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COMPENSATION MEANS FOR CATHODE RAY TUBES

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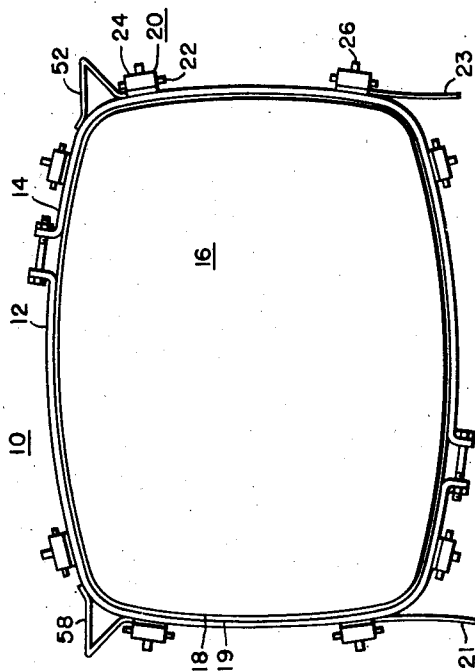


Fig. 1.

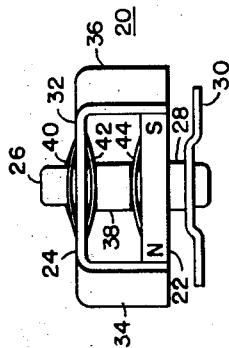


Fig. 2.

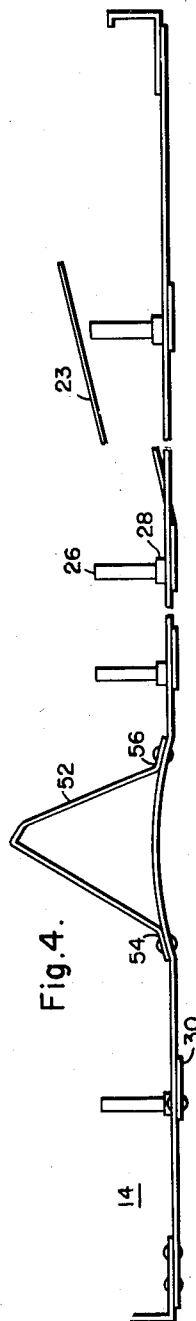


Fig. 3.

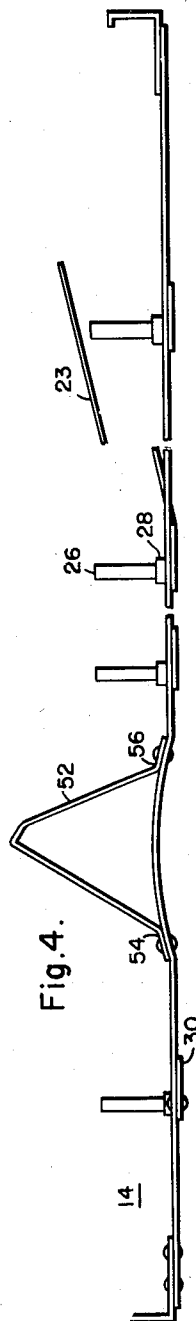


Fig. 4.

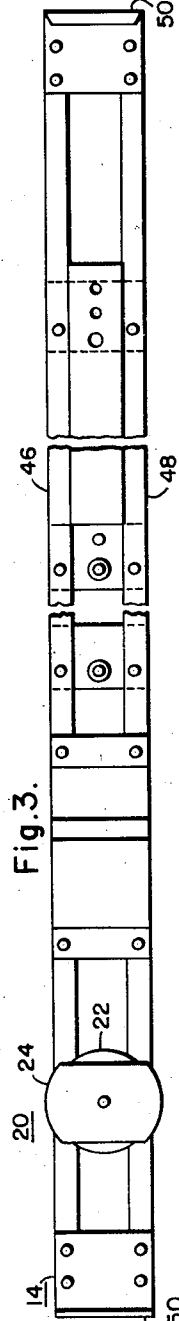


Fig. 5.

WITNESSES

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2,900,544

COMPENSATION MEANS FOR CATHODE RAY TUBES

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5 Claims. (Cl. 313—77)

This invention relates to cathode ray tube apparatus, and in particular relates to means for compensating, in color television image-reproducing tubes, for errors in registration between the point of electron beam impingement on the luminescent screen and the sub-elemental phosphor areas which comprise the screen of such a tube. Such registration errors may be caused by the earth's magnetic field, other extraneous magnetic fields or mechanical misalignment in the structure of the color image-reproducing tube.

One example of a cathode ray tube used in color television for image-reproducing is a multi-color kinescope forming the subject matter of U.S. Patent 2,595,548, granted May 6, 1952, to A. C. Schroeder, and titled "Picture Reproduction Apparatus." The luminescent screen of this tube consists of a multiplicity of phosphor areas of sub-elemental dimensions. Different ones of the phosphor areas are capable of producing light of the component image colors when excited by electron beam energy. In this tube, the different light-producing phosphor screen areas are excited respectively by a plurality of electron beams approaching the screen from different angles through an apertured masking electrode. Color selection is secured by the angle at which the electron beams approach the screen.

Another example of a cathode ray tube used in color television with which the present invention is useful is described in an article entitled "A One-Gun Shadow-Mask Color Kinescope" by R. R. Law, published in the Proceedings of the I.R.E., volume 39, No. 10, October 1951, at page 1194. In general, this tube is similar to the tube which is the subject matter of U.S. Patent No. 2,595,548. It employs a single electron gun by which to produce the plurality of electron beam components, whereas in the tube of the Schroeder patent, an electron gun is provided to produce each beam. In the tube of the Law article, a spinning type of movement is imparted to the beam so that it is made to rotate about the central, or longitudinal, axis of the tube. In its rotation about the tube axis, the beam occupies, in successive intervals, substantially the same positions as the different electron beams of the Schroeder patent.

The expression "electron beam components," as used in this specification and claims, is intended to cover the type of phosphor exciting electronic energy used by a single or a plurality of electron guns.

In the practical operation of multi-color kinescopes of the type referred to, it has been found advantageous to use what is known as a magnet-field equalizer. This equalizer provides sectionalized, steady magnetic fields which permit compensation in localized areas for the effects of stray magnetic fields and the earth's magnetic field on the electron beam components of the kinescope. If not compensated for, such fields cause color impurities usually concentrated near the edges of the face of the kinescope. Similar impurities result from the misalignment of the masking electrode with respect to the phosphor dot array which often exists near the periphery of

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the masking electrode. Color impurities of this latter type may also be corrected by the magnetic-field equalizer.

The magnetic-field equalizer comprises an array of adjustable permanent magnets mounted on two parallel pole-piece rings. Each of the permanent magnets has a shunt member associated with it. The magnetic field equalizer assembly is positioned around the face plate end of the kinescope so that the axes of the magnets are perpendicular to the longitudinal axis of the kinescope.

In one prior art construction, a cylindrical shunt member is used. The magnitude of the flux in the peripheral area of the screen of the kinescope adjacent to each magnet is changed by axial or translational movement of the magnet with respect to the shunt member. When the magnet is fully retracted within the shunt member, the magnitude of the flux is at a minimum. When the magnet is fully extended from the shunt member, the magnitude of the flux is at a maximum. The direction of the flux adjacent to each magnet is changed by rotation of the magnet. When using this construction for the magnetic-field equalizer additional space must be allowed in the cabinet of a color television receiver for the required axial movement of the magnets.

It is, therefore, an object of the present invention to provide an improved means for compensating for the effects of extraneous magnetic fields on a plurality of electron beam components used in a cathode-ray tube such as a tri-color kinescope.

It is another object to provide an improved means to compensate, in a shadow mask type of color picture tube, for misalignment of the apertures of the masking electrode with respect to the sub-elemental phosphor areas of the luminescent screen in regions near the periphery of the screen.

It is another object to provide an improved compensating means for a tri-color kinescope comprising a permanent magnet and a shunt in which the magnitude of the field provided by the magnet may be changed by rotation of either the magnet or the shunt with respect to each other.

It is another object to provide an improved compensating means which utilizes less space than other compensating means heretofore employed.

These and other objects are effected by my invention, as will be apparent from the following description taken in accordance with the accompanying drawing throughout which like reference characters indicate like parts, and in which:

Figure 1 is a diagrammatic representation of the magnetic field compensating means assembly and illustrates its positioning about the face plate end of a cathode ray tube;

Fig. 2 is an enlarged view in side elevation of one of the compensating means of this assembly;

Fig. 3 is a top plan view of one-half of the compensating means assembly shown in Fig. 1;

Fig. 4 is a view in side elevation of the compensating means assembly shown in Fig. 3.

Referring to Fig. 1 of the drawing, the compensating means assembly 10 is preferably made in two separate sections 12 and 14 whose extremities are joined so that the assembly completely surrounds the face plate end 16 of the image reproducing device 18. Insulating ring 19 is provided between the assembly 10 and the reproducing device 18 to permit the assembly to operate at ground potential. The assembly is connected to ground potential by means of the leads or straps 21 and 23 which are connected to the sections 12 and 14, respectively, of the assembly.

It will be assumed that the image reproducing device 18 is a multi-color kinescope of the general type referred to

in the Schroeder patent previously referred to. It will be understood that the kinescope alternately may be of other types such as that shown in the Law article referred to or modification of these tubes wherein the luminescent screen is deposited on the inner surface of the face plate. Therefore, the type of kinescope with which the compensating means is used has a luminescent screen mounted in back of, and somewhat spaced from, the face plate end or end wall 16 of the tube. The luminescent portion of the screen which is on the side of the screen remote from the end wall 16, comprises a multiplicity of groups of phosphor elements. Each of the elements is of sub-elemental image dimensions so that each group of such elements has an elemental image dimension. One such group of phosphor elements consists of red, green and blue light-producing dots, respectively. The kinescope 18 also is provided with an apertured masking electrode for use in conjunction with the luminescent screen. The masking electrode is provided with apertures suitably arranged with respect to associated groups of phosphor dots so that proper selective excitation of these areas may be affected to produce the desired component colors of a received image.

The compensating means assembly 10 comprises a plurality of magnet assemblies 20, each of which comprises a permanent magnet 22 and a shunt member 24 of ferromagnetic material.

Referring to Fig. 2 in detail, a magnet assembly 20 comprises a circular shaft or post 26 having a portion 28 near one of its ends which has a larger diameter than the rest of the shaft. The ends of the shaft 26 nearest the portion 28 is passed through an opening in a plate 30. The shaft 26 is held in a fixed position relative to the plate 30 by turning over the end of the shaft nearest the portion 28 so that this turned-over end is secured against one side of the plate 30 while the other side of the plate is brought to bear against portion 28 of the shaft. The ground strap 23, for example, is also provided with an opening in one end in order to accommodate the shaft 26 and it is secured to the plate 30 by being sandwiched between the turned-over end of the shaft and the plate.

The permanent magnet 22 is of circular construction and has a central opening therein so that it may be slid along the shaft 26 to a position abutting the portion 28. The shunt member 24 has a circular base portion 32 and a pair of diametrically opposed arcuate flanged portions 34 and 36. The base portion 32 has a central opening therein so that the shunt member 24 may be slid along the shaft 26 to a position whereby the flange portions 34 and 36 surround the circumferential area of the permanent magnet 22. The shunt member 24 is secured in this position by the insertion of a sleeve or spacer 38 between the magnet 22 and the inner side of the portion 32 of the shunt member. A spring clip 40 of a type well known in the art adjacent to the outer side of the base portion 32 is utilized to draw the shunt member up against the spacer 38. Spring-washers 42 and 44 are positioned at each side of the spacer 38 so that both the permanent magnet 22 and the shunt member 24 may be easily rotated about the shaft 26. Either the magnet 22 or the shunt 24 may be rotated with respect to each other and both may be rotated together.

Figs. 3 and 4 show one section 14 of the compensating means assembly 10, section 12 being substantially similar in construction. The section 14 comprises two parallel pole-piece rings 46 and 48 upon which a plurality of magnet assemblies 20 are mounted. The plate 30 of a magnet assembly is riveted to the pole-piece straps 46 and 48. Alternately, the plate 30 may be clipped on to the pole-piece straps. In the latter event, a magnet assembly may be more readily shifted in position around the face plate end 16 of the kinescope. At each end of the pole-piece straps there is provided a bracket 50 which is utilized to connect the sections 12 and 14 of the

assembly 10 so that the assembly may be securely positioned about the face plate end of the kinescope.

Each of the shafts 26 thus comprise a support for a magnet 22 and a shunt 24 while the pole-piece straps 46 and 48 comprise a supporting ring for each of the above supports.

In operation, the magnet 22 in a magnet assembly 20 is rotated to obtain the desired direction of the magnetic field. The magnet is permanently magnetized across its diameter. When the flange portions 34 and 36 of the shunt member 24 are aligned with the direction of magnetization (position shown in Fig. 2), the field produced by the magnet is at a minimum. When the flange portions 34 and 36 are perpendicular to the direction of magnetization, the field produced by the magnet is at a maximum. Magnet assemblies are located at positions around the face plate end 16 of kinescope wherever it is found desirable to compensate for the effects of the earth's magnetic field or other stray magnetic fields on the plurality of electron beam components of the kinescope.

The section 14 of the compensating means assembly 10 has a support structure or leg 52, the ends 54 and 56 of which are connected to the pole-piece straps 46 and 48. The section 12 is provided with a similar support structure 58. When the compensating means assembly 10 is in place about the face plate end of the kinescope, the support structures 52 and 58 are located on the assembly 10 so that they serve as supports for the kinescope when it is desired to turn it on either of its sides. These support structures may also serve as means for mounting various components of the television receiver.

It thus may be seen from the foregoing disclosure of an illustrative embodiment of the invention that there is provided an improved compensating means in which the direction and strength of the magnetic field produced by the compensating means is changed by rotational motion of the magnet or shunt without resort to any axial or translational motion of the magnet or shunt with respect to each other.

While I have shown my invention in a preferred embodiment, it will be obvious to those skilled in the art that it is not so limited but is susceptible of other changes and modifications without departing from the spirit and scope thereof.

I claim as my invention:

1. In a color television image-reproducing system including a cathode ray tube having a luminescent screen of a type producing light of the component colors of an image when impinged by electron beam components, apparatus disposed adjacent to said luminescent screen for compensating for errors in registration of said electron beam components with said luminescent screen comprising a plurality of rotatable permanent magnets, a rotatable magnetic shunt coaxial with each of said magnets, the axis of each of said magnets and said shunts being perpendicular to the longitudinal axis of said tube, with each of said magnets and said shunts being fixed in relation to movement along its axis.

2. In a color television image-reproducing system including a cathode ray tube having a face plate end comprising a luminescent screen of a type producing light of the component colors of an image when impinged by electron beam components, apparatus for compensating for errors in registration of said electron beam components with said luminescent screen comprising a plurality of rotatable permanent magnets, a rotatable magnetic shunt coaxial with each of said magnets, means for mounting said magnets and said shunts about the face plate end of said tube in such a manner that the longitudinal axis of each of said magnets and said shunts is perpendicular to the longitudinal axis of said tube, and each of said magnets and said shunts is fixed in relation to movement along its longitudinal axis.

3. In a color television image-reproducing system in-

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cluding a cathode ray tube having a face plate end comprising a luminescent screen of a type producing light of the component colors of an image when impinged by electron beam components, apparatus for compensating for errors in registration of said electron beam components with said luminescent screen comprising a supporting ring mounted about the face plate end of said cathode ray tube substantially encircling said luminescent screen, a plurality of supports secured to said ring at spaced locations thereon, each of said plurality of supports having a longitudinal axis perpendicular to the longitudinal axis of said cathode ray tube, a permanent magnet and a shunt means mounted about each of said supports and adapted to be rotated in relation to its support and in relation to each other, each of said magnets and shunt means being fixed on its support in relation to movement along the longitudinal axis of its support.

4. In a color television image-reproducing system including a cathode ray tube having a face plate end comprising a luminescent screen of a type producing light of the component colors of an image when impinged by electron beam components, apparatus for compensating for errors in registration of said electron beam components with said luminescent screen comprising a supporting ring mounted about the face plate end of said cathode ray tube substantially encircling said luminescent screen, a plurality of supports secured to said ring at spaced locations thereon, each of said plurality of supports having a longitudinal axis perpendicular to the longitudinal axis

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of said cathode ray tube, a rotatable permanent magnet and a rotatable magnetic shunt means mounted about each of said supports, and means retaining each of said magnets and said shunt means at a fixed location on its support.

5. In a color television image-reproducing system including a cathode ray tube having a luminescent screen of a type producing light of the component colors of an image when impinged by electron beam components, apparatus for compensating for errors in registration of said electron beam components with said luminescent screen, comprising a supporting ring mounted about the face plate end of said cathode ray tube substantially encircling said luminescent screen, a plurality of supports secured to said ring at spaced locations thereon, a cylindrical permanent magnet and a shunt means mounted about each of said supports, said shunt means having a pair of diametrically opposed flange portions surrounding portions of said magnet, said magnet and said shunt means adapted to be rotated in relation to its support and in relation to each other, and means retaining each of said magnets and said shunt means at a fixed location on its support.

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