Aug. 26, 1958 J. C. FRANCKEN 2,849,647

COLOR TELEVISION REPRODUCING DEVICE

Filed Feb. 28, 1955 2 Sheets-Sheet 1

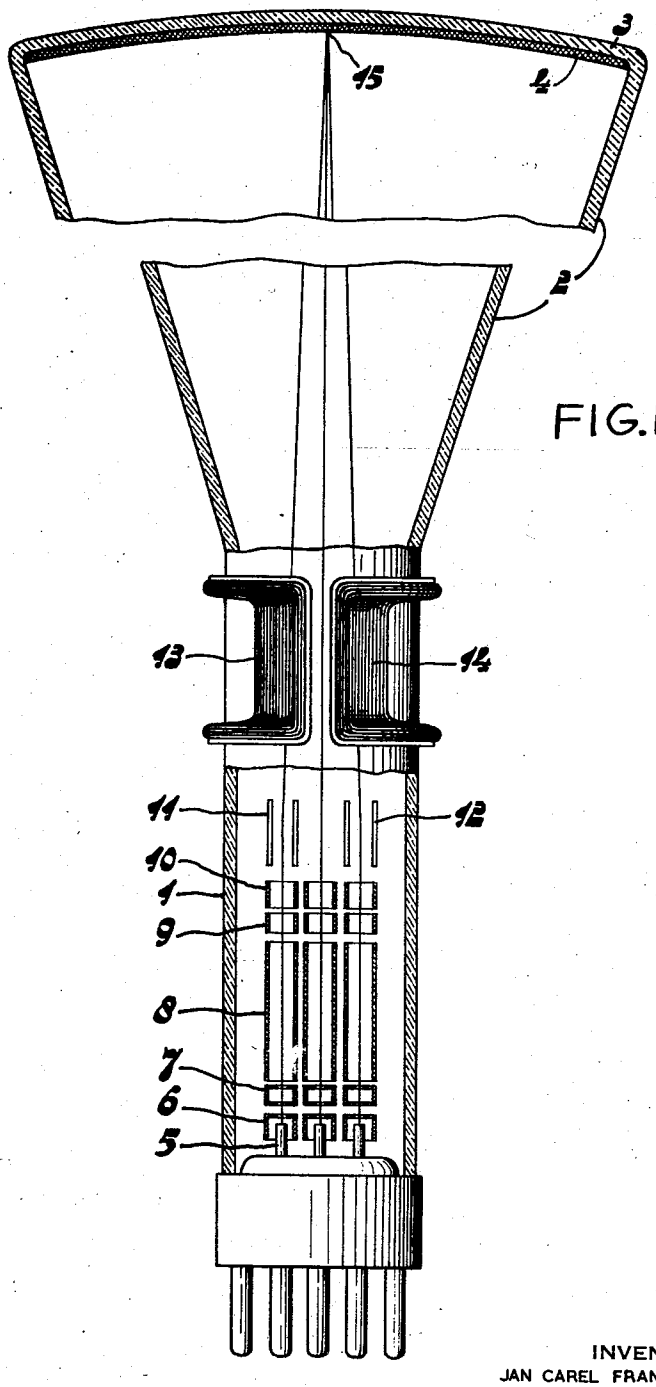


FIG. 1.

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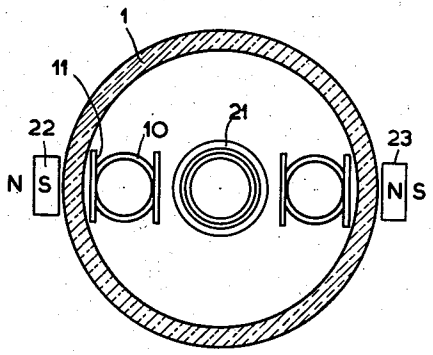


FIG. 2

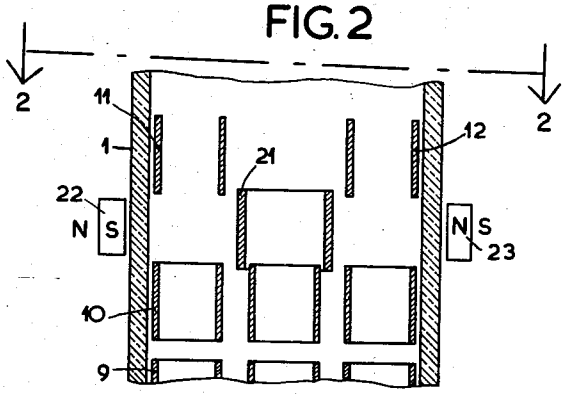


FIG. 3

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COLOR TELEVISION REPRODUCING DEVICE

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Application February 28, 1955, Serial No. 491,163

Claims priority, application Netherlands March 4, 1954

6 Claims. (Cl. 315—13)

This invention relates to devices for reproducing images, more particularly for reproducing colour television images, comprising cathode-ray tubes having three electron guns.

For many purposes it is desirable to have a cathode-ray tube comprising three electron guns. Such is the case more particularly for reproducing colour television images. Consequently, many suggestions have previously been made for the construction of such tubes, in which the arrangement of the electrode systems for producing the cathode rays, which systems are referred to as electron guns, is dependent upon the way in which the images are produced. One of the tubes most known comprises three electron guns, the axes of which are directed according to the edges of an equilateral prism. It has also been suggested to arrange the three guns in such manner that their axes extend in parallel and in one flat plane.

Tubes of the last-mentioned kind comprising three parallel guns are known for both oscillography and reproducing colour television images. The object of the first kind of tubes is to record simultaneously three oscillograms, so that it will be easily understood that each gun for this purpose comprises one or more deflection systems. In the above-mentioned tubes for colour television comprising three guns located in one plane, each gun comprises a set of deflection electrodes of its own. The three sets of deflection electrodes permit of directing the three beams to one point on a "collector." In the device concerned the "collector" or electron-receiving screen comprises a luminescent screen and a grid of parallel wires which is arranged in front thereof and which produces an image of line structure. All three electron beams in this case are directed to the same area of the grid. In the description following hereinafter of the device according to the invention, the term "collecting or electron-receiving screen" must not be understood to mean solely the screen serving to produce the visible image. For certain systems the "collecting or electron-receiving screen" is actually only the luminescent screen, but for other systems the "collecting or electron-receiving screen" is a perforated electrode, for example a grid, arranged in front of the luminescent screen. In the first-mentioned systems the three beams are thus required to be directed to the same point on the luminescent screen, whereas in the other systems it is more common practice to direct the beams to the same area of the perforated electrode.

In the above-mentioned colour television tubes, comprising three guns, it is necessary for the three cathode rays to be directed to the same point on the collecting screen, even if the beams are deviated or scanned across the screen to produce a raster-like image. This may be realized owing to each beam having a deflection or scanning system of its own, but it is then necessary to apply deflection voltages of particular shape to the said systems. Said voltages are required to be highly asymmetrical for writing a symmetrical raster.

A device according to the invention exhibits the above-

mentioned disadvantages to a greatly reduced extent and also affords some other advantages.

A device according to the invention for reproducing images, more particularly for reproducing colour television images, comprises a cathode-ray tube having three electron guns producing three electron rays or beams which scan a collecting screen under the action of a deviation or scanning field, common to all rays and comprising two relatively almost perpendicular components, which rays are always convergent upon leaving the three electron guns and which are located in a flat plane upon entering the deviation field. The device exhibits the characteristic that one component of the deviation or scanning field is parallel to the intersecting line of a plane at right angles to the axis of the tube and the plane of the cathode rays and is also characterized in that two out of the three electron guns each comprise an electrostatic deflecting system having applied to it voltages such that the meeting point of the three cathode rays is always located on the collecting screen.

The term "deviation" is to be understood in this description to mean the common deviation or scanning of the three rays for producing the image raster. The term "deflection" is to be understood to mean the action exerted upon the electron rays to give them the correct direction before entering the common deviation field.

A device according to the invention affords the advantage that the deviation system may have applied to it simple voltages or currents of the usual shape, for example saw-tooth shape. Owing to the three electron rays, upon entering the deviation field, being located in one plane, the advantage is obtained that, if for a determined intensity of the deviation field the rays meet at one point, such is always the case, apart from the error referred to as coma, even if the deviation is varied. When the three electron rays are regarded as parts of one beam, it can thus be said that any interfering astigmatism does not occur. However, one error still remains, viz. that the geometric position of the meeting point of the three rays is not a flat plane but falls along a curved surface. This constitutes a disadvantage, since the collecting screen can usually be regarded to a first approximation as a flat surface.

Since two electron guns comprise individual deflecting systems, it can primarily be ensured that the rays meet at one point on the collecting screen for a determined strength of the deviation field, and furthermore the necessary correcting voltages may be applied to the said deflecting systems, so that the above-mentioned curved surface is deformed so as to coincide with the collecting screen.

In a determined case it is even not necessary to aply voltages to the deflecting systems for bringing the three rays together at one point on the collecting screen, namely if the three electron guns are arranged at an angle to one another such that the axes of the guns already meet at one point on the collecting screen without voltages on deflecting systems. It is then only necessary to apply simple correcting voltages to the deflecting systems to ensure that the rays, when the deviation field is switched on, actually meet on the collecting screen.

Arranging the electron guns at an angle has a disadvantage, since in this case the space occupied by the electron guns is large with respect to the space occupied if the three guns are arranged with their axes in parallel. It is thus frequently more advantageous to arrange the three guns with their axes in parallel and to ensure by means of direct voltages on the deflecting systems that the three rays meet at a point on the collecting screen when the deviation field is not switched on.

It is naturally immaterial which two out of the three electron guns are provided with deflecting plates, since

the direction of one electron ray may always be regarded as the correct direction, so that the other rays may be directed to the point at which the first-mentioned ray strikes the collecting screen.

If the axes of the three guns are located in parallel in a flat plane, it is very advantageous to provide the outer guns with deflecting plates, it then being possible to direct the central gun to the centre of the collecting screen. The whole structure of the electrode system is thus rendered symmetrical and hence simple.

Since the electron rays are located in a flat plane, they need be deflected only in this plane. If there should be small deviations bringing the rays outside this plane before reaching the deflection electrodes, they can be moved back into the plane by carrying out a correction with the use of magnets provided outside the tube. As before, the direction of one of the electron rays is usually regarded as the correct direction, the other two electron rays being deflected magnetically, so that all three rays come to lie in one plane. Preferably the two outer electron rays are thus influenced by magnetic means. However, in this case it is necessary for the central electron ray to be screened magnetically. This screening may consist, for example, of a ferromagnetic envelope surrounding at least part of the central gun. However, as an alternative, it is possible for one electrode of the central gun to be manufactured of ferromagnetic material.

In order that the invention may be readily carried into effect, it will now be described with reference to the accompanying drawing, given by way of example, in which:

Fig. 1 shows a cross-sectional view of a cathode-ray device of the invention;

Figs. 2 and 3 orthogonal cross-sectional views of a modification.

In the figure, the cathode-ray tube comprises a cylindrical neck **1** and an adjoining conical portion **2**, closed by a slightly curved window **3**. The latter is covered on its inner side with a luminescent layer **4** serving as the electron-receiving screen. Arranged inside the neck **1** of the tube are three rectilinear parallel electron guns, the axes of which are located in one flat plane, i. e., the plane of the drawing. All three guns, except the deflection plates of the two outer ones, are identical, so that one gun only is provided with reference numerals for the sake of clarity. In this gun **5** indicates the cathode, **6** indicates the control grid, **7** the accelerating anode and **8** the anode. This portion of the gun produces an electron current which is already slightly beamed but which is concentrated still further in order to obtain a very small focus. This concentration is effected with the use of electrodes **9** and **10** which, together with the electrode **8**, constitute a lens system. For this purpose it is, of course, necessary to apply suitable voltages to the electrodes **5** to **10** inclusive. However, this has no concern with the invention as such, since the gun is built up in a fully conventional way and also included in a circuit in known manner. It is thus also possible, for example, to utilize so-called triode systems, in which an accelerating anode is not present.

The cathode-ray tube shown comprises two sets of deflection plates **11**, **12** in the two outer electron guns. Furthermore, the figure shows a set of coils **13**, **14** by which the three rays or beams produced by the electron guns are jointly deviated in one direction perpendicular to the plane of the drawing and caused to scan the screen so that the raster is written on the luminescent screen **4**. The other set of coils for the deflection in the plane of drawing at right angles to said one direction is not shown for the sake of clarity. As will be noted, one deviation field component extends in the plane of the three guns but at right angles to their axes. By applying suitable direct voltages to the deflecting systems **11**, **12** it may be ensured that, in the rest or center positions, the three electron rays converge to meet at one point **15** at

the centre of the luminescent screen **4**. The device once thus adjusted, the three rays always meet substantially at one point, even if deviating currents are supplied to the deviation coils to cause the converged beams to scan the screen. In order to arrange for these points always to be located on the luminescent screen **4**, it will in many cases be necessary for the deflection systems **11**, **12** to be supplied, in addition, with correcting voltages, which are derived from the voltages providing the currents in the deviation coils. However, as an alternative, the luminescent screen **4** may be given a curvature such that the meeting point of the three rays is always located on the luminescent screen without correcting voltages on the deflection systems **11**, **12**. In this case it is necessary only to apply direct voltages to the deflecting systems **11**, **12**.

As pointed out before, there is the possibility that the three electron rays or beams may not maintain their single planar relationship. Figs. 2 and 3 show a modification for restoring this relationship. The part of the device shown in these figures is that in the vicinity of the deflection systems **11**, **12**. As illustrated, magnets **22** and **23** can be provided alongside the envelope adjacent the two outer beams to provide magnetic fields to correct the positions of the outer two beams, i. e., adjust the positions of the outer two beams so that they lie in a single flat plane with the center beam. To avoid influencing the course of the center beam, a ferromagnetic member **21** can be provided to surround the center beam and thus shield it from external magnetic fields. If desired, further shielding of the center beam can be obtained by constructing the electrode **10** also of ferromagnetic material.

What is claimed is:

1. An electrical device comprising a cathode-ray tube including an electron-receiving screen, means including three electron guns within said tube producing three electron beams lying in as single flat plane, deviation-field-producing means common to said three electron beams for causing said three beams in said single plane jointly to scan said electron-receiving screen, said deviation-field-producing means establishing a field having substantially two perpendicular components, one of said perpendicular components being parallel to the single plane of the beams and also substantially at right angles to the axis of the tube, and electrostatic deflecting means associated with each of two of said electron guns for causing the beams produced by said two guns to be directed substantially to the same area of said screen as the beam from the third gun.

2. An electrical device as set forth in claim 1 wherein the three electron guns are located such that their axes intersect the screen at a common point.

3. An electrical device for producing color television images, comprising a cathode-ray tube including an electron-receiving screen, three electron guns within said tube and located substantially in a single flat plane and substantially parallel to one another, deviation-field-producing means common to said three electron beams for causing said three beams jointly to scan said screen, said three electron beams lying in a single flat plane when they traverse the deviation-field, said deviation-field-producing means producing a field within said tube constituted of two substantially perpendicular components, one of said components extending parallel to the plane of the three beams and at right angles to the axis of the cathode-ray tube, the other perpendicular component being also at right angles to the tube, and electrostatic deflecting means associated with each of the two outer electron guns for causing the beams produced by said two guns to coverge to the same point at the screen as the beam from the central gun, said last-named means lying on the side of the deviation-field-producing means remote from said screen.

4. A device as set forth in claim 3 wherein the deflect-

ing means includes a pair of flat deflection electrodes associated with each of the two outer guns.

5. A device as set forth in claim 4 wherein magnets are provided to correct the position of the electron beams produced by the outer two guns, and means are provided for shielding the electron beam produced by the central gun from the fields producd by the magnets.

6. A device as set forth in claim 5 wherein at least one electrode of the central electron gun is constituted of ferromagnetic material to shield the electron beam produced thereby from the field produced by the magnets.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,849,647 August 26, 1958

Jan Carel Francken

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 3, line 34, after the numeral "3" insert -- are --; column 4, line 38, for "as single" read -- a single --.

Signed and sealed this 25th day of November 1958.

(SEAL)

Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents

UNITED STATES PATENT OFFICE

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