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Miyaoka

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[54] **ACUTE ANGLE SOURCE OF PLURAL BEAMS FOR COLOR CATHODE RAY TUBE**

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Related U.S. Application Data

[63] Continuation of Ser. No. 829,420, June 2, 1969, abandoned.

[52] **U.S. Cl.** **313/414**, 313/415

[51] **Int. Cl.** **H01j 29/48**, H01j 31/20

[58] **Field of Search** ..... 313/69 C, 70 C, 85, 92 B, 313/92 PD

[56] **References Cited**

UNITED STATES PATENTS

2,726,347	12/1955	Benway	313/70 C
3,448,316	6/1969	Yoshida et al.	313/70 C
3,639,795	2/1972	Barten	313/70 C

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[57] **ABSTRACT**

In a single-gun, plural-beam cathode ray tube, for example, a color picture tube, in which the plurality of beams originate in spaced relation to each other and are directed toward the receiving screen along convergent paths so as to impinge on the screen after intersecting each other at a location in the tube between the beam producing means and the screen, individual prefocusing electron lenses are provided for the beams at positions between the beam producing means and the location where the beams intersect and are operative to partially focus the respective beams on the screen, and a main focusing electron lens common to all of the beams is provided to complete the focusing of the beams on the screen, such main focusing lens having an optical center and being positioned to dispose the optical center thereof substantially at the location where the beams intersect for diminishing the effects of certain optical aberrations.

8 Claims, 6 Drawing Figures

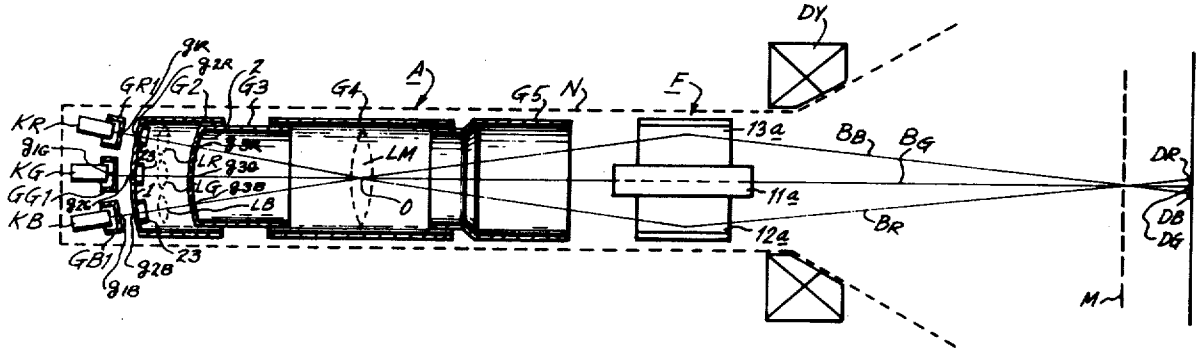
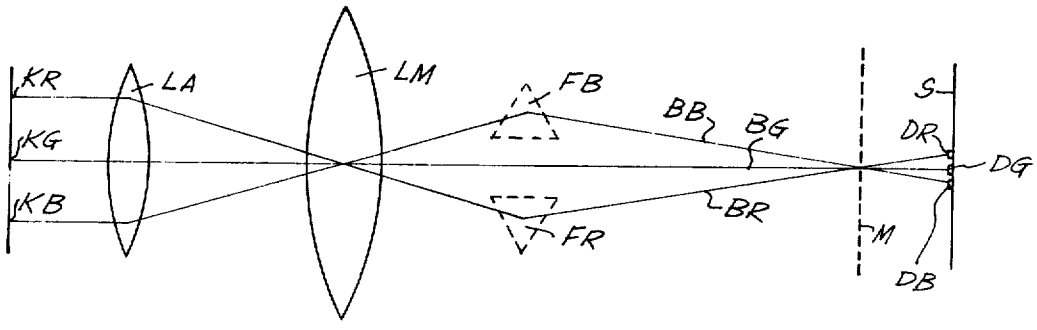


FIG. 1.



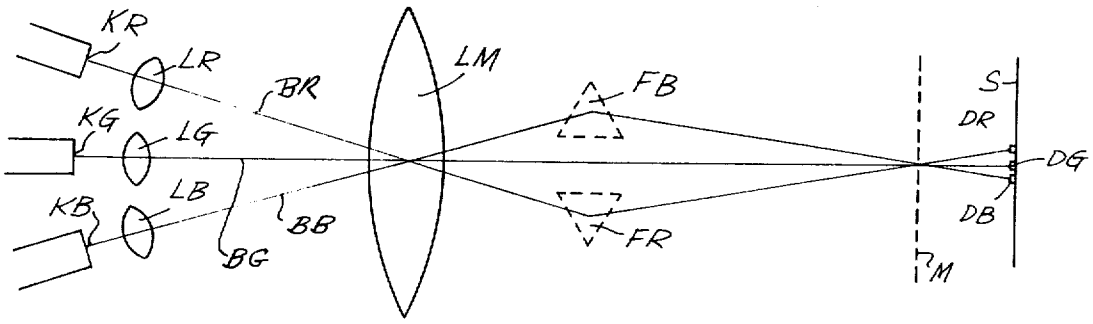


FIG. 2.

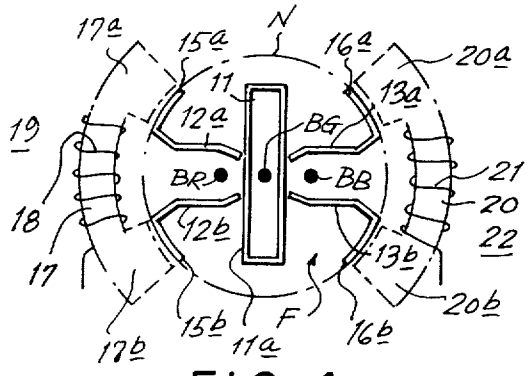


FIG. 4.

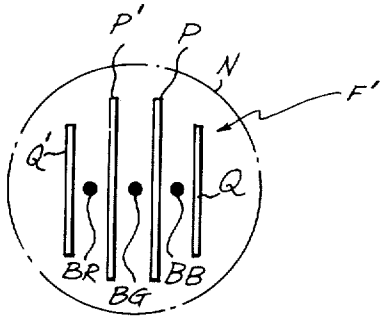


FIG. 6.

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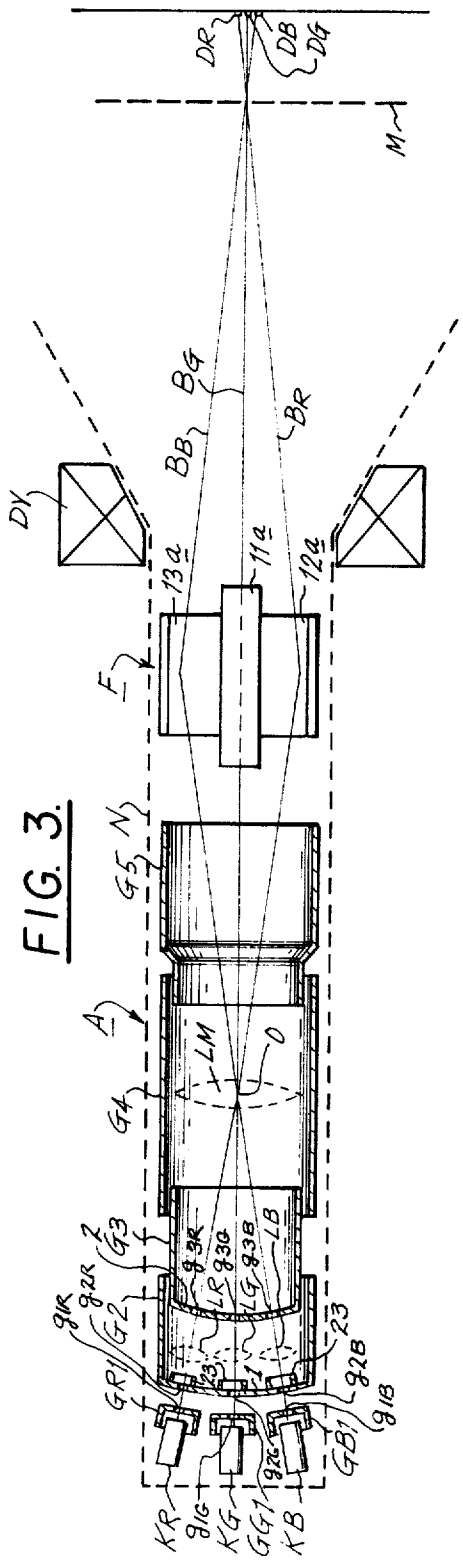


FIG. 3.

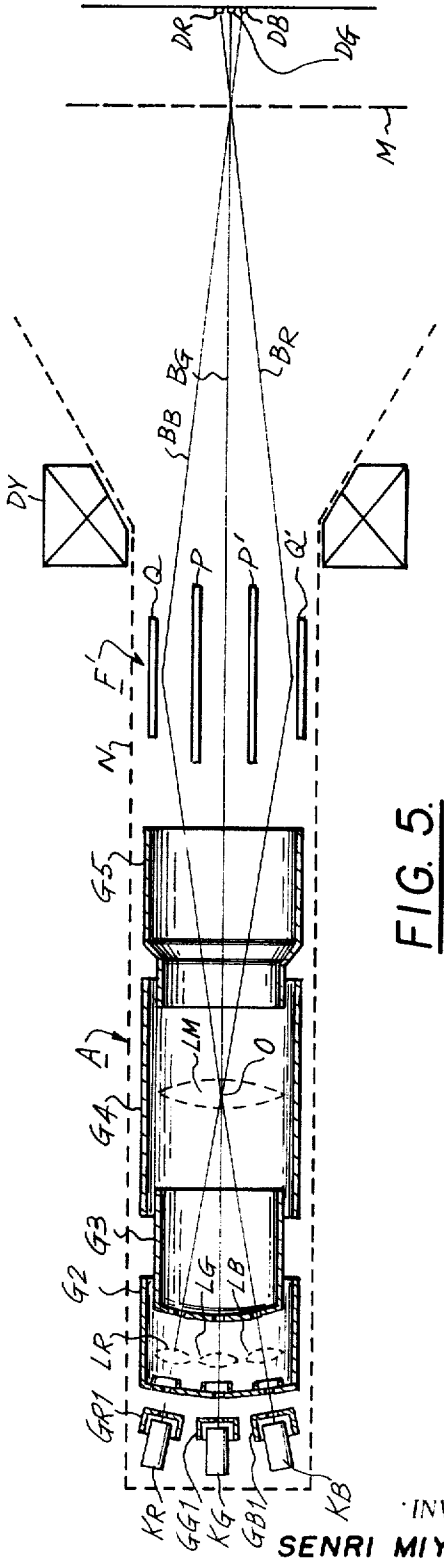


FIG. 5.

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ACUTE ANGLE SOURCE OF PLURAL BEAMS FOR COLOR CATHODE RAY TUBE

This application is a continuation of application Ser. No. 829,420, filed June 2, 1969, and now abandoned. This invention relates generally to cathode ray or color picture tubes of the single-gun, plural-beam type, and particularly to tubes of that type in which the plural beams are passed substantially through the optical center of a common electron lens by which the beams are focused on the color phosphor screen.

In single-gun, plural beam color picture tubes of the type to which this invention relates, for example, as specifically disclosed in the copending U.S. application Ser. No. 697,414, filed Jan. 12, 1968 and issuing June 3, 1969 as U.S. Pat. No. 3,448,316, and having a common assignee herewith, a plurality of electron beams are emitted or originated by a beam generating a cathode assembly and converged to cross or intersect each other at a location between the cathode assembly and the color screen upon which the beams impinge, and a single electron focusing lens for focusing all of the beams on the screen is positioned to dispose its optical center substantially at the location where the beams intersect, whereby the coma and spherical aberrations imparted to the beams by the focusing lens are substantially diminished. When the beams are thus converged to intersect each other substantially at the optical center of the focusing lens, at least certain of the beams emerge from the lens along divergent paths, and pairs of convergence deflecting plates may be arranged along such divergent paths and have voltages applied thereacross to deflect the divergent beams in directions for causing all of the beams to converge at a common point on the apertured beam selecting grill or mask associated with the color screen, or the divergent beams may be allowed to land on the beam selecting grill or mask at spaced locations with suitable time delays being applied to the color signals by which the respective beams are modulated so as to obtain correspondence of the pictures produced on the screen. In either case, the beams are acted upon by the magnetic fields resulting from the application of horizontal and vertical sweep signals to the corresponding coils of a deflection yoke, whereby the beams are made to scan the screen in the desired raster.

In single-gun, plural-beam color picture tubes as disclosed in the above identified application, the plural beams originating in spaced relation to each other are mde to converge for intersecting each other substantially at the optical center of the electron focusing lens either by arranging the beam generating means so that the beams are directed therefrom along convergent paths to the location of intersection, or by providing an auxiliary electron lens common to all of the beams and positioned between the beam generating means and the main focusing lens. If the beams are made to intersect at the optical center of the electron focusing lens by directing the beams along convergent paths from the beam generating means, in which case all focusing of the beams is effected by such electron focusing lens, the single electron focusing lens must have a sufficiently large power to focus the beams on the screen and thus must correspond to an optically equivalent lens having large curvatures, that is, small radii of curvature at its surfaces, by reason of which the beams, even though passing through the central portion of the single large power electron focusing lens, have some optical aberrations imparted thereto. On the other hand, if the beams are generated parallel to each other and converged to cross or intersect each other substantially at the optical center of the electron focusing lens by means of an auxiliary lens positioned between the beam generating means and the main focusing lens and through which all of the beams pass, the auxiliary lens can effect prefocusing of the beams, that is, partial focusing of the beams on the screen, and the focusing power of the main focusing lens can be reduced to further diminish the small optical aberrations imparted thereby to the beams. However, in the latter case, those beams passing through the auxiliary lens at substantial distances from the center of the latter have optical aberrations imparted thereto by the auxiliary lens.

Accordingly, it is an object of this invention to provide a cathode ray or color picture tube of the described type in which optical aberrations of the beams, as focused on the screen, are further minimized.

Another object is to provide a cathode ray or color picture tube of the described type in which there is prefocusing of the beams on the screen and the main focusing lens completes the focusing of the beams on the screen, with optical aberrations of the beams being substantially completely eliminated.

A further object is to provide a cathode ray or color picture tube of the described type in which the plural beams have landing spots on the screen that are of the same size so as to improve the resolution of the produced picture.

In accordance with an aspect of this invention, a single-gun, plural-beam cathode ray tube in which the plurality of beams originate in spaced relation to each other and are directed toward the screen along convergent paths so as to impinge on the screen after intersecting each other at a location in the tube between the beam generating or producing means and the screen, is provided with individual electron prefocusing lenses for the beams at positions between the beam producing means and the location where the beams intersect and which are operative to partially focus the respective beams on the screen, and with a main electron focusing lens common to all of the beams for completing the focusing of the beams on the screen, such main focusing lens having an optical center and being positioned to dispose the optical center thereof substantially at the location where the beams intersect. Since the beams are prefocused or partially focused on the screen by the prefocusing lenses, the power of the main focusing lens can be relatively reduced to minimize the aberrations imparted by the main lens to the beams, and particularly to the beams passing through the central portion thereof at angles to the optical axis, and the use of individual prefocusing lenses for the beams ensures that the prefocusing will be achieved without imparting optical aberrations to the beams.

In accordance with this invention, the individual prefocusing lenses may all be of the same focusing power or, if desired, for example, in the case where a central beam passes coaxially through the main focusing lens and two side beams converge with to the central beam and intersect the latter substantially at the optical center of the main lens, the individual prefocusing lenses associated with the side beams may have a focusing power slightly greater than the focusing power of the prefocusing lens associated with the central beam to

effect greater prefocusing of the side beams than of the central beam and thereby to compensate for the very slight optical aberrations imparted to the side beams in passing through the main lens.

The above, and other objects, features and advantages of this invention, will become apparent from the following detailed description of illustrative embodiments which is to be read in conjunction with the accompanying drawings, in which:

FIG. 1 is a diagrammatic view illustrating the optical equivalent or analogy of a single-gun, plural-beam cathode ray tube of the type from which optical aberrations are to be removed by the present invention;

FIG. 2 is a diagrammatic view similar to that of FIG. 1. but illustrating an embodiment of this invention;

FIG. 3 is a schematic, longitudinal sectional view of a cathode ray tube according to an embodiment of this invention, and in which the section is taken in a horizontal plane containing the tube axis;

FIG. 4 is an end elevational view of the convergence deflection device included in the tube of FIG. 3;

FIG. 5 is a view similar to that of FIG. 3, but showing another embodiment of this invention; and

FIG. 6 is an end elevational view of the convergence deflection device included in the tube of FIG. 5.

In order that the electron gun for a cathode ray tube according to the present invention may be better understood, there will first be described the principles and features of a cathode ray tube shown, by its optical equivalent or analogy on FIG. 1, and which is of the type disclosed in detail in copending application Ser. No. 697,414, filed Jan. 12, 1968, and issuing June 3, 1969 as U.S. Pat. No. 3,448,316, having a common assignee herewith, and of which I am one of the named joint inventors. In such tube, a single electron gun includes equivalent beam generating sources KR, KG and KB which are located on a straight line in a plane substantially perpendicular to the axis of the electron gun and spaced apart from each other. These beam generating sources KR, KG and KB emit three electron beams BR, BG and BB, respectively, which are refracted and prefocused by means of a common auxiliary lens LA so as to be converged substantially at the optical center of a main lens LM. Thus, the three beams BR, BG and BB are made to cross each other substantially at the optical center of the main lens LM and then emerge from the latter in divergent directions. Subsequently, the beams BR and BB which diverge from the optical axis and from the beam BG lying on such axis, are deflected toward the center beam BG by means of convergence deflectors FR and FB provided between the electron-receiving screen S and the main lens LM so that the three converge to a common point at an aperture of an aperture grill or shadow mask M and then diverge again to strike or impinge on respective phosphor stripes or dots DR, DG and DB arranged in arrays or sets to constitute the color screen S.

Since all three beams BR, BG and BB pass through the center of main lens LM blurring of the focused beam spots due to coma and spherical aberration introduced by such main lens LM is diminished substantially as compared with arrangements according to the prior art in which certain of the beams pass through portions of the main focusing lens spaced substantially from the optical axis and thus have substantial coma and spherical aberrations imparted thereto. consequently, a picture with good resolution can be produced by the arrangement shown on FIG. 1. However, it will be apparent that, with the arrangement described with reference to FIG. 1, the auxiliary lens LA provided to converge the beams BR, BG and BB for intersection substantially at the optical center of the main focusing lens LM imparts some optical aberration to the beams passing therethrough at substantial distances from the center of the lens, that is, to the beams BR and BB in the example shown. Even with the optical aberrations imparted to beams BR and BB by auxiliary lens LA, the arrangement of FIG. 1 provides a very substantial improvement in resolution over the prior art, but it is nevertheless desirable to eliminate or reduce even such small aberrations and thereby further improve the picture quality.

If the auxiliary lens LA is merely removed and convergence of the beams at the optical center of the main lens LM is achieved by suitably directing the beam producing means, the absence of any prefocusing of the beams makes it necessary to effect the entire focusing of the beams by the main lens which therefore has to have a large focusing power and the consequent large curvatures of such a lens result in an increase in the aberrations imparted to the beams even though the latter pass through the central portion of the main lens.

Therefore, it is the general purpose of this invention to retain the prefocusing of the beams, so that the main lens need only have a power sufficient to complete the focusing of the beams on the screen, and yet to eliminate any aberrations as a consequence of the prefocusing.

Referring to FIG. 2, it will be seen that, in accordance with this invention such purpose is achieved by replacing the auxiliary lens LA with individual prefocusing lenses LR, LG and LB for partially focusing the respective beams BR, BG and BB on screen S, and by arranging the beam producing means KR, KG and KB so that the beams emerge therefrom along convergent paths which intersect each other substantially at the optical center of the main lens LM which completes the focusing of the beams on the screen. Since the beams BR, BG and BB pass through the central portions of the respective prefocusing lenses LR, LG and LB, the prefocusing lenses do not impart optical aberrations to the beams. Further, since the prefocusing lenses LR, LG and LB partially focus the respective beams on the screen S, the main focusing lens LM may have a focusing power only sufficient to complete the focusing thereof on the screen, and thus may have relatively flat surfaces of large radii of curvature to avoid imparting substantial optical aberrations to the beams, and particularly to the beams BR and BB which pass through the main lens at substantial angles to the optical axis.

Although the beam generating sources KR, and KB in FIG. 2 are spaced apart from each other along a straight line, it is possible to arrange these beam generating sources at the vertices of an equilateral triangle, in which case deflectors, as at FB and FR, may be provided for each of the three beams or for only two of them.

Further, in the embodiment of this invention diagrammatically shown on FIG. 2, the beams BR and BB which emerge from main lens LM along paths that are divergent from beam BG pass through deflectors FR and FB so as to converge to a common point with beam BG at an aperture of the aperture grill or mask M. However, it is also possible to omit the deflectors FR

and FB so that the three beams BR, BG and BB cross each other substantially at the optical center of the main lens LM and thereafter continue along divergent paths so as to strike the screen at three different positions spaced from each other by a predetermined distance. When the beam spots are thus spaced apart on screen S, time difference corresonding to the three beam spot positions are imparted to the video signals modulating the three beams, thereby achieving correspondence between the three pictures produced on the phosphor screen by the three beams.

A particular example of the structure of a single-gun, plural-beam cathode ray tube corresponding to the optical analogy of FIG. 2 will now be described with reference to FIGS. 3 and 4 in which the electron gun A is shown within the neck N of the tube and comprises three electrically separated cathodes KR, KG and KB to which "red," "green" and "blue" video signals are respectively supplied. The three cathodes are arranged with their electron emitting surfaces in a straight line so as to be aligned with similarly arranged apertures *g*1R, *g*1G and *g*1B in first grids GR1, GG1 and GB1. A second cup-shaped grid G2 has an end plate or wall 1 disposed adjacent the first grids and formed with three apertures *g*2R, *g*2G and *g*2B which are respectively aligned with apertures *g*1R, *g*1G and *g*1B. Arranged in order following the grid G2 in the direction away from the first grids are successive, open-ended, tubular grids or electrodes G3, G4 and G5 (FIG. 3).

Electrode G3 is supported to extend into cup-shaped grid G2 and is spaced radially from the side wall of the latter. Electrode G4 is of a diameter larger than that of electrode G3 and is mounted so that an end portion of electrode G3 extends into, and is spaced radially inward from an adjacent end portion of electrode G4. Electrode G5 includes an end portion of a diameter smaller than that of electrode G4, and which extends into, and is spaced radially inward from an adjacent end portion of electrode G4. The several electrodes G3, G4 and G5, grids GR1, GG1, GB1 and G2 and cathodes KR, KG and KB are all assembled together in the described relation by means of suitable supports (not shown) of insulating material.

In the embodiment shown, cathode KG, first grid GG1 and the central portion of second grid G2 are all arranged so that beam BG generated thereby is coincident with the tube axis, while cathode KR, grid GR1 and the portion of grid G2 having aperture *g*2R therein, and cathode KB, grid GB1 and the portion of grid G2 having aperture *g*2B therein, are angled with respect to the tube axis so that the beams BR and BB respectively generated thereby are converged with respect to beam BG, whereby to cause the three beams to intersect each other at the location O. Further, the electrode G3 is shown to include an end wall 2 with a shape similar to that of the end wall 1 of grid G2 and having apertures *g*3R, *g*3G and *g*3B positioned for the passage of beams BR, BG and BB therethrough.

In operating the electron gun A of FIG. 3, appropriate voltages are applied to grids GR1, GG1, GB1 and G2 and to electrodes G3, G4 and G5. For example, a voltage of 0 to −400V. is applied to the grids GR1, GG1 and GB1, a voltage of 0 to 500V is applied to grid G2, a voltage of 13 to 20KV is applied to electrodes G3 and G5, and a voltage of 0 to 400KV is applied to electrode G4, with the voltage of cathodes KR, KG and KB as the reference. Therefore, the voltage distributions with respect to the grids and electrodes and their lengths and diameters are substantially identical with those of a unipotential-single beam type electron gun which includes a first single grid member and a second grid provided with a single aperture. with the applied voltage distribution described above, electron lens fields are established between end walls 1 and 2 of grid G2 and electrode G3 to constitute the prefocusing lenses LR, LG and LB individual to beams BR, BG and BB, respectively, and an electron lens field corresponding to the main lens LM of FIG. 2 is formed at the axial center of electrode G4 by the electrodes G3, G4 and G5 which are positioned to dispose the optical center of lens LM substantially at the location O where the beams intersect.

In order to cause convergence of the beams BR and BB which emerge from electrode G5 along divergent paths; the electron gun of FIG. 3 further has deflecting means F that is of the magnetic type end is shown to comprise a magnetic shield member 11 which may be in the form of a tube of rectangular cross-section arranged axially afer the electrode G5 so as to permit the passage therethrough of the center beam BG. Extending from one side 11*a* of shield member 11 are two magnetic plate 12*a* and 12*b* which are in opposing, spaced relation to each other so as to permit the passage therebetween of the beam BR, and a similar pair of magnetic plates 13*a* and 13*b* extend from the other side of shield member 11 to permit the passage therebetween of the third beam BB. The edge portions of the plates 12*a* and 12*b* and of the plates 13*a* and 13*b* which are adjacent the shield member 11 are preferably bent so as to converge toward each other in the direction toward member 11, as particularly shown on FIG. 4. Further, the outer edge portions 15*a and 15b* of the plates 12*a* and 12*b* are preferably bent outwardly away from each other to extend along the inner wall surface of the neck portion of the tube envelope indicated a N on FIG. 4. The outer edge portions of plates 13*a* and 13*b* are similarly bent away from each other, as at 16*a* and 16*b*. Such bent outer edge portions 15*a*, 15*b*, 16*a* and 16*b* from magnetic poles. Provided at the outside of the tube neck N are electromagnets 19 and 22 respectively including windings 18 and 21 on cores 17 and 20. The core 17 has magnetic pole portions 17*a* and 17*b* disposed in opposing relation to poles 15*a* and 15*b*, respectively, and the core 20 similarly has pole portions 20*a* and 20*b* in opposing relation to poles 16*a* and 16*b*, repectively.

With the above described arrangement, the three beams BR, BG and BB which have been made to cross each other at the optical center of the main lens LM and then emerge from the electrode G5 respectively pass between the opposing magnetic plates 12*a and 12b*, through the shield member 11 and between the opposing magnetic plates 13*a* and 13*b*. The beam BG is not deflected since it is shielded from the external magnetic field by the member 11, while the side beams BR and BB are deflected by reason of the magnetic flux distributions between the magnetic plates 12*a* and 12*b* and between the plates 13*a* and 13*b* which result from static convergence current flow through the electromagnets 19 and 22, whereby the three beams BR, BG and BB are made to converge as desired at a point on the aperture grill or shadow mask in front of the screen. Of course, it is possible to superimpose dynamic convergence currents on the static convergent currents

flowing through the electrogmagnets **19** and **22** so that, in that case, separate dynamic convergence is not required.

Due to the fact that the inner edge portions of magnetic plates **12***a*, **12***b* and **13***a*, **13***b* adjacent the sides of shield member **11** are convergent or inwardly bent, as shown in FIG. **4**, the beams are made to come very close to each other, that is, they are made to come very close to the magnetic shield member **11** so that it is possible to effectively prevent disturbance of the magnetic field at the positions of the beams BR and BB by the magnetic flux passing from the magnetic plates **12***a*, **12***b*, **13***a* and **13***b* to the magnetic shield member **11**. Thus, it is possible to effectively prevent distortion of the beam spots on the phosphor screen.

Alternatively, as shown on FIGS. **5** and **6**, the electron gun A of a cathode ray tube according to this invention may have a deflection means F' of the electrostatic type which includes shielding plates P and P' provided in spaced opposing relationship to each other and extending axially from the free end of electrode G5. Deflecting means F' further includes converging deflector plates Q and Q', which are shown flat but may be outwardly convexly bent or curved, and which are mounted in spaced opposing relation to the outer surfaces of shielding plates P and P', respectively. The plates P and P' and the plates Q and Q' are disposed so that the beams BB, BG and BR pass between the plates P and Q, between the plates P and P' and between the plates P' and Q', respectively. A voltage equal to that imparted to the electrode G5 is applied to the plates P and P', and a voltage lower than that applied to the plates P and P' by 200 to 300V is applied to the plates Q and Q'. Thus, deflecting voltage differences are applied between the plates P and Q and between the plates P' and Q' respectively constitute the deflectors FB and FR of FIG. **2** and are adapted to impart the deflecting action to the beams BB and BR, respectively, as described above in connection with FIG. **2**.

The usual horizontal and vertical deflection means, as indicated by the yoke DY, are provided in each of the illustrated embodiments of the invention for horizontally and vertically scanning the three beams simultaneously with respect to the screen S as in the conventional picture tube.

Thus, by supplying "red," "green" and "blue" color video signals between the cathodes KR, KG and KB and the first grids GR**1**, GG**1** and GB**1**, respectively, the three beams BR, BG and BB are intensity-modulated, whereby a color picture is produced on the color screen.

In the cathode ray tubes according to this invention, a cylindrical flange **23** may extend from plate or end wall **1** of grid G**2** around each of the apertures *g***2**R, *g***2**G and *g***2**B toward end wall **2** of electrode G**3**, and the focusing power of each of prefocusing lenses LR, LG and LB can be determined by suitably selecting the axial and diametrical dimensions of such flanges **23** and also the diameters of grid G**2** and electrode G**3**. The powers of the three prefocusing lenses LR, LG and LB may be made equal to each other, or the powers of prefocusing lenses LR and LB may be made slightly greater than that of prefocusing lens LG. In the latter case, the increased prefocusing power of lenses LR and LB relative to that of prefocusing lens LG will slightly reduce the spot size of beams BR and BB on screen S and thereby compensate for the slight aberrations imparted to those beams in the course of their passage through main lens LM at angles to the optical axis of the latter. Thus, the effect of the foregoing will be to ensure that the landing spots of the three beams on screen S are exactly of the same size for optimum resolution of the resulting picture.

In the foregoing, electron guns embodying this invention have been described as being applied specifically to color picture tubes in which a single gun is employed to produce three electron beams which are intensity modulated with the usual "red," "green" and "blue" color signals. However, it is obvious that an electron gun in accordance with this invention can be used in any other cathode ray tube requiring a plurality of beams which are to be focused at a common spot or at separated spots on an electron-receiving screen. Further, although the invention has been described with reference to electron guns of the unipotential type, it will be understood that similar application can be made to guns of the so-called tri-potential type.

Although illustrative embodiments of electron guns according to this invention have been decribed in detail herein with reference to the accompanying drawings, it is to be understood that the invention is not limited to those precise embodiments, and that various changes and modifications may be made therein by one skilled in the art without departing from the scope or spirit of the invention.

What is claimed is:

1. a cathode ray tube comprising a screen having arrays of different color phosphors; beams producing means angularly disposed with respect to each other for producing a plurality of electron beams which are in a common plane and originate in spaced relation to each other and at acute angles to each other and which are directed toward said screen in directions at angles to each other so as to impinge on the screen after intersecting each other at a location in the tube between said beam producing means and said screen, said beam producing means including cathode means having electron-emitting surfaces facing generally in said directions of the beams, first grid means confronting said electron-emitting surfaces in adjacent, substantially parallel relation to the latter and having respective spaced apart apertures for the passage of said electron beams therethrough, and a second grid having a wall confronting said first grid means at the side of the latter facing away from said cathode means with portions of said wall being in adjacent, substantially parallel relation to said first grid means and having respective spaced apart apertures which are aligned with respective apertures of said first grid means in said directions of the respective beams for passage of the latter through said apertures of the second grid; first, second and third tubular electrodes arranged successively in axial alignment between said second grid and said screen for the passage of all of said beams therethrough, said first and third electrodes being maintained at a high electrical potential relative to said second electrode for establishing an electrical field constituting a main focusing electron lens common to all of said beams and being positioned to dispose the center of said electrical field subtantially at said location where the beams intersect for diminishing the effects of certain optical abberations; an an end wall on said first tubular electrode at the end of the latter facing toward said wall of the second grid with portions of said end

wall being in substantially parallel relation to said portions of the second grid wall and having respective spaced apart apertures which are aligned with said apertures of the second grid wall in said directions of the respective beams for passage of the latter through said apertures in the end wall of said first tubular electrode, said second grid being maintained at an electrical potential substantially less than that of said first tubular electrode for establishing individual electrical fields between the aligned apertures of said second grid wall and said end wall of the first tubular electrode through which the respective beams pass between said beam producing means and said main focusing electron lens and which constitute relatively spatially displaced individual prefocusing electron lenses for the respective beams each operative to partially focus the respective beam and to combine with the effect of said main focusing electron lens for focusing the respective beam on said screen.

2. A cathode ray tube according to claim **1**; further comprising deflection means located between said main focusing electron lens and said screen for deflecting those beams which emerge from said main focusing electron lens along divergent paths and causing convergence of said beams at a common area on said screen.

3. A cathode ray tube according to claim **2**; further comprising a beam selecting means having aperture corresponding to said arrays of color phosphors on the screen and being disposed in front of said screen, and in which said deflection means converges all of said beams to an aperture of said beam selecting means.

4. A cathode ray tube according to claim **2**; in which said deflection means includes spaced paltes at different electrical potentials disposed at opposite sides of each of said divergent paths to electrostatically deflect the beam in the respective path.

5. A cathode ray tube according to claim **2**; in which said deflection means includes means establishing a magnetic field across each of said divergent paths to magnetically deflect the beam in the respective path.

6. A cathode ray tube according to claim **2**; in which said beam producing means produces three of said beams, with the electron-emitting surface for one of said beams being on the axis of said main focusing electron lens and the electron-emitting surfaces for the other two beams being equally spaced from said axis at opposite sides of the latter on a straight line extending diametrically across said axis so that only said other two beams follow divergent paths upon emerging from said main focusing electron lens.

7. A cathode ray tube according to claim **1**; in which said wall of the second grid has cylindrical flanges extending therefrom around the respective apertures in the direction toward said end wall of the first tubular electrode.

8. A cathode ray tube according to claim **7**; in which said second grid further includes a cylindrical flange extending from the periphery of said wall of the second grid and telescoping over the adjacent end portion of said first tubular electrode with a radial clearance therebetween.

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