Jan. 9, 1968 H. DE FRANCE ETAL 3,363,128

CONVERGENCE SYSTEM FOR A TRICOLOR, THREE-GUN TELEVISION TUBE

Filed July 20, 1965 3 Sheets-Sheet 1

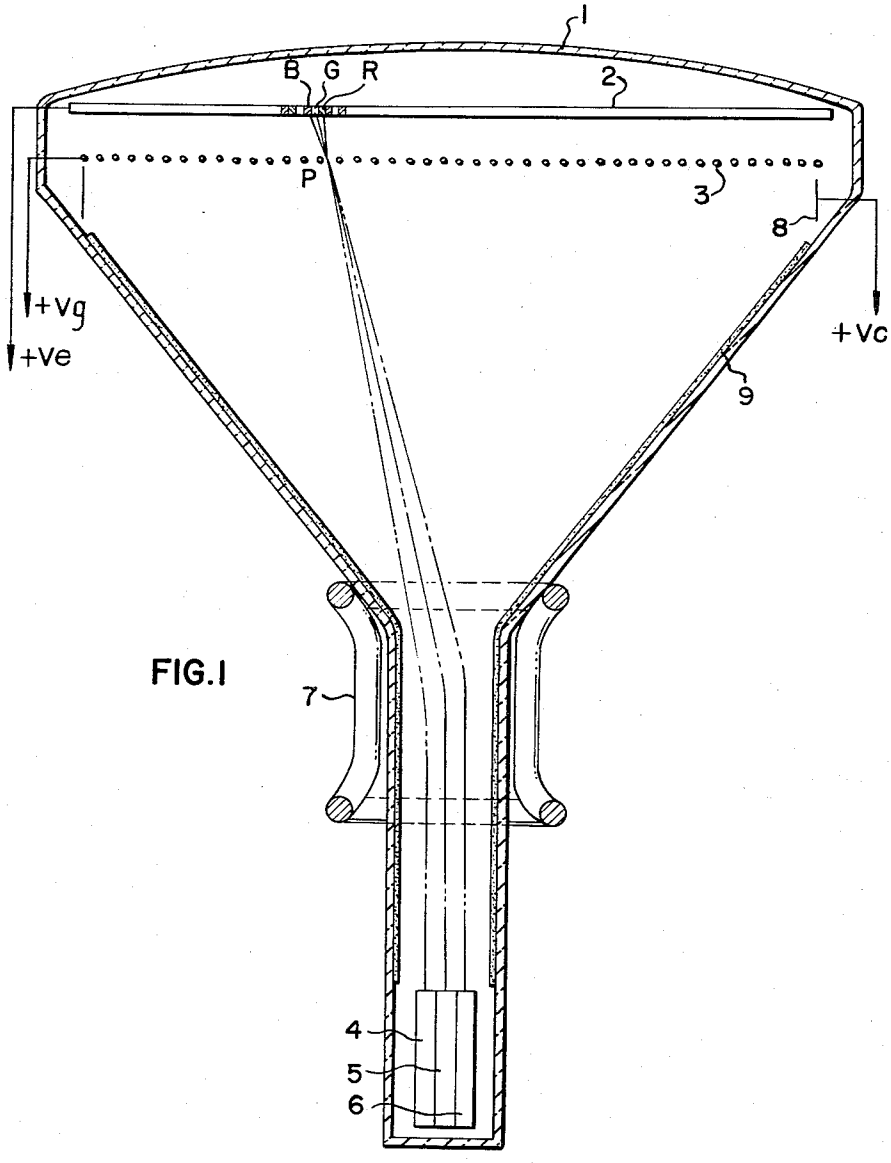

FIG.1

INVENTORS.
HENRI DE FRANCE
ROGER R. CAHEN
BY Kurt Kelman
AGENT

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FIG.2

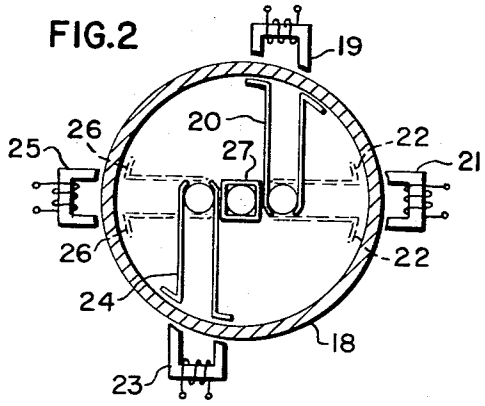


FIG.3

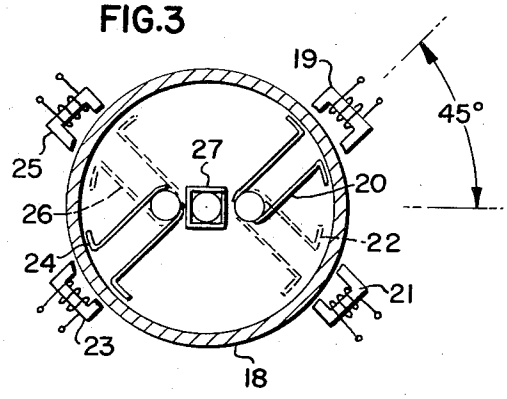


FIG.4

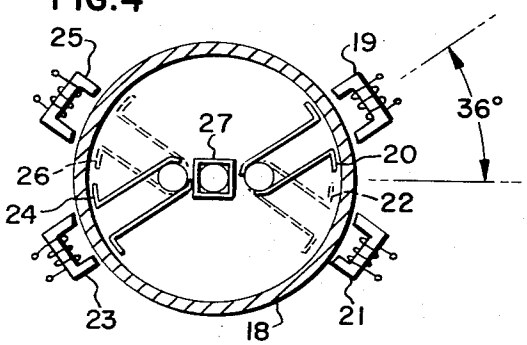
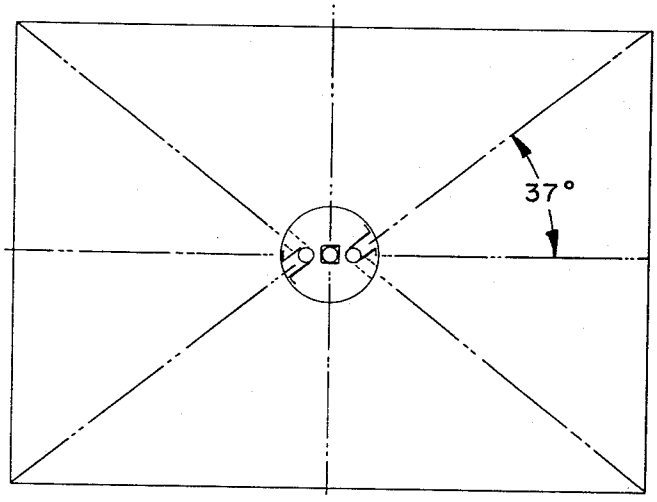


FIG.5



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HENRI DE FRANCE
ROGER R. CAHEN

BY Kurt Kelman

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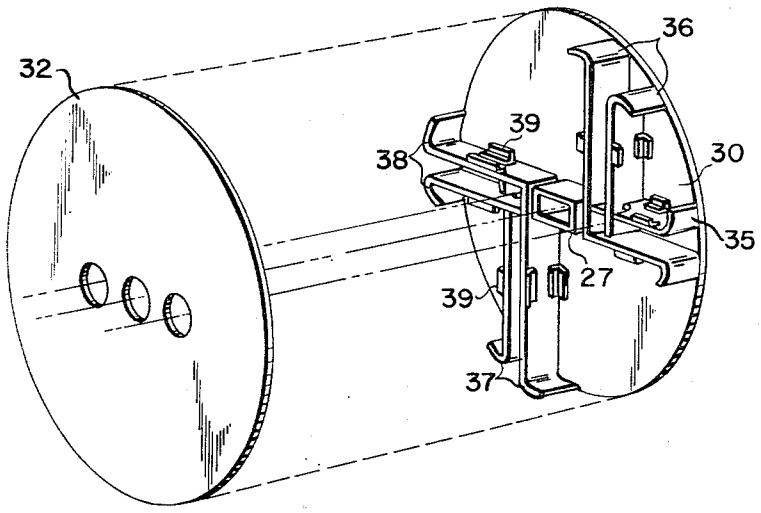
FIG.6



INVENTORS.
HENRI DE FRANCE
ROGER R. CAHEN
BY Kurt Kelman
AGENT

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CONVERGENCE SYSTEM FOR A TRICOLOR, THREE-GUN TELEVISION TUBE

Henri de France and Roger R. Cahen, Levallois, France, assignors to CFT—Compagnie Francaise de Television, a corporation of France

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1 Claim. (Cl. 313—77)

ABSTRACT OF THE DISCLOSURE

A convergence system for a tricolor, three-gun cathode ray tube in which each of the two lateral electron beams is straddled by two pairs of magnetic deflection plates, one plate of each pair being formed with a slot engaged by a plate of the other pair so that the magnetic fields generated between the plates of each pair act upon the same portion of the electron beam.

This invention relates to systems for effecting convergence of the beams of a cathode ray tube, comprising three electron guns, such as used in colour television.

Trichrome tubes of this type comprise a luminescent screen, with three groups of elemental areas, usually strips or dots, of phosphor of three different colours and three guns respectively associated with those three groups.

The three corresponding electron beams are imparted a common general scanning motion, so that they sweep the screen line by line as is the case for a black and white picture.

Means are provided to ensure that each beam impinges upon the elemental phosphor areas of the colour with which the corresponding gun is associated.

However, those means do not provide for the convergence of the beams, i.e. that the three points of the screen which are simultaneously impinged upon by the three beams correspond to the same "image point," in other words are not substantially more spaced from one another than is required by the condition that the three impingement points should be located on three areas of three different colours.

It is always possible to ensure the convergence of the three beams at the centre of the screen, for example through giving to the axes of the two lateral guns small inclinations relatively to the axis of the central gun.

But the convergence thus obtained is destroyed when the general scanning motion causes the impingement points to move towards other regions of the screen, as the latter is plane or, at least, does not have the form which would allow the convergence to be maintained all over the screen.

Consequently, it is a known practice to impart to at least two of the three beams convergence corrections, i.e. small auxiliary deflections each of which may present a static component, i.e. a component independent of the general scanning motion, and a dynamic component which is a function of this motion, or may be purely dynamic.

It has also been proposed to consider as correct the position of one of the three beams, preferably, the central beam, and to act only on the other two.

Systems of this kind have been proposed, in particular one making use, for each corrected beam, of a magnetic field and an electric field having the same direction, the first of variable strength, and the second one of fixed strength, both fields acting on the beam at its point of emergence from the gun.

The applicants have found that it was preferable, and possible through a proper arrangement of the four pairs of magnetic deflection plates which are then necessary, to use, for each corrected beam, two magnetic fields of different directions, preferably both variable in strength and both operating at the output of the corresponding gun. There is thus obtained a convergence system of great flexibility, maintaining the advantage inherent in a convergence correction entirely made at the outputs of the guns as concerns the avoidance of aberrations of the spot, without reintroducing the astigmatic defects resulting from the use of an electric field.

According to the invention, a color-television cathode-ray tube equipped with a tricolor fluorescent screen, a central electron gun and two lateral electron guns is provided with two pairs of spaced magnetic deflection plates associated with each lateral gun. One plate of each pair is formed with a slot extending substantially over one-half of the width thereof and engaged by a plate of the other pair. The plates of the two pairs straddle the electron beam emitted by the associated lateral gun toward the screen. A magnetic field is established in the space between the plates of each pair, the field being transverse to the direction of the associated lateral electron beam, and a magnetic shield surrounds the central beam in the vicinity of the deflection plates.

The invention will be further explained, and other features will become apparent, from the following description in conjunction with the accompanying drawings, in which:

FIG. 1 shows schematically a three-colour tube of known type to which the invention can be applied;

FIG. 2 illustrates a sectional view of an arrangement of three guns disposed in the same plane with a magnetic convergence device according to the invention;

FIGS. 3 and 4 illustrate modifications of the magnetic convergence device of FIG. 2;

FIG. 5 is a diagram illustrating the positioning of the pairs of plates of the magnetic correction device of FIG. 4 relatively to the tube screen; and

FIG. 6 illustrates an embodiment of the invention in a perspective view.

The invention will be described by way of a non-limitative example, in the following case: the axes of the three guns lie in the same horizontal plane, and a convergence correction is applied only to the two lateral guns.

FIG. 1 shows, highly diagrammatically and in axial horizontal section, by way of example, a type of tube, having an envelope 1, to which the invention may be applied.

A luminescent screen 2 is formed with adjacent parallel, successively red, green and blue phosphor strips R, G and B, three adjacent strips forming a triplet. These strips may be for example vertical or inclined at 45° to the horizontal.

The figure shows only a few phosphor strips whose dimensions have been exaggerated to make the figure clearer. Actually, the tube possesses a large number of triplets, each of which supplies an "image point" (formed

by a triad comprising a red dot, a green dot, and a blue dot) on each image line.

In front of screen **2** is a grid **3** of very fine wires arranged in a direction parallel to the strips, and bounding the triplets. The distance of grid 3 from screen **2** is also much exaggerated in the figure.

Three electrostatically focused guns **4**, **5** and **6**, whose axes lie in the same horizontal plane, are so arranged that their beams converge at a point P situated approximately in the plane of grid **3**.

It is this convergence of the three beams in a point P displacing itself in a plane when the three beams sweep the screen under the action of the sweep voltages applied to an electromagnetic deflection system, of which only coil **7** is visible in the figure, which is to be ensured by means of the convergence corrections.

The screen **2** is raised to a potential V_o, which is high compared to that of the cathodes of the guns, and grid **3** is raised to a lower positive potential V_g, the grid and screen assembly forming a system of convergent cylindrical lenses for the electron beams issuing from the guns. The conducting coating **9** on the internal wall of the tube, commonly known as the anode, is raised to the highest potential of the guns. The potential V_g of the grid is equal to it.

Preferably, as shown in the figure, the grid-screen focusing system is associated with an auxiliary electrode **8** raised to a fixed potential V_c, higher than that of the grid, or preferably to a potential variable with the scanning so as to correct, at least partly, for the spurious deflection suffered by the beams in the grid-screen space due to the high field, essentially normal to the screen existing in this space; neither these parasitic deflections nor the compensating ones have been shown in the figure.

FIGS. 2, 3 and 4 illustrate three embodiments of the invention, as concerns the directions of the applied magnetic fields.

Each of them represents a section of the neck of the cathode tube and of the three guns in the region of the emergence of the beams.

In each of them, there is seen the neck **18** of the tube, the terminal electrodes of the three guns which do not carry any references for the purpose of simplicity of the drawings, but which will be called the central gun, left lateral gun and right lateral gun, two pairs of magnetic deflection plates, **20** and **22**, associated with the right lateral gun, two other pairs of plates **24** and **26**, associated with the left lateral gun, four electro-magnets **19**, **21**, **23** and **25**, whose fluxes are respectively applied to pairs of plates **20**, **22**, **24** and **26**, and a magnetic shield **27**, protecting the beam of the central gun from the correction fields of the lateral guns, the shape of which can best be seen in FIG. 6.

The peripheral ends of the deflection plates are curved for the sake of ensuring a better coupling with the electromagnets.

This common description of the devices of FIGS. 2, 3 and 4 will make apparent a difference in orientation of the deviation plates with respect to the horizontal axis of the screen.

In FIG. 2, the magnetic deflection fields of the pairs of plates **20** and **24** permit of vertical displacements and the magnetic fields of the pairs of plates **22** and **26** permit of horizontal displacements of the beams of the two lateral guns, that is to say displacements at 90° relatively to one another.

In FIG. 3, which is a first modification which is of interest where a screen with strips inclined at 45° to the horizontal is used, the deflection assemblies have been the object of a rotation through 45° so that the pairs of plates **20** and **24** are parallel to the luminescent strips and the pairs of plates **22** and **26** are perpendicular thereto, or inversely, depending on whether the direction of the luminescent strips is one or other of the two directions at 45° to the horizontal.

In FIG. 4 which is a second modification, the angles with the horizontal of the deflection plate assemblies are 37° so that their positions correspond substantially to the directions of the diagonals of a rectangular luminescent screen of format 3/4.

The angles between two pairs of plates of the same gun are obviously 74°.

FIG. 5 shows schematically, in a cross-section normal to the axis of the tube, this arrangement of the plates relatively to the diagonals of the screen shown schematically as a rectangle.

The arrangement in FIG. 3 has the supplementary advantage of avoiding an increase in the value of the magnetic correction fields which would otherwise be necessary with a luminescent screen formed by oblique strips.

The arrangement of FIG. 4 has another interesting feature. It is in fact known that the spacing between the spots of three guns is a maximum in the corners of the screen where the scanning angle is maximum if, the screen being spherical, its radius of curvature is greater than the distance between the scanning centers and the screen and more so if it is flat, and the arrangement of FIG. 4 facilitates the dynamic convergence because of the orientation of the magnetic deflection plates towards the corners of the screen.

It is to be noted that in the particular case of luminescent strips inclined at 45° to the horizontal, and the standardized format of the screen being 3/4, corresponding to diagonals forming an angle of 37° (only slightly different from 45°) with the horizontal, the arrangement of FIG. 4 additionally presents to large degree the advantage inherent in the arrangement of FIG. 3 and vice versa.

The FIGS. 2, 3, 4 indicate only the relative dispositions of the deflection plates by their section in a plane.

FIG. 6 is a perspective view of this arrangement.

The flanges **30** and **32**—flange **32** being, in the figure, removed from its normal position—bound a single box containing the two pairs of deflection plates **35** and **36** of the right lateral gun, the two pairs of deflection plates **37** and **38** of the left lateral gun, and the shield **27** of the central gun. Brackets **39** are used for fixing the deflection plates to flanges **30** and **32**. The guns, not shown, have the same position relatively to flange **30** as in FIG. 2.

This arrangement is made possible because the right hand deflection plate of pair **36** is provided with a slot formed over half its width in the vicinity of flange **30**, while the upper plate of pair **35** is provided with a corresponding slot in the vicinity of flange **32**, those two slots permitting the two corresponding plates to cross without contact by engagement of one plate in each pair with a slot in the other pair.

The arrangement is similar for the left hand plate of pair **37** and the lower plate of pair **38** so that both pairs of plates associated with the same lateral gun straddle the beam emitted by the gun.

The signals applied to the coils of the electromagnets **19**, **21**, **23**, **35** are related to line and field scanning frequencies and generated in accordance with the characteristics and the particular features of the electronic optics of the tube.

Of course the tube according to the invention might be used—although less advantageously—with permanent magnets instead of magnets.

The invention is not limited to the embodiments shown and described in the foregoing.

It should be noted, in particular, that pairs of magnetic deflection plates are sometimes used which are built up by two plates which are not parallel, but at a small angle with each other, and that such pair of plates could be used in the embodiments according to the invention.

Generally, the invention may be applied whatever the type of the screen and the arrangement of the guns associated therewith.

The embodiments have been described with reference to the case in which three guns have their axes in the

same horizontal plane. Obviously the arrangement can also be applied to the case in which the axes of the three guns are in a single plane having another direction, or where the axis of the centre gun is not in the same plane as the axes of the remaining two guns. Finally, it will also be noted that arrangements of the type described may be associated with a convergence control of the third beam maintaining the selective actions on the other two beams.

What is claimed is:

1. In a color-television cathode-ray tube, in combination:

(a) a tricolor fluorescent screen;

(b) a central electron gun and two lateral electron guns arranged in the tube for emitting a central electron beam and two lateral electron beams respectively toward said screen;

(c) two pairs of spaced magnetic deflection plates associated with each of said lateral guns,

(1) one plate of each pair being formed with a slot extending substantially over one half of the width thereof and engaged by a plate of the other pair,

(2) the plates of said two pairs straddling the associated lateral electron beam;

(d) means for establishing a magnetic field in the space between the plates of each pair,

(1) said field being transverse to the direction of the associated lateral electron beam; and

(e) a magnetic shield surrounding said central beam in the vicinity of said deflection plates.

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ROBERT SEGAL, *Primary Examiner.*