Feb. 14, 1961 H. S. VASILEVSKIS 2,972,074

MAGNETIC BEAM-CONTROLLING MEANS FOR CATHODE RAY TUBES

Filed Oct. 14, 1959

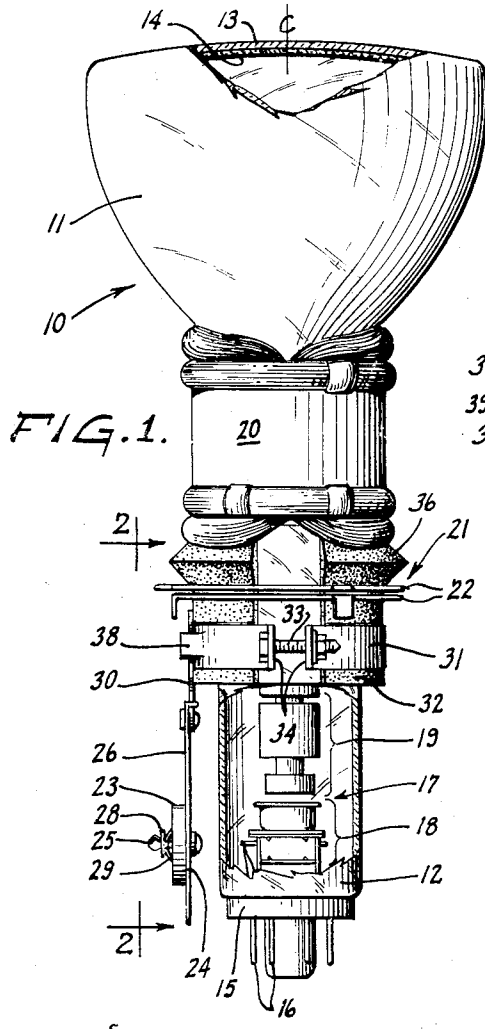

FIG. 1.

FIG. 2.

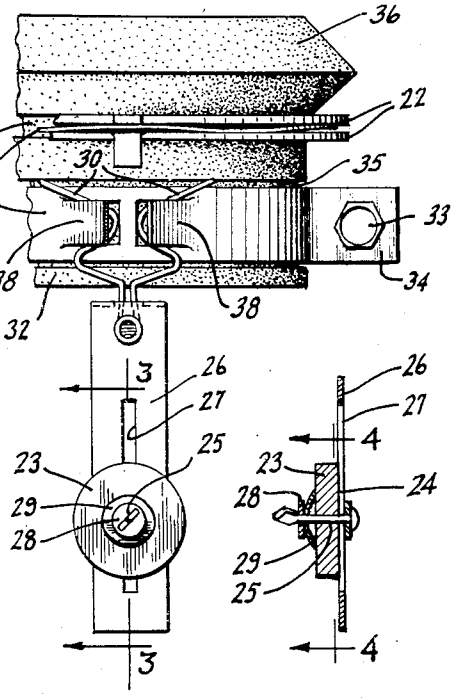

FIG. 3.

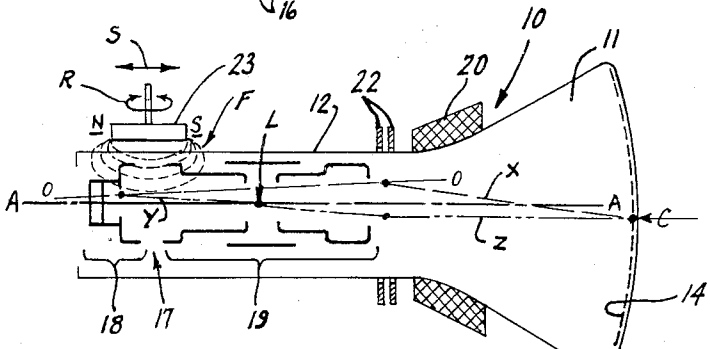

FIG. 5.

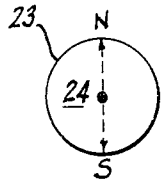

FIG. 4.

INVENTOR.
HENRY S. VASILEVSKIS
BY
ATTORNEY

United States Patent Office

2,972,074

Patented Feb. 14, 1961

2,972,074

MAGNETIC BEAM-CONTROLLING MEANS FOR CATHODE RAY TUBES

Henry S. Vasilevskis, Ardsley, Pa., assignor to Philco Corporation, Philadelphia, Pa., a corporation of Pennsylvania

Filed Oct. 14, 1959, Ser. No. 846,337

11 Claims. (Cl. 313—84)

The present invention relates to cathode ray tubes, and particularly to electron-beam controlling means for such tubes. More specifically, the invention has to do with a novel magnet arrangement for correcting misalignment of electron beams in cathode ray tubes.

In a cathode ray tube, especially when used in a television receiver, it is important that the undeflected electron beam be properly focussed and accurately aligned so as to form a sharply defined scanning spot at the geometric center of the luminescent screen of the tube. Beam-focussing problems can be and usually are solved by means of conventional electrostatic focussing leans elements which, in accordance with present day techniques, are combined with cathode-grid elements to form a unitary gun assembly for convenient handling and mounting within the neck section of the cathode ray tube envelope. Also, most beam-aligning problems, particularly those which arise when the electron gun assembly as a whole is off-center, can be and usually are overcome by means of conventional magnetic centering devices arranged about the neck section of the envelope tube between the focussing portion of said gun assembly and the deflection coil-yoke assembly which adjoins the flared section of the tube envelope. However, it has been found that conventional centering devices are inadequate in most instances to overcome those beam-aligning problems which are brought about by reason of accidental misalignment between cooperative elements of an electron gun assembly.

The present invention, in its specific aspect, concerns these latter beam-aligning problems, and one of its primary objectives is to solve such problems in a simplified and economical manner.

It is also an object of the invention to provide a novel magnetic beam-aligning apparatus composed of simple and inexpensive parts which cooperate to compensate for alignment inaccuracies incident to unavoidable variations in manufacturing and assembling the several elements which constitute the electron gun assembly.

The invention is particularly characterized in that it makes possible the provision of a compact unit which is readily mountable in cooperative association with a cathode ray tube envelope and which, when so mounted, occupies very little space about the tube envelope and provides for varying and selectively adjusting the direction and strength of a magnetic field to insure correction of electron beam distortions caused by misalignment between elements of the cathode ray tube.

Another characteristic feature of the invention resides in the fact that the novel beam-aligning unit is such that it can be easily incorporated in a unitary structure capable of serving the additional purpose of securing the coil and yoke assembly employed to deflect the aligned beam.

Briefly stated, the embodiment of the invention described herein comprises an adjustably movable magnet mounted on a support close to the neck section of a

cathode ray tube envelope, the support being constructed and arranged in such a manner that adjustable movement of the magnet can take place only in a predetermined region within which the cathode-grid arrangement of the gun assembly is located in said neck section. This adjustable movement is obtained by supporting the magnet so as to rotate about an axis perpendicular to and traversing the longitudinal central axis of the tube envelope, and so as to slide in the same direction as said longitudinal axis within the predetermined region. In accordance with a specific embodiment, the magnet takes the form of a disk magnetized so that opposite poles are on a line coinciding with the diameter of one face of the disk and so that the magnetic field is present at said one face. The disk is carried on the support so that said one face is disposed to confront the neck section of the cathode ray tube envelope.

The principles of the invention, and the manner in which the above noted and other objects and characteristic features are attained, will be fully understood from the following description based upon the accompanying drawing, in which:

Figure 1 is a side view, partly in elevation and partly in section, illustrating a cathode ray tube including certain conventional components and provided with apparatus embodying the present invention;

Figure 2 is a fragmentary view looking in the general direction of arrows 2—2 in Figure 1 and showing on an enlarged scale, certain parts of the apparatus of the invention removed from the cathode ray tube;

Figure 3 is a cross sectional view taken substantially on line 3—3 of Figure 2;

Figure 4 is a plan view of the magnetized disk looking in the general direction of arrows 4—4 in Figure 3; and

Figure 5 is an explanatory view schematically representing the arrangement shown in Figure 1 and illustrating the principles of the invention.

With more particular reference to the drawings, the conventional cathode ray tube shown in Figure 1 includes a tube envelope **10** having a flared bulb section **11** and an elongated neck section **12**. The flared section is provided with a viewing face **13**, the internal surface of which is coated with a fluorescent substance forming a luminescent screen **14**, in the usual manner. The neck section is provided with a base **15** which supports terminals **16** leading to an electron gun assembly **17** enclosed within said neck section. This gun assembly includes a cathode-grid arrangement **18** for emitting electrons, and a three-element electrostatic lens arrangement **19** for forming and focussing a beam of electrons to define a scanning spot on the luminescent screen **14**.

A coil and yoke assembly **20** is mounted on the neck section of the tube envelope **10** adjacent the flared section **11** thereof. This coil and yoke assembly is adapted to deflect the electron beam horizontally and vertically so that the scanning spot traces a two-dimensional raster upon the luminescent screen of the tube.

Beam-centering means **21** is associated with the tube to center the raster on the screen. The illustrated centering means is in the customary form of magnet rings **22** which are mounted to encircle the neck section of the tube envelope, adjacent the rearward portion of the coil and yoke assembly **20**, and which are rotatably movable about said section for adjustment in a position where their magnetic flux patterns cause the undeflected focussed electron-beam to strike the luminescent screen at its geometrical center represented at C.

The constructional and operational details of the gun assembly **17**, coil and yoke assembly **20** and centering means **21**, are well known in the art and need no further description herein. These known assemblies and means form no part of the invention except insofar as they are

related to apparatus embodying the principles of the invention, which apparatus will now be described.

In the illustrated embodiment, the apparatus of the invention comprises a disk 23 of magnetizable material, said disk being so magnetized that the N-pole and the S-pole are disposed diametrically across one face 24 of the disk, as is represented in Figure 4. This disk 23 is disposed adjacent the neck section 12 of the tube envelope in the region of the cathode-grid arrangement 18 and is so supported that said magnetized face 24 confronts said neck section of the tube envelope. The disk has a centrally disposed axle or pin 25 adapted to mount said magnet for combined rotational and sliding adjustments on a support member 26 of non-magnetic material, such as a brass strip. This supporting strip or member 26 is provided with an elongated slot 27 through which one end of the pin 25 passes freely, said pin cooperating with a washer 28 and spring element 29 for frictionally retaining the disk 23 in adjusted position on said member 26.

As shown, the supporting member 26 is associated with means for mounting the disk 23 in the aforesaid position with respect to the neck section of the tube envelope. For that purpose one end of the supporting member 26 is provided with fingers 30 disposed for engagement with a non-magnetic split annular clamp 31 which encircles a pliable non-magnetic split tubular collar or sleeve 32. This collar or sleeve is adapted to fit over the neck section 12 of the tube envelope and to be secured thereon by tightening a screw or bolt 33 in engagement with angular tabs 34 formed on the clamp, the latter being seated in a recess 35 provided in said sleeve (Figure 2).

As shown in Figure 1, the sleeve 32 is utilized to retain the coil and yoke assembly 20 in position on the tube envelope and also to carry the centering magnet rings 22 in their position adjacent said assembly. For these purposes, the sleeve 32 is provided, as best illustrated in Figure 2, with a tapered portion 36 and with a circumferential groove 37. The tapered portion 36 forms a seat for said coil and yoke assembly 20 so that the latter, as shown in Figure 1, becomes fixedly sandwiched between the flared section 11 of the tube envelope and said tapered portion of the collar 32, whereas the groove 37 forms a raceway in which the centering magnet rings are seated for rotatable adjustment as was previously described.

As more clearly appears in Figure 2, the fingers 30 affixed to the supporting member 26 are adapted to provide a detachable connection between said member and the clamp 31. For that purpose, these fingers can be and preferably are constructed from spring wire stock bent for resilient engagement with ears 38 stuck outwardly from said clamp 31. Because of this arrangement the subassembly including the magnetized disk 23 and its supporting member 26 can be readily attached to and removed from the clamp, whenever desired or necessary, without disturbing the sleeve 32 and therefore without interfering with the setting and operation of the deflection coil and yoke assembly 20 nor with the setting and operation of the magnet rings 22. These rings 22 are frictionally retained in their set position within the groove 37 by means of a non-magnetic annular spring 39 which, as more clearly seen in Figure 2, is interposed between and resiliently bears upon said rings.

The use and function of the apparatus as described above will be best understood upon referring to schematic Figure 5. As represented in this Figure 5, an electron beam formed by the gun assembly 17 should be directed along an axis A which passes through the lens center L of the three-element electrostatic lens arrangement 19. This desired operative condition, to a large extent, depends upon accurate positioning of the electron gun elements with respect to each other. For example, during construction and processing of the tube, the cathode-grid arrangement 18 may accidentally become located out of line with respect to the lens arrangement 19, so that the electron beam would be directed along an off-center axis represented at O, resulting in objectionable aberration even should the centering rings 22 be adjusted to shift the beam as represented at X.

To remedy such detrimental conditions, the magnetized disk 23 constructed and arranged in accordance with the invention is rotated clockwise or counterclockwise as represented by arrow R, and is slidably moved to the right or left as represented by arrow S, until said disk assumes a position in which the direction and strength of its magnetic field F is such that it acts on and directs the electron beam to pass through the lens center L, as is diagrammatically represented at Y. It is to be understood that this beam-directing function of the magnetized disk 23 supported in the region of the cathode-grid arrangement, is distinct and separate from the function of the centering magnet rings 22 which adjoin the coil and yoke assembly 20 and which, as represented at Z, serve to bring the electron beam in line with the geometric center line C of the screen 14 of the tube envelope 10.

It should be noted that, in schematic Figure 5, indication of the magnet poles N and S is made solely for purposes of illustration and that, in actuality, adjustment of the disk 23 to correct the represented conditions may result in locating the magnetic poles in a position other than the one illustrated with respect to the elements of the gun assembly within the neck section 12 of the tube envelope.

From the foregoing description, it will be appreciated that the invention provides an exceedingly simple arrangement for obtaining correct positioning of an electron beam in a cathode ray tube so that the beam passes properly through the lens elements of the gun assembly to produce a well-defined image on the screen of the tube envelope. Whereas a preferred embodiment has been shown and described, it will be understood that the invention is not limited to this specific embodiment but that it embraces such change and modifications which come within the scope of the subjoined claims.

What I claim is:

1. In combination with beam-centering magnetic rings for cathode ray tubes, a sleeve adapted to fit over the tubular section of a tube envelope and having a portion on which said rings are mounted to rotate concentrically about said sleeve, an elongated member carried by said sleeve and extending longitudinally therefrom, a magnet supported by said member in a position remote from said rings, and means interconnecting said member and said magnet to mount the latter for rotation on said member and for sliding motion along the length thereof.

2. In combination with beam-centering magnetic rings for cathode ray tubes, a sleeve adapted to fit over the tubular section of a tube envelope and having a portion on which said rings are mounted to rotate concentrically about said sleeve, an elongated member carried by said sleeve and extending therefrom, a magnet having a magnetized surface, said magnet being supported by said member in a position where said surface is remote from said rings, and means interconnecting said member and said magnet to mount the latter for rotation and for sliding motion on said member.

3. In combination with beam-centering magnet rings for cathode ray tubes, a sleeve of non-magnetic material adapted to fit over a tubular section of a tube envelope and having a portion on which said rings are mounted to rotate concentrically about said sleeve, a clamp of non-magnetic material encircling said sleeve, a strip of non-magnetic material carried by said clamp and extending therefrom in a direction perpendicular to said rings, a magnetized disk supported on said strip in a position remote from said rings and in a plane paralleling the longitudinal axis of said sleeve, and means interconnecting said strip and said disk to mount the latter for rotation on said strip and for sliding motion along the length thereof.

4. In combination with beam-centering magnet rings for cathode ray tubes, a sleeve of non-magnetic material adapted to fit over a tubular section of a tube envelope and having a portion on which said rings are mounted to rotate concentrically about said sleeve, a clamp of non-magnetic material encircling said sleeve, a strip of non-magnetic material carried by said clamp and extending therefrom in a direction perpendicular to said rings, a disk of magnetic material magnetized so that opposite poles are on a line extending diametrically across one face of said disk, said disk being supported on said strip in a position where said one face is remote from said rings and in a plane paralleling the longitudinal axis of said sleeve, and means interconnecting said strip and said disk to mount the latter for rotation on said strip and for sliding motion along the length thereof.

5. In combination with beam-centering magnet rings for cathode ray tubes, a sleeve having an annular recess and an annular groove spaced from each other, said annular groove receiving said rings for rotatable adjustment about said sleeve, a clamp encircling said collar and seated within said recess, a strip carried by said clamp and extending therefrom in a direction perpendicular to said rings, said strip having an elongated slot, a magnetized disk, and a pin extending centrally of said magnet and projecting into said slot to provide for combined rotational and sliding motions of said disk on said strip.

6. In a cathode ray tube having an elongated envelope portion enclosing an electron gun assembly provided with a cathode-grid arrangement, the combination comprising an element having a plane surface, said element being so magnetized that opposite poles are on a line extending along the plane of said surface, and structure for supporting said element in a position where said surface confronts said envelope portion in the region of said cathode-grid arrangement, said structure including means mounting said element for rotation on an axis perpendicular to said envelope portion and for sliding motion lengthwise thereof and within said confines of said region.

7. In a cathode ray tube having an elongated envelope portion enclosing an electron gun assembly provided with a cathode-grid arrangement, the combination comprising a magnet, and structure for supporting said magnet in the region of said cathode-grid arrangement, said structure including a member having an elongated slot and a pin extending through said slot and engaging said magnet to provide for rotational and sliding motions thereof, said slot and pin cooperating to prevent sliding of said magnet beyond said region.

8. In a cathode ray tube having an elongated envelope portion enclosing an electron gun assembly provided with a cathode-grid arrangement, the combination comprising a magnet having a flat circular face and polarized along a diameter of said face, and structure for supporting said magnet in a position where said face confronts said envelope portion in the region of said cathode-grid arrangement, said structure including a member having an elongated slot and a pin extending through said slot and engaging said magnet to provide for rotational and sliding motions thereof, said slot and pin cooperating to prevent sliding of said magnet beyond said region.

9. In a cathode ray tube having an elongated envelope portion enclosing an electron gun assembly provided with a cathode-grid arrangement, the combination comprising a magnetized disk, and structure for supporting said disk in the region of said cathode-grid arrangement, said structure including a sleeve anchored on said envelope portion and an elongated member extending from said sleeve in a plane paralleling said portion, said disk being carried by said member to rotate thereon about an axis perpendicular to said envelope portion and to slide lengthwise thereof, and interengageable means between said member and disk to prevent sliding thereof beyond said region.

10. In a cathode ray tube having an elongated envelope portion enclosing an electron gun assembly provided with a cathode-grid arrangement, the combination comprising a magnetized disk with opposite poles on a line coinciding with the diameter of one face of said disk, and structure for supporting said disk in a position where said one face confronts said envelope portion in the region of said cathode-grid arrangement, said structure including a sleeve anchored on said envelope portion and an elongated member extending from said sleeve in a plane paralleling said portion, said disk being carried by said member to rotate thereon about an axis perpendicular to said envelope portion and to slide lengthwise thereof, and interengageable means between said member and disk to prevent sliding thereof beyond said region.

11. In a cathode ray tube having an elongated envelope portion enclosing an electron gun assembly provided with a cathode-grid arrangement, the combination comprising a magnetized disk, and structure for supporting said disk in the region of said cathode-grid arrangement, said structure including a sleeve anchored on said envelope portion and an elongated member extending from said sleeve, said disk being carried by said member to rotate and to slide thereon, and interengageable means between said member and disk to prevent sliding thereof beyond said region.

References Cited in the file of this patent

UNITED STATES PATENTS

2,568,631	Hoellerich	Sept. 18, 1951
2,606,301	Court	Aug. 5, 1952
2,707,246	Zuerker	Apr. 26, 1955
2,852,712	Fabel	Sept. 16, 1958
2,889,477	King	June 2, 1959
2,899,578	Kirkham	Aug. 11, 1959