising a second section for supporting said bar magnet for rotation about its said principal axis and perpendicular to said central axis of said tube and at a fixed spacing from said annular magnets along said central axis,

said second section including integral means for mounting said support element upon said tube neck,

said mounting means comprising a plurality of resiliently coupled segments normally having an effective diameter less than the diameter of said tube neck but expandable to frictionally grasp said neck section and retain said support element at any desired location upon said tube neck.

6. An electron beam positioning device for a color television cathode ray tube comprising:

a cylindrical bar magnet magnetized normal to its longitudinal axis;

and a unitary frame member of non-magnetic material having a mounting section for at least partially encircling the neck section of said tube to mount said frame member thereon,

and further having a non-magnetic bearing section for supporting said magnet for rotation about its said longitudinal axis and in a plane that is essentially tangential to said neck section of said tube.

7. In an electron beam control arrangement for a color television cathode ray tube having a neck section containing means for projecting a plurality of electron beams, which arrangement includes a cylindrical bar magnet magnetized normal to its longitudinal axis for selectively positioning one of said electron beams relative to the others, a holder for said magnet comprising:

a unitary frame member of non-magnetic material having a mounting section for at least partially encircling said neck section of said tube to mount said frame member thereon,

and further having a non-magnetic bearing section for supporting said magnet for rotation about its said longtiudinal axis and in a plane that is essentially tangential to said neck section of said tube.

8. In an electron beam control arrangement for a color television cathode ray tube having a neck section containing means for projecting a plurality of electron beams, which arrangement includes a cylindrical bar magnet magnetized normal to its longitudinal axis for selectively positioning one of said electron beams relative to the others, a holder for said magnet comprising:

a frame member of non-magnetic insulating material having a mounting section for at least partially encircling said neck section of said tube to mount said frame member thereon,

and further having a magnet receiving section comprising a pair of apertured lobes interconnected by a bridging section,

said bridging section and a confronting portion of said mounting section establishing bearing surfaces for supporting said magnet for rotation about its said longitudinal axis and in a plane that is essentially tangential to said neck section of said tube.

9. In an electron beam control arrangement for a color television cathode ray tube having a neck section containing means for projecting a plurality of electron beams, which arrangement includes a cylindrical bar magnet magnetized normal to its longitudinal axis for selectively positioning one of said electron beams relative to the others, a holder for said magnet comprising:

a frame member of non-magnetic insulating material having a collar section substantially encircling said neck section of said tube to mount said frame member thereon,

and further having a magnet receiving section comprising a pair of apertured lobes interconnected by a bridging section,

said bridging section and a confronting portion of said collar establishing bearing surfaces for captivating and supporting said magnet for rotation about its said longitudinal axis and in a plane that is essentially tangential to said neck section of said tube,

each said lobe having an integrally formed web engageable with an extremity of said magnet for preventing displacement of said magnet along its said longitudinal axis.

10. An electron beam positioning device for a color television cathode ray tube comprising:

a cylindrical bar magnet magnetized normal to its longitudinal axis;

and a holder for said magnet comprising a unitary frame member of non-magnetic insulating material having

a collar section substantially encircling said neck section of said tube,

said collar section including means for securing said frame member upon said neck section,

said frame member further having a magnet receiving section comprising a pair of apertured lobes integrally formed from said collar and interconnected by a bridging section,

said bridging section and a confronting portion of said collar establishing bearing surfaces for captivating and supporting said magnet for rotation about its said longitudinal axis and in a plane that is essentially tangential to said neck section of said tube,

each said lobe having an integrally formed web engageable with an extremity of said magnet for centering said magnet within said receiving section of said frame member.

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