Feb. 14, 1961 B. R. CLAY 2,972,073

ELECTRON BEAM CONTROLLING APPARATUS

Filed Aug. 31, 1955 3 Sheets-Sheet 1

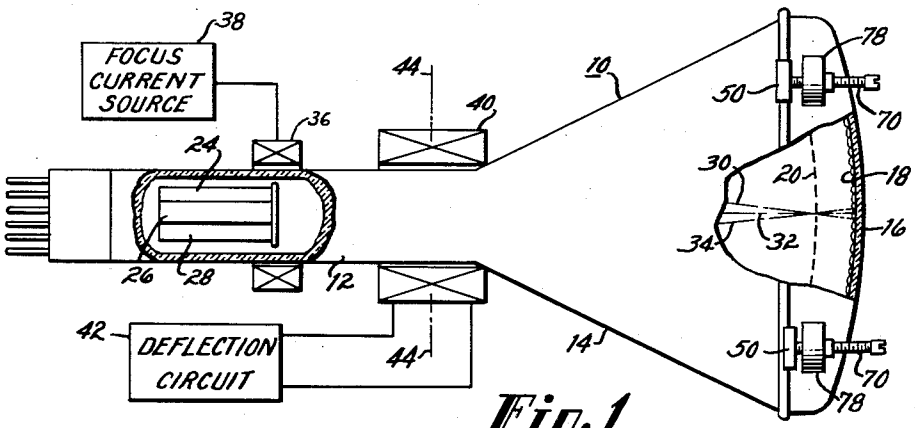


Fig. 1

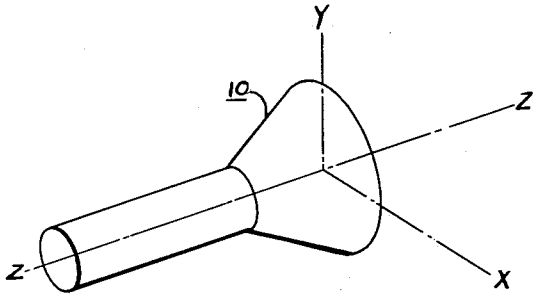


Fig. 2

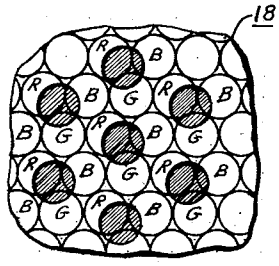


Fig. 3

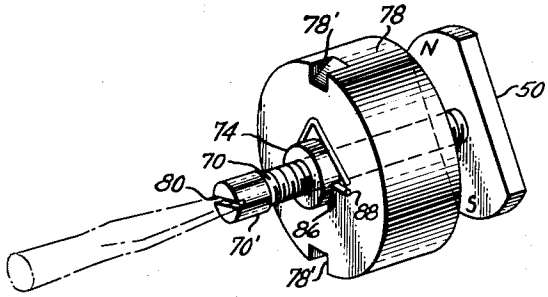


Fig. 4

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ELECTRON BEAM CONTROLLING APPARATUS

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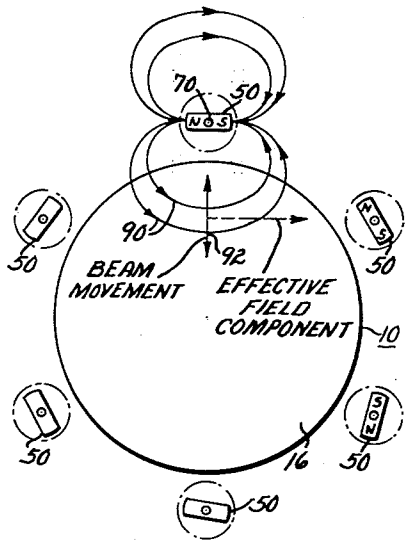


Fig. 5a

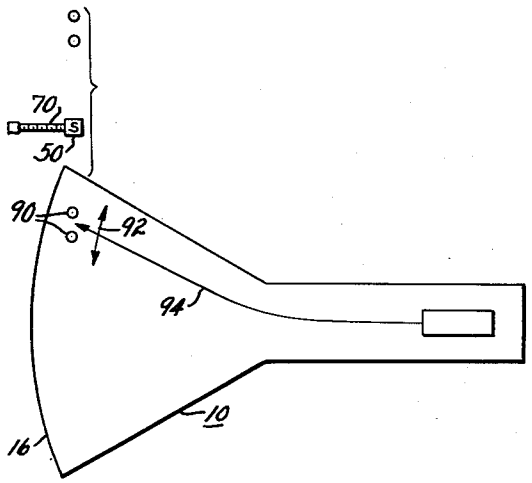


Fig. 5b

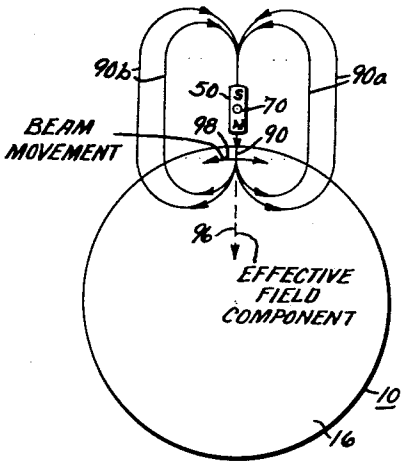


Fig. 6a

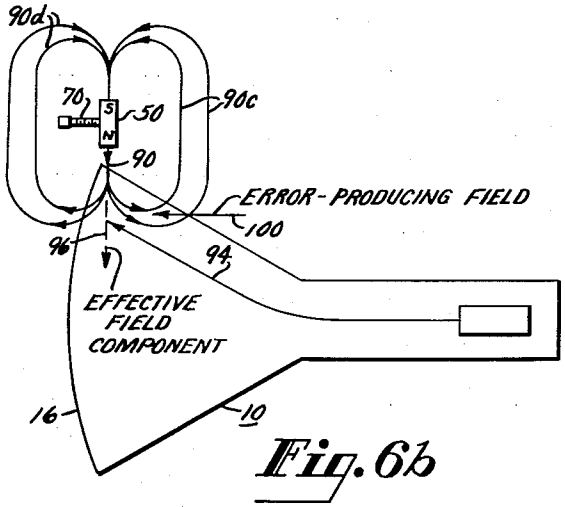


Fig. 6b

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Fig. 7

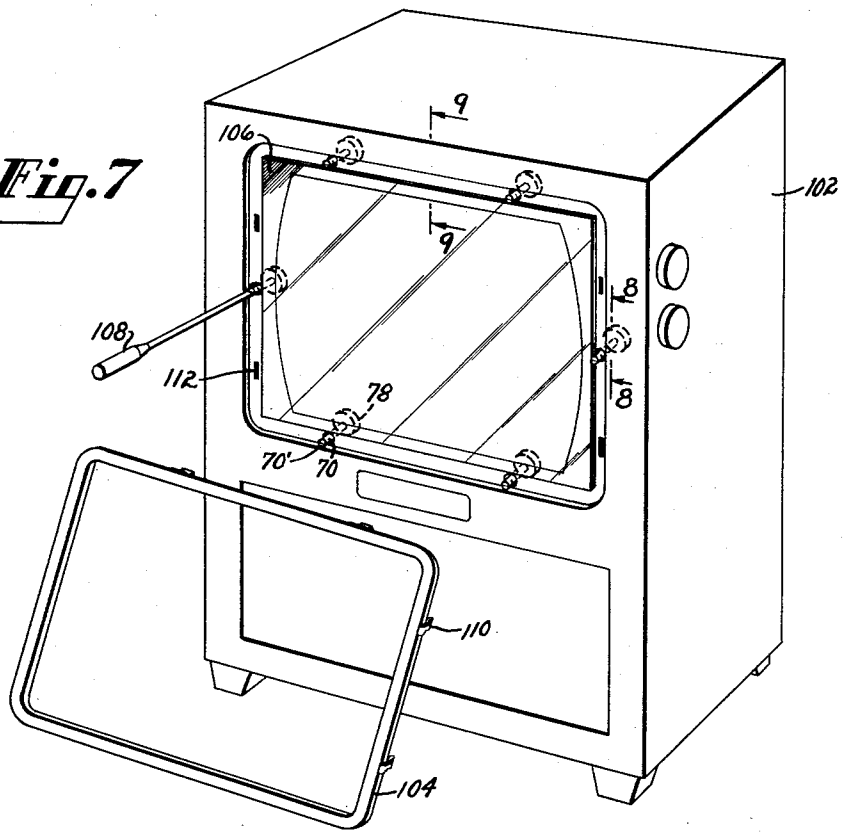


Fig. 9

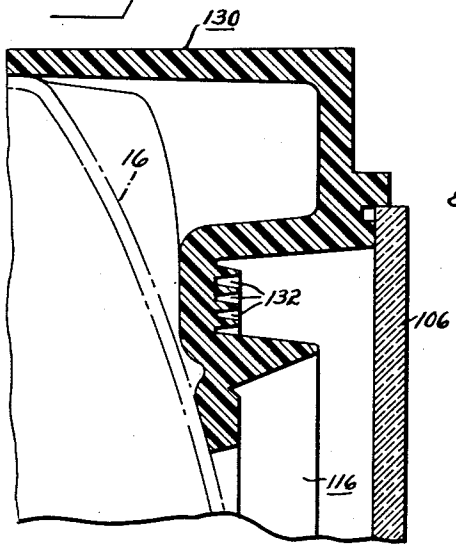
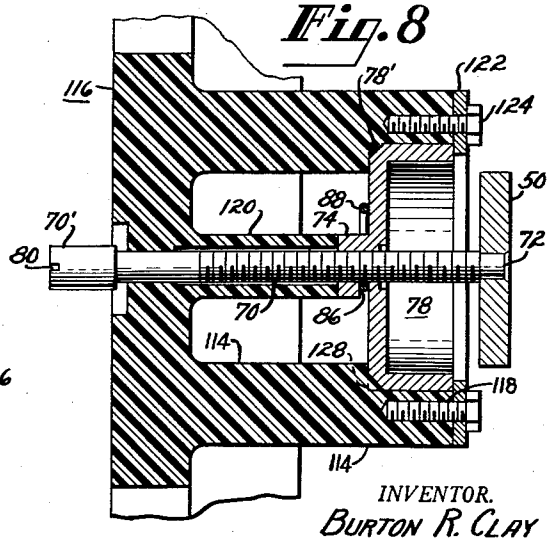


Fig. 8



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ELECTRON BEAM CONTROLLING APPARATUS

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Filed Aug. 31, 1955, Ser. No. 531,705

10 Claims. (Cl. 313—77)

The present invention relates to new and improved apparatus for use in controlling electrons in cathode ray tubes of the type employed as color television image reproducing devices. Specifically, the invention relates to apparatus for use in conjunction with cathode ray tubes having a plane of deflection at which electrons are subjected to a scanning movement in their travel toward a screen unit of the type comprising a mosaic screen and one or more adjacent grills or masks through which electrons pass in different angular directions to preselected elemental areas of the mosaic.

While the present invention is described herein as applied to a cathode ray tube of the dot-screen variety disclosed in an article by H. B. Law "A Three-Gun Shadow-Mask Color Kinescope" (October, 1951, issue of Proceedings of the I.R.E.), its applicability is not so limited, since the invention may also be employed with other types of cathode ray tubes wherein the angle of approach of an electron beam toward a mosaic screen determines its point of contact with the screen.

As described in the cited Law article, the particular screen area which is illuminated at any given instant in a cathode ray tube of the type in question is a function of the precise angle at which the electron beam approaches the color screen. When such tubes are manufactured in accordance with present-day mass production methods, it is not always possible to maintain the necessary accuracy in the assembly of the grill or mask and the phosphor screen. By virtue of such difficulties, many cathode ray tubes which are otherwise satisfactory in structure must be rejected because of "color dilution." One particular form of color dilution which is encountered in color kinescopes is that which results from misalignment of the shadow mask or grill about its longitudinal axis with respect to the phosphor screen, this form of color dilution being termed "tangential" or "rotational" color dilution. Another form of color dilution is that which results from radial misalignment of shadow mask or grill and screen such that the electrons strike a point on the screen radially displaced from their desired point of impingement and which may be termed "radial" color dilution. Still another source of difficulty in the operation of color kinescopes of the type under consideration is that which is brought about by stray magnetic fields such, for example, as the earth's magnetic field and which may be "tangential" and/or "radial" in nature.

It is, therefore, a primary object of the present invention to provide new and improved apparatus for preventing color dilution of the type stemming from rotation and/or radial misalignment of the tube parts and/or from magnetic fields.

In view of the foregoing, there have been proposed arrangements involving a plurality of magnets located around the screen region of the kinescope, each magnet being adjustable in strength and direction of intensity. According to certain prior arrangements, permanent magnets have been disposed with their axes of rotation

oriented radially of the kinescope. In the case of such apparatus, tangential error resulting from ambient magnetic fields parallel to the longitudinal axis of the tube is corrected by bucking or cancelling the undesired field by an equal but opposite field from the corrective magnet. A problem presented by such prior arrangements, however, is that of manipulating the magnets about their radial axes for adjustment purposes, so that special receiver cabinets permitting access to the magnets have been required in certain instances.

In general, the present invention provides means for subjecting the electron beams, in the space between the tube's shadow mask and target screen to substantially constant direct current magnetic fields of such intensity, polarity and orientation as to direct said electrons to their normal or intended points of impact on the screen, regardless of the section of the screen in which the beams may be operating. In accordance with a specific illustrative embodiment of the present invention, such direct current magnetic field producing means comprises a plurality of permanent magnets having north and south poles and disposed around the screen unit of the cathode ray tube. Each magnet is supported rotatably about an axis which is parallel to the longitudinal axis of the tube so that the direction of flux from the magnet may be adjusted. Means are additionally provided for effectively controlling the intensity of the fields of the permanent magnets. As will be more fully appreciated, adjustment of the magnets as to strength and polarization may be simply accomplished from the front of the cabinet in which the kinescope is housed.

Additional objects and advantages of the present invention will become apparent to those skilled in the art from a study of the following detailed description of the accompanying three sheets of drawings in which:

Figure 1 is a side elevational view, partially in section, of a three-gun tri-color kinescope of conventional construction which is provided, in accordance with one form of the invention, with novel electron beam path-controlling apparatus;

Figure 2 is a diagrammatic illustration of a cathode ray tube oriented with respect to certain axes to be described;

Figure 3 is a fragmentary front view, greatly enlarged, of the screen of the tube of Figure 1;

Figure 4 is an isometric view of one of the magnets of Figure 1;

Figures 5*a* and 5*b* are partly schematic front end and side elevational views, respectively, of the tube and magnet assembly of Fig. 1; the drawings being marked to illustrate the direction of beam movement when subject to a magnetic field of a certain orientation;

Figs. 6*a* and 6*b* are views similar to those of Figs. 5*a* and 5*b*, respectively, but with a magnetic field of another orientation;

Figure 7 is an isometric view of a television receiver cabinet showing a manner in which access to the magnets of Figure 1 may be had;

Figure 8 is a sectional view taken along line 8—8 of Figure 7; and

Figure 9 is a section along line 9—9 of Figure 7.

Referring to Figure 1 of the drawing, the color kinescope 10 shown therein comprises an evacuated envelope having a cylindrical neck portion 12 of glass, for example, which terminates in a flared "cone" portion 14 whose larger end is closed by a glass face plate 16 through which is visible the phosphor screen 18 of the target structure of the tube which further includes a shadow mask or aperture mask electrode 20. The tube as described thus far may be of the type disclosed in the above-cited Law article in which the phosphor screen 18 is of the well-known dot screen variety. As shown in

the drawing, the phosphor screen is deposited directly upon the rear surface of the face plate **16** and the mask **20** is curved approximately like the curvature of the face plate. Specifically, the screen **18** is provided on its rear surface with a multiplicity of groups of red (R), blue (B) and green (G) phosphor dots, the dots of each group being arranged at the apices of an equilateral triangle. The mask element **20** of the screen unit comprises a thin metal plate containing a multiplicity of apertures arranged in the same triangular pattern as the trios of phosphor dots such that there is one mask aperture for each trio of phosphor dots. The aperture mask **20** is supported in spaced relationship with respect to the screen **18** by suitable means (not shown). Such a tube is described in detail in an article entitled, "Development of a 21-Inch Metal Envelope Color Kinescope" by Seelen et al. which appeared in the March, 1955, issue of RCA Review.

The cylindrical neck portion **12** of the kinescope **10** houses three electron guns **24**, **26** and **28**, each of which produces an electron beam intended for bombardment of a particular screen color. The guns **24**, **26** and **28** may be arranged at the apices of an equilateral triangle as shown in the Law article or in any other suitable manner such, for example, as an "in-line" arrangement. The electron beams produced by the guns are indicated diagrammatically by the dotted lines **30**, **32** and **34** and are focused in a conventional manner by suitable means indicated as an electromagnetic focus coil **36** energized by currents from a source **38**, whereby to provide fine spots at the target screen. The electron beams are subjected to the action of substantially perpendicular magnetic fields for the scanning, in horizontal and vertical directions, of a conventional rectangular raster at the screen unit. Such scanning fields are produced by means of a deflection yoke **40** which may comprise a pair of normally arranged deflection windings disposed about the neck of the kinescope and energized by suitable sawtooth currents of television line and field frequencies from the deflection circuits **42**. As indicated by the dotted line **44—44'**, the plane of deflection for the three beams **30**, **32** and **34** extends transversely through the deflection yoke **40**.

In subsequent portions of the instant specification, reference will be made to the X, Y and Z axes of the kinescope **10**. In order to facilitate an understanding of such designations, Figure 2 illustrates, in simplified form, the kinescope **10** oriented about its several axes X, Y and Z. It will be seen from Figure 2 that the Z-axis coincides with the longitudinal axis of the tube, while the X and Y-axes are normal to each other and to the Z-axis.

As has been stated generally supra, one object of the present invention is that of eliminating the so-called "tangential" color dilution which results from a situation tantamount to that which exists when the shadow mask of a screen unit is rotationally displaced with respect to the phosphor screen (about their common axis). Figure 3 illustrates a front view of such a screen unit, showing a typical case of "tangential" dilution. It will be understood that the three beams **30**, **32** and **34** are intended to converge at the shadow mask **20** and diverge therefrom so that the red beam **30** strikes the red-designated phosphor "R" and the other beams **32** and **34** strike the green and blue-designated phosphors "G" and "B," respectively, which phosphor dots are arranged, as explained, at the apices of an equilateral triangle. Assuming that there is some rotational mislocation of the shadow mask **20** and screen **18** or that there exists a magnetic field in the path of the beams between the shadow mask and phosphor screen unit such that components of the magnetic field are parallel to the Z axis of the tube, color dilution of the tangential type will result. Thus, referring to Figure 3 wherein it is assumed, for purposes of simplicity of description, that only the red beam **30** is "on" and that only the red screen dots R are intended to be struck by electrons, the tangential color dilution is manifest at peripheral regions of the screen such that the red beam spots are not centered exactly on the red phosphor dots. Rather, the red beam spots are tangent to or overlap and, hence, illuminate peripheral portions of the adjacent blue and green phosphor dots, thus diluting the red light and preventing it from appearing with its proper degree of saturation.

While not illustrated in the drawing, it will be understood that "radial" color dilution, such as may result from a radial misalignment between the shadow mask **20** and screen **18**, would be manifested by the beam spot's being shifted laterally (i.e., horizontally or vertically) from its desired point of impingement, and that the beam spot intended for illumination of a red phosphor dot might instead land on an adjacent blue or green dot.

The present invention eliminates or, at least, substantially minimizes both forms of color dilution through the agency of means for subjecting the several electron beams to the action of substantially constant (i.e., D.C.) magnetic fields (axial or transverse, for tangential or radial errors, respectively) in their travel between the shadow mask **20** and the phosphor screen **18**. The intensity and polarity of the field are chosen so as to divert the electrons from their predetermined angularly related paths to other angular directions as required to direct them to their intended points of impact upon the phosphor screen **18**.

Figure 1 illustrates means, in accordance with a specific form of the invention, for providing the requisite axial or transverse magnetic field, such means comprising a plurality of permanent magnets **50** disposed around the screen unit of the tube **10**. The number of magnets thus employed may vary, but the illustrative embodiment shown herein includes six magnets which may be equi-spaced about the screen region of the tube, three on each side of its vertical centerline. The manner in which these magnets perform their functions of minimizing tangential and radial color dilution will be explained later. At this point, one of the magnets will be described in detail in connection with Figure 4.

The permanent magnet **50** is illustrated in Figure 4 as a bar magnet magnetized along its longitudinal axis and having north and south poles designated "N" and "S." A threaded bolt **70** is secured to the magnet **50** as by means of a rivet **72** (Figure 8) so that it is perpendicular to the magnet. The bolt **70** is slidably received by a bushing **74** which is securely held in an aperture located centrally of a cup **78**. The end of the bolt **70** remote from the magnet **50** is provided with a screw driver slot **80**. The bushing **74** is slotted throughout a portion of its periphery as at **86**. A generally triangular friction spring **88** (Fig. 4) which surrounds the bushing communicates with the bolt **70** through the slot **86** and engages the bolt. Thus, as will be understood, the spring **88** is in engagement with the threads of the bolt **70**, so that, when the bolt is rotated, it will thread its way toward or away from the cup **78**. Alternatively, the bolt may be pulled or pushed through the bushing **74** along its axis, which movement is permitted by the expansion of the spring **88** as it is cammed outwardly by the threads.

The cup **78** is formed of iron or other magnetic material and is of internal diameter sufficient to receive the magnet **50**. Of the assembly thus far described, all of the members with the exception of the magnet and cup **78** may be of any suitable non-magnetic material. The cup **78** is supported, with respect to the tube, in a manner to be described, so that the magnet **50** is rotatable about an axis parallel to the longitudinal axis of the tube and is movable along the axis of the bolt **70**.

When the magnet is in its extreme retracted position so that it is within the cup **78**, the cup acts as a shunt therefor, shortcircuiting the flux from the magnet so that the field of the magnet outside of the ring is substantially

zero. On the other hand, when the magnet **50** is in its extended position (as in Figure 4), the strength of the field produced by the magnet is at its maximum value. For positions of the magnet intermediate the two described extreme positions, proportionately different field strengths may be obtained.

Figure 5*a* illustrates diagrammatically a front view of the kinescope **10** showing a plurality of magnets **50** disposed around the screen region of the tube. The magnets **50** may be located as shown in Fig. 5*a* or may be disposed three on each side of the vertical center line of the tube, for example. As shown in Fig. 5*a*, each of the magnets **50** is rotatable about the axis of its associated bolt **70**, the bolts **70** being parallel to the longitudinal axis of the kinescope. The uppermost magnet **50** in Fig. 5*a* is disposed with its north and south poles oriented along a line which is parallel to the X-axis of the tube. That is to say, the magnet in question will be understood as being tangential to the tube. Several of the flux lines of the magnetic field produced by the magnet **50** are also shown in the drawing. The flux lines **90** are generally parallel, in the region of the tube screen unit, to the X-axis of the tube, so that an electron beam within the field of the flux lines **90** will be caused to move along the radial line **92**, since the electron beam "sees" a transverse field, as shown in Fig. 5*b*, wherein the electron beam is indicated diagrammatically in a deflected position by the line **94**. The direction of radial movement of the beam may be reversed by rotating the magnet **50** 180° about the axis of the bolt **70**, thereby reversing the direction of the magnetic field.

The use of the magnet **50** as described in connection with Figs. 5*a* and 5*b* affords a corrective magnetic field insofar as radial color dilution is concerned, since the field is effective to move the electron beams of the kinescope radially of the tube as explained. Such corrective action of the magnets, moreover, may be employed regardless of whether the radial color dilution error results from a magnetic field which is transverse of the tube or radial misalignment of the tube parts. It will further be recognized that the intensity of the corrective field produced by any one of the magnets may be adjusted by moving the magnet axially toward and away from its associated magnetic cup **78** (not shown in Figs. 5*a* and 5*b*). Thus, if no corrective action is required in any given sector of the tube, the magnet associated with that sector may be moved axially to its retracted position within its cup **78** so that the field of that magnet is effectively short-circuited by the cup.

Figs. 6*a* and 6*b* are views corresponding, respectively, to those of Figs. 5*a* and 5*b* but illustrating the orientation of one of the magnets **50** for the minimization or elimination of tangential error such as that which results, for example, from the presence of a magnetic field whose lines of flux are generally parallel to the Z-axis of the kinescope. In the interest of simplicity, only one magnet is shown in each of Figs. 6*a* and 6*b*, but it will be understood that additional magnets are present as shown in the preceding figures. In the front view of Fig. 6*a*, the magnet **50** is illustrated as disposed with its north and south poles oriented along a line which is radial of the tube **10**. Flux lines traveling from the north pole "N" of the magnet **50** are indicated by the reference numeral **90**. As is known, the flux lines branch out, as shown by the flux lines **90***a* and **90***b* around the magnet, in returning to the south pole thereof. The effective field component of the magnetic field produced by the magnet **50** is represented by the dotted line **96**. The effective field component will be understood, therefore, as being radial of the tube, so that an electron beam in the region of the field is moved tangentially, as represented by the line **98**. The direction in which the beam is thus moved tangentially by the field of the magnet **50** may be controlled by rotating the magnet about the axis of its bolt **70** by 180° in order to reverse the direction.

Since the flux lines of the field produced by the magnet **50** are present in three dimensions, Fig. 6*b* shows the lines of flux in a plane drawn through the Y- and Z-axes. In Fig. 6*b*, the flux at the north pole of the magnet **50** is again represented by the reference numeral **90**, the branch flux being indicated by reference characters **90***c* and **90***d*. The effective component of the magnetic field is shown in Fig. 6*b* by the dotted line **96**, which component will be understood as being perpendicular to the Z-axis of the tube. Since, as stated, the orientation of the magnet **50** in Figs. 6*a* and 6*b* produces tangential movement of the electron beams in the tube for the purpose of correcting for tangential error, it should be recognized that the correcting field is one which is perpendicular to the offending field. That is to say, and as has been explained, tangential error in such a tube is produced by a magnetic field whose lines of force are parallel to the Z-axis of the tube. The tangential error results, specifically, from the fact that the beam, in its deflected position, sees the Z-axis field components as transverse and is, therefore, deflected in a direction tangential of the tube. It is important to note, in this connection, that the correction for tangential error as effected by the present invention does not involve the provision of a tangential field which is equal to and opposite from an offending Z-axis field. Rather, the correcting field is in quadrature with the offending or "error-producing" field. This latter fact is illustrated in Fig. 6*b* wherein the error-producing field is represented by the arrow **100**.

The use of a quadrature field for the correction of tangential error in accordance with the present invention affords the advantage that the control of the magnet (both directional and intensity-wise) may be had from in front of the cathode ray tube. This is to be contrasted with prior art arrangements in which tangential error is corrected through the use of a bucking tangential field and in which control of the correcting magnets is had through rotation of each magnet about a radius of the tube.

The important advantage of having the control of each magnet in the form of a shaft which extends parallel to the longitudinal axis of the tube is clearly illustrated in Fig. 7 which shows a typical color television receiver cabinet **102**.

In Fig. 7, the decorative bezel **104** has been removed from its usual position to reveal the slotted ends **70'** of the magnet shafts **70** which project forwardly outside of the safety glass plate **106**. Rotational movement of each of the magnets located within the cabinet **102** may be effected as by means of a screw driver **108** which engages the slotted end of the magnet shaft. Axial movement of the magnets may be effected by pushing or pulling the shaft **70**, as explained above. Once the adjustment of the magnets has been completed, the bezel **104** may be returned to its proper place by snapping the spring fingers **110** into slots **112** in the front wall of the cabinet **102**.

In the interests of completeness of description, Figs. 8 and 9 illustrate sectional views of a plastic "mask" **116** adapted for use with the permanent magnet arrangement of the present invention. In a television receiver, a mask is conventionally provided for masking off the peripheral region of the cathode ray tube screen and it has been found that such a mask may serve to hold the permanent magnets in proper position with respect to the screen unit of the tube. As shown in Fig. 8, the mask is provided at spaced points about its periphery with arcuate axial flanges which extend inwardly toward the rear of the receiver cabinet. The sectional view of Fig. 8 illustrates the flanges **114** which project from the mask **116**. The flanges are formed with seats **118** for receiving snugly the cup **78** with which the permanent magnet **50** is associated. A tubular protection **120** of the mask is located between the flanges **114** and slidably receives the shaft **70** of the mag-

net. Thus, the slotted end 70' projects outwardly from the front of the mask 116 and is accessible for manipulation. The cup 78 is secured in place between the seats 118 of the flanges 114 as by means of a ring 122 secured to the flanges as by means of screws 124. The ring 122 prevents axial movement of the cup 78 with respect to the flanges 114. As shown in Fig. 4, each of the cups 78 is provided with notches 78'. The notches 78' of the cup 78 receive lugs 128 which are formed in the seats of the flanges 114, so that the stationary lugs 128 prevent rotational movement of the cup 78 in its seat.

As many magnet mounting flanges as desired may be formed on the mask, as will be understood.

As shown in the vertical sectional view of Fig. 9, the mask 116 further includes an axially and rearwardly extending rim portion 130 which serves as a support for the front end of a cathode ray tube whose screen is denoted by the dotted line 16. The rim 130 also acts as a safety device insofar as the high voltage applied to the tube is concerned. A plurality of corrugations 132 may be formed in the radial wall of the mask 116 in order to increase the high voltage leakage path of the mask. The safety glass 106 is shown in its normal position with respect to the mask 116.

From the foregoing, it will be appreciated that the plastic mask structure normally provided in a television receiver may be readily adapted to serve additionally as a mount for the plurality of permanent magnets provided in accordance with the present invention for the purpose of minimizing color dilution. The magnet shafts 70 extend forwardly from the mask so that access to the shafts may be had through the simple expedient of removing the bezel which normally covers them. It is to be borne in mind, that it is by reason of the novel arrangement of the magnets that the simplified receiver cabinet structure is possible.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In combination, a cathode-ray tube having a central axis and wherein beam-electrons may be subjected to undesired radial and tangential departures from their normal paths of scan in their transit to discrete elemental areas of an electron-sensitive screen of the mosaic variety, a permanent magnet disposed in such close proximity to said mosaic screen that said beam-electrons are subjected to the influence of the field of said magnet immediately prior to their impingement upon the discrete elemental areas of said screen, a rotatable shaft upon which said magnet is secured with its north and south poles extending radially in opposite directions therefrom, and means permanently supporting said shaft, and hence said magnet for rotation about a single fixed axis substantially parallel to said tube axis whereby the effective field of said magnet may be rotated between a first position whereat said field is substantially tangential to said screen to correct for said undesired radial departures of said beam-electrons from their said normal paths and a second position whereat said effective field is substantially radial of said screen to correct for said undesired tangential departures of said beam-electrons from their said normal paths.

2. In combination, a cathode-ray tube having a central axis and wherein beam-electrons are subjected to undesired radial and tangential departures from their normal paths of scan in their transit to discrete elemental areas of an electron-sensitive screen of the mosaic variety, a permanent magnet having north and south poles, a shaft to which said magnet is secured with its north and south poles extending radially in opposite directions therefrom, means including said shaft for supporting said magnet in the vicinity of said mosaic screen for independent axial and rotational movements along and about a single axis substantially parallel to said tube axis whereby the effective intensity of the field between the north and south poles of said magnet may be altered by moving said shaft axially toward and away from said screen and the orientation of said magnetic field may be altered independently of the axial position of said shaft by rotating said shaft between a first position whereat said field is substantially tangential to said screen to correct for said undesired radial departures of said beam-electrons from their said normal paths and a second position whereat said effective field is substantially radial of said screen to correct for said undesired tangential departures of said beam-electrons from their said normal paths.

3. In combination, a cathode ray tube of the type including a plane of deflection at which electrons are subjected to a scanning deflection in their transit along the longitudinal axis of said tube toward a screen unit including a target made up of a plurality of respectively different elemental areas, a permanent magnet having north and south poles, and means permanently supporting said magnet in the region of said screen unit for rotation about a single fixed axis parallel to said longitudinal axis of said tube.

4. In combination, a cathode ray tube of the type including a plane of deflection at which electrons are subjected to a scanning deflection in their transit along the longitudinal axis of said tube toward a screen unit including a target made up of a plurality of respectively different elemental areas, a permanent magnet having north and south poles, means for supporting said magnet in the region of said screen unit for rotation about a single fixed axis parallel to said longitudinal axis of said tube, a member of flux permeable material disposed about a portion of said fixed axis and means for producing relative movement along said axis between said magnet and said member for controlling the effective intensity of the field of said magnet.

5. In combination, a cathode ray tube of the type including a plane of deflection at which electrons are subjected to a scanning deflection in their transit along the longitudinal axis of said tube toward a screen unit including a target made up of a plurality of respectively different elemental areas, a plurality of permanent magnets, each of which has a north and south pole; and means permanently supporting said magnets around the screen unit of said tube for rotation about fixed axes parallel to said longitudinal of said tube.

6. In combination, a cathode ray tube of the type including a plane of deflection at which electrons are subjected to a scanning deflection in their transit along the longitudinal axis of said tube toward a screen unit including a target made up of a plurality of respectively different elemental areas, a plurality of permanent magnets, each of which has a north and south pole, individual control shafts for supporting said magnets around the screen unit of said tube for rotation each about a single permanently fixed axis parallel to said longitudinal axis of said tube; and means for effectively controlling the intensity of the field produced by each of said magnets.

7. In combination, a cathode ray tube of the type including a plane of deflection at which electrons are subjected to a scanning deflection in their transit along the longitudinal axis of said tube toward a screen unit including a target made up of a plurality of respectively different elemental areas, a permanent magnet having north and south poles, and a shaft for supporting said magnet for rotation about a permanently fixed axis parallel to said longitudinal axis, whereby said magnet may be positioned tangentially of such tube to produce radial movement of electrons therein and said magnet may be positioned with respect to a line joining said poles lying along a radius of said tube to produce tangential movement of electrons therein.

8. In combination, a cathode ray tube of the type including a plane of deflection at which electrons are subjected to a scanning deflection at which electrons are subjected to a scanning deflection in their transit along the longitudinal axis of said tube toward a screen unit in-

cluding a target made up of a plurality of respectively different elemental area, a permanent magnet having north and south poles, a shaft for supporting said magnet for rotation about a permanently fixed axis parallel to said longitudinal axis whereby said magnet may be positioned tangentially of said tube to produce radial movement of electrons therein and whereby said magnet may be positioned with respect to a line joining said poles lying along a radius of said tube to produce tangential movement of electrons therein; and means for effectively controlling the intensity of the field produced by said magnet.

9. In a color television receiver of the type which includes a color kinescope having a screen unit including a target made up of a plurality of elemental areas of respectively different color light-emitting characteristics and means for producing and directing electrons toward said target and a mask element for obscuring the peripheral portion of said target, apparatus comprising: a plurality of permanent magnets, each having a north and a south pole; and means for supporting said magnets on said mask element in the region of the screen unit of said kinescope for rotation about an axis parallel to the longitudinal axis of said kinescope.

10. In a color television receiver of the type which includes a cabinet housing a color kinescope having a screen unit which includes a target made up of a plurality of elemental areas of respectively different color light-emitting characteristics and means for producing and directing a plurality of electron beam components toward said target, said cabinet having a front panel containing an opening through which such kinescope screen may be viewed; apparatus for controlling the impingement of said beam components upon said screen, said apparatus comprising: a plurality of permanent magnets each having north and south poles at its opposite extremities; a plurality of inflexible control shafts secured, respectively, to each of said magnets intermediate its extremities and at substantially right angles to a line joining said poles; and means including said front panel and said inflexible shafts for supporting said magnets in said cabinet around the screen region of such kinescope for rotation about an axis parallel to the longitudinal axis of said kinescope, said magnet control shafts extending forwardly of said kinescope screen unit and through said front panel for access from the exterior of said cabinet.

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