March 31, 1959 M. G. KROGER 2,880,339

DEVICE FOR CATHODE RAY TUBE

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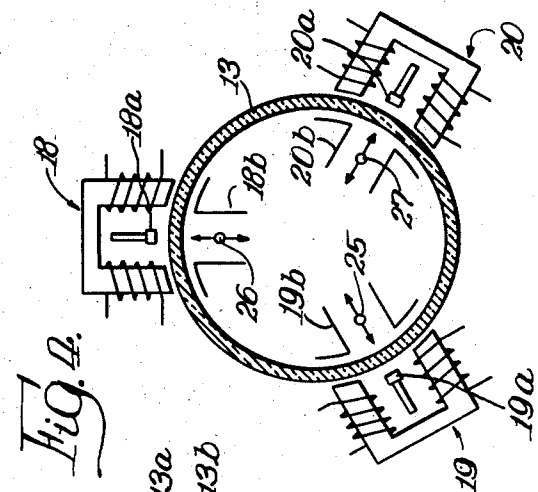


Fig. 4.

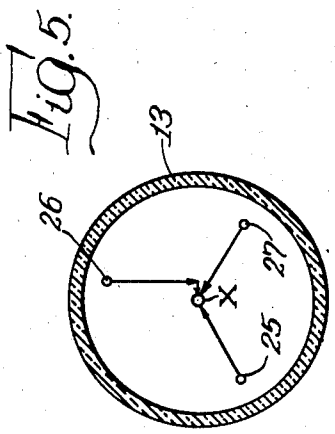


Fig. 5.

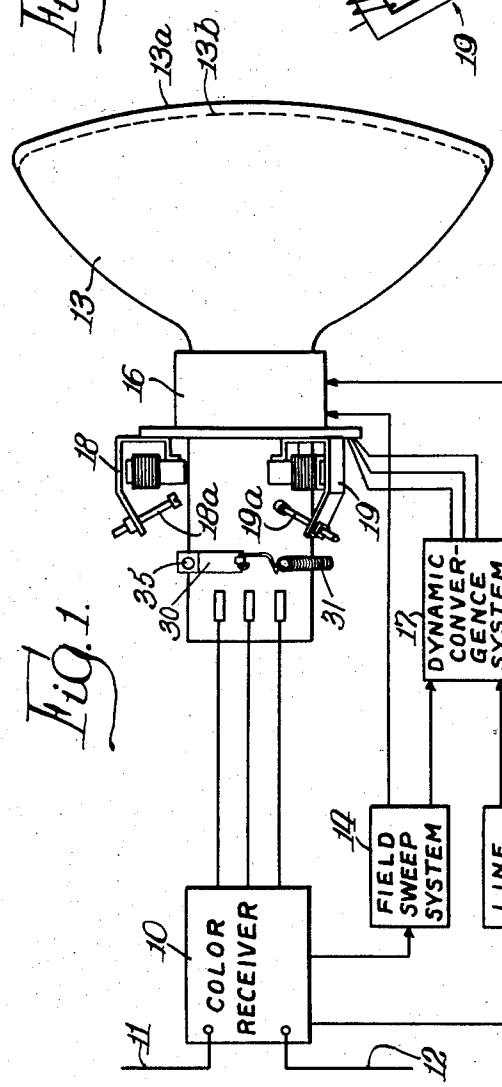


Fig. 1.

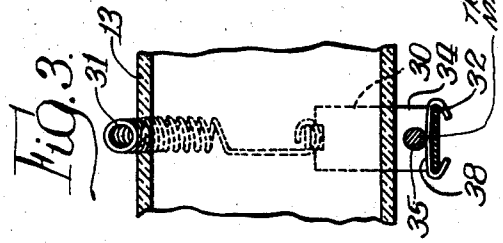


Fig. 3.

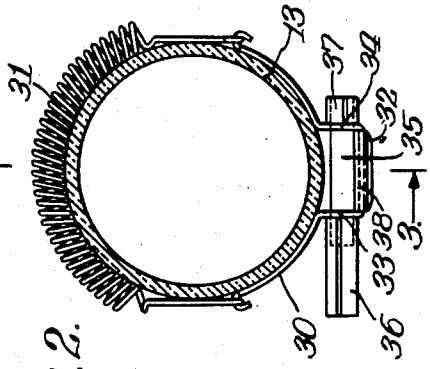


Fig. 2.

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2,880,339

DEVICE FOR CATHODE RAY TUBE

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Application January 31, 1955, Serial No. 485,108

3 Claims. (Cl. 313—75)

The present invention relates to a beam-positioning device for use with a cathode-ray tube, and more particularly to a device for use with the tri-gun type of cathode-ray color image reproducer to provide an independent adjustment for one of the three beams developed therein so that all three beams can be brought to a converged point in a selective plane.

One type of cathode-ray color image reproducer known to the art is the tri-gun tube in which three guns are set at different inclinations to the screen of the device, and each gun develops a cathode-ray or electron beam which is directed to the screen from a particular angle. An apertured shadow mask is provided adjacent the screen, and it is desirable for proper color reproduction that the three beams be converged in the plane of that mask and that they be maintained so converged throughout each line and field scansion of the beams.

One present-day system for converging the three beams within the color image reproducer comprises a coil and permanent magnet assembly in which three pole piece assemblies are provided within the cathode-ray tube each embracing a different one of the three cathode-ray beams. Associated with each of the pole piece assemblies is an electromagnet and permanent magnet arrangement whereby the field of pole piece assembly may be separately controlled to bend the respective beams inwardly to their converged point. Appropriate dynamic convergence signals are supplied to the electromagnets and the permanent magnets are adjustable so that proper dynamic and static convergence of the beams may be obtained.

It is evident that in adjusting the permanent magnets to control the static convergence of the beams, that two of the beams can be brought together to converge at a single point in the plane of the shadow mask, which point corresponds to the intersection of the adjusted paths of the two beams. It is necessary that the third beam also be adjusted to converge at this point. However, it is possible when the static adjustment is effected on the third beam that its closest point to the intersection of the paths of the other two beams lies on either side of this intersection. This necessitates a further adjustment which provides lateral movement for the third cathode-ray beam so that it, too, may be converged in the plane of the shadow mask at the intersection of the adjusted paths of the other two beams. It is usual in tri-gun tubes of present-day red-blue-green color systems to exert this further adjustment on the blue beam, and a permanent magnet device is used for the control and which is usually termed the "blue-beam positioning assembly."

It is an object of the present invention to provide a "blue-beam positioning assembly" of the permanent magnet type, and which assembly has a mechanical construction that renders it more economical to fabricate and more convenient to control than prior art devices of this general type.

A more general object of the invention is to provide a permanent magnet positioning device for a cathode-ray beam in a cathode-ray tube; which device is convenient

to control, accurate in its function, and which uses relatively few component parts that are so related with one another so as to render the construction of the device simple and inexpensive.

A feature of the invention is the provision of a permanent magnet device for positioning an electron beam in a cathode-ray tube and which device includes a transversely magnetized elongated permanent magnet supported on the cylindrical neck of the cathode-ray tube to extend across the path of the electron beam so as to permit a simple supporting structure for the device and a readily adjustable positioning field within the tube.

Another feature of the invention is the provision of such a device in which the permanent magnet is supported on an arcuate rigid bracket which, in turn, is supported on the neck of the cathode-ray tube by a helical spring bridging the end of the bracket, the magnet rod being conveniently supported in an outwardly extending offset portion of the bracket for rotational motion therein about its longitudinal axis so as to provide an adjustable positioning field within the tube.

Yet another feature of the invention is the provision of such a beam positioning device in which the permanent magnet is resiliently biased within the offset portion of the bracket so that it may be retained in any angular position to which it may be set to produce a desired positioning field within the tube.

The above and other features of the invention which are believed to be new are set forth with particularity in the appended claims. The invention itself, however, together with further objects and advantages thereof, may best be understood by reference to the following description when taken in conjunction with the accompanying drawing in which:

Fig. 1 shows the device of the invention mounted on the cylindrical neck of a color image reproducer, and shows also a schematic representation of the color receiver system associated with the reproducer;

Fig. 2 is a sectional view of the neck of the image reproducer of Fig. 1;

Fig. 3 is a sectional view taken along the lines 3—3 of Fig. 2; and

Figs. 4 and 5 are schematic representations useful in explaining the operation of the invention.

The invention provides a permanent magnet device adapted to be mounted on the neck of a cathode-ray tube for controlling the position of a cathode-ray beam therein. The device comprises an elongated strip of rigid material, with a helical spring member bridging the ends of the strip and adapted to extend around the neck of a cathode-ray tube to support the strip thereon. The strip also has an intermediate offset portion having a pair of spaced sides. A transversely magnetized permanent magnet member extends between the sides to be rotatably supported thereby, and this magnet establishes an adjustable magnetic positioning field within the neck of the cathode-ray tube for positioning an electron beam therein.

The system of Fig. 1 includes a color television receiver **10** having input terminals connected to an appropriate antenna **11**, **12** and having output terminals connected to the electron guns of a tri-beam cathode-ray color image reproducer **13**. The color receiver includes a field sweep system **14** and a line sweep system **15**, the sweep systems being connected to the deflection yoke **16** of the image reproducer **13**.

The sweep systems **14** and **15** are also connected to a dynamic convergence system **17** which, in turn, is connected to a series of coil assemblies **18**, **19** and **20** mounted in radial relation around the cylindrical neck of reproducer **13**. The assemblies **18**, **19** and **20** serve as dynamic convergence control means for the three

beams developed within reproducer 13. A series of permanent magnet structures 18*a*, 19*a* and 20*a* are associated respectively with the coil assemblies 18, 19 and 20 and serve as static convergence adjustment means for the electron beams within the reproducer.

The static and dynamic convergence assemblies form no part of the present invention and may be of any known type. For example, these assemblies may be of the type disclosed in copending application of Merlyn Armstrong, Serial No. 485,160, filed January 31, 1955. Briefly, three beams respectively called the blue, red and green beams are developed within reproducer 13 and are directed at different angles to the image reproducing screen 13*a* at the end of the reproducer remote from the electron guns. These beams are converged in the plane of a shadow mask 13*b* adjacent the screen, and this static convergence adjustment is made by adjusting the positions of permanent magnets 18*a*, 19*a* and 20*a*. The function of the convergence coil assemblies 18, 19 and 20 is to maintain the beams so converged throughout each line and field sweep, and this is accomplished by obtaining suitable field and line dynamic convergence signals from system 17. These signals may be derived in unit 17 in known manner.

The dynamic convergence coil assemblies 18, 19, 20 and associated permanent magnet static convergence elements 18*a*, 19*a*, 20*a*, are shown somewhat schematically in Fig. 4. That figure shows a section through the cylindrical neck of tube 13, and three pairs of pole pieces 18*b*, 19*b* and 20*b* are mounted internally of the neck to embrace the red beam 25, the blue beam 26 and the green beam 27, respectively. Manipulation of permanent magnets 19*a* and 20*a* causes the red and green beams to be moved inwardly along certain paths, and they may be converged in the plane of the apertured shadow mask 13*b* at the intersection of the paths of adjustment of these beams. Similarly, the blue beam 26 may be moved toward the center or converged points of the other two beams in the plane of the shadow mask, but there is no reason why the path of adjustment of the latter beam should pass through the intersecting point of the paths of adjustment of the other two beams. However, such common convergence is necessary for all three beams for proper operation of the system.

The conditions described above are shown schematically in Fig. 5 in which the convergence static adjustment of the blue beam 26 brings it to the right of the statically converged point X of the red and green beams 25, 27. It is evident that an additional lateral adjustment to the left is necessary for the blue beam to bring it to point X, and this adjustment is provided by the device of the present invention.

The device of the invention as shown in Figs. 2 and 3 includes an elongated metallic strip 30 having a substantially arcuate configuration and adapted to embrace a peripheral portion of the neck section of tube 13. A resilient member in the form of a helical spring 31 is bridged between the ends of strip 30, and is adapted to extend around the neck of the cathode-ray tube to support the strip on the neck.

The strip has an intermediate offset portion 32 which extends radially outwardly, and the offset portion has a rectangular section and a pair of spaced and essentially parallel sides 33, 34. The sides 33 and 34 each have a central aperture therein with the apertures being aligned with one another.

A transversely magnetized permanent magnet rod 35 composed, for example, of a ferrite and of circular cross section extends through the apertures in the sides 33 and 34 in essentially tangential relation with the neck of device 13 and traversing the path of the blue beam.

The permanent magnet rod is retained within bracket 30 by a pair of sleeves 36, 37 wrapped around the rod outside the offset portion 32 and engaging the sides 33 and 34 thereof. The sleeves, for example, may be in the form of brass strips wrapped around the permanent magnet rod, and the sleeves act to retain the rod longitudinally on the bracket formed by strip 34, yet permitting rotational adjustment of the rod about its longitudinal axis to be made so that the rod may be set to any selected angular position.

An arched resilient metallic plate 38 is secured by integral lugs to the portion of strip 30 intermediate sides 33 and 34, and this plate resiliently bears against the magnetic rod 35 in frictional engagement therewith to retain the rod in the angular position to which it is adjusted.

The direction of the magnetic field in the neck of tube 13 due to the transversely magnetized permanent magnet rod 35 is such that the beam is deflected at 90° to the deflection imparted thereto by the corresponding permanent magnet 18*a* in the convergence control assembly. Moreover, rotation of rod 35 changes the value of the component of the magnetic field due to the rod that produces this 90° deflection, the other component being longitudinally of the neck and having no visible effect on the beam. Therefore, the amount of the 90° deflection of the beam can be controlled simply by rotating the rod 35, and the blue beam can be brought to the converged point X in Fig. 5 by setting rod 35 at a certain angular position.

The invention provides, therefore, a beam positioning device for a cathode-ray tube that uses a minimum of relatively inexpensive components, and which components provide for simple and expeditious construction of the device. Moreover, the beam positioning device of the invention lends itself to simple and convenient manual adjustment for bringing the beam to its desired position within the tube.

I claim:

1. A beam positioning assembly for the neck of a tri-beam cathode ray tube in a color television receiver for laterally shifting the beam associated with a blue raster produced by such cathode ray tube, said assembly including in combination, support means adapted to be disposed about the tube neck, said support means having a metallic member surrounding an arcuate section of the neck through which section the beam passes and including an offset portion with a pair of spaced sides extending outwardly from the neck and a further portion joining the outward ends of said sides in spaced relation from the periphery of the tube neck, said spaced sides having aligned apertures therein, an assembly comprising elongated sleeve means and a magnet carried thereby intermediate the ends of said sleeve means, said assembly being rotatably supported in said apertures with the longitudinal axis thereof substantially parallel to a tangent of the tube neck and one end of said sleeve means forming means for manual rotation of said assembly, said magnet being magnetized transversely to the longitudinal axis of said assembly whereby rotation thereof moves the poles of said magnet in a path parallel to the axis of the tube neck to bring such poles alternately into proximity with the cathode ray beam therein, and said assembly being maintained in said support means in an established position of rotation upon adjustment thereof to such position.

2. A beam positioning assembly for the neck of a tri-beam cathode ray tube in a color television receiver for laterally shifting the beam associated with a blue raster produced by such cathode ray tube, said assembly including in combination, support means adapted to be disposed about the tube neck, said support means having a metallic member surrounding an arcuate section of the neck through which section the beam passes and including an offset portion with a pair of spaced sides extending outwardly from the neck and a further portion joining the outward ends of said sides in spaced relation from the periphery of the tube neck, said spaced sides having aligned apertures therein, an assembly comprising elongated sleeve means and a magnet carried thereby inter-

mediate the ends of said sleeve means, said assembly being rotatably supported in said apertures with the longitudinal axis thereof substantially parallel to a tangent of the tube neck and one end of said sleeve means forming means for manual rotation of said assembly, said magnet being magnetized transversely to the longitudinal axis of said assembly whereby rotation thereof moves the poles of said magnet in a path parallel to the axis of the tube neck to bring such poles alternately into proximity with the cathode ray beam therein, and resilient means carried by said support means and frictionally engaging said assembly for maintaining said assembly in an established position of rotation upon adjustment thereof to such position.

3. A beam positioning assembly for the neck of a tribeam cathode ray tube in a color television receiver for laterally shifting the beam associated with a blue raster produced by such cathode ray tube, said assembly including in combination, support means adapted to be disposed about the tube neck, said support means having a metallic member surrounding an arcuate section of the neck through which section the beam passes and including an offset portion with a pair of spaced sides extending outwardly from the neck and a further portion joining the outward ends of said sides in spaced relation from the periphery of the tube neck, said spaced sides having aligned apertures therein, an assembly comprising elongated sleeve means and a magnet carried thereby

intermediate the ends of said sleeve means, said assembly being rotatably supported in said apertures with the longitudinal axis thereof substantially parallel to a tangent of the tube neck and with portions of said assembly engageable with said spaced sides to reduce longitudinal movement of said assembly, one end of said sleeve means forming means for manual rotation of said assembly, said magnet being magnetized transversely to the longitudinal axis of said assembly whereby rotation thereof moves the poles of said magnet in a path parallel to the axis of the tube neck to bring such poles alternately into proximity with the cathode ray beam therein, and said assembly being maintained in said support means in an established position of rotation upon adjustment thereof to such position.

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