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(54) IMPROVEMENTS RELATING TO CATHODE RAY TUBES

(71) We, RCA CORPORATION, a Corporation organized under the laws of the State of Delaware, United States of America, of 30 Rockefeller Plaza, City and State of New York, 10020, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a method of assembling a cathode-ray tube bulb assembly and mount assembly.

In a commercial color television picture tube of the apertured mask type having a three-color, viewing-screen structure, the viewing-screen structure is photographically printed using light centers accurately positioned relative to the axis of each of the three electron guns in the final tube. Thus, the printed screen has the necessary orientation with the gun axes for accurate registry at the screen of the electron beams with the phosphor mosaic. In commercial color television picture tubes using dynamic convergence circuitry, a mount assembly having three electron guns in fixed relationship ordinarily must be positioned in the tube within 3 degrees of rotation from a precise orientation of the screen with the gun positions. In a commercial color television picture tube using no dynamic convergence circuitry or simplified dynamic convergence circuitry, a more accurate rotational positioning of the mount assembly is usually required.

Normally, for assembling a multiple electron gun structure, the alignment is accomplished by two separate assembly operations. During the mount-assembly operation, the central longitudinal axis of the electron-gun assembly is aligned with the stem axis, and the electron guns are rotationally aligned with the stem leads. Then, the electron-gun assembly is attached to the stem leads with metal wires and ribbons to form a mount assembly. Then, the preassembled mount assembly is positioned and the stem and

stem leads oriented with respect to the bulb assembly, and then the stem sealed to the bulb assembly on a sealing unit. The sealing unit holds and orients the bulb assembly rotationally with respect to the major and minor axes and axially with respect to the longitudinal axis of the bulb assembly. The sealing machine also holds and orients the mount assembly axially with respect to the stem, and rotationally with respect to the stem leads.

Although this method of alignment is suitable for angular positioning of a mount assembly in some type cathode-ray tubes, it does not provide the accuracy required in other tubes for the orientation of the screen with the gun assembly itself. One reason for a lack of complete accuracy is that in the mount-sealing operation, the gun mount assembly is held with the stem leads positioned within aligned holes on the sealing machine. Since the holes include a clearance for loading and the mount assembly includes assembly tolerances, the rotational alignment of the gun assembly with respect to the screen structure is normally within 3 degrees of rotation. In addition, since the mount assembly is preassembled and transported to the sealing machine, the fragile wires supporting the electron-gun assembly may be accidentally bent, thereby misaligning the electron-gun assembly with the stem leads. This may result in angular misalignment of the electron-gun assembly as the stem leads are used to angularly align the bulb assembly and the mount assembly.

According to the present invention there is provided a method of assembling a cathode ray tube comprising a bulb assembly, having a central longitudinal axis and including a substantially rectangularly shaped faceplate panel having a transverse axis intersecting said bulb assembly axis, and a mount assembly having a central longitudinal axis and including an electron gun assembly having a plurality of electron guns, a portion of said electron gun assembly spaced from said mount assembly axis defining an orientation

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plane parallel to said mount assembly axis, said method comprising positioning said mount assembly in a location spaced from the bulb assembly with the mount assembly axis coincident with the bulb assembly axis, measuring the distance between a reference point and a point in said orientation plane, rotating said mount assembly about said coincident axes until the result of said measurement shows that said orientation plane is predeterminedly angularly related to a reference plane defined by said coincident axes and said transverse axis, then, while maintaining said orientation plane in said predetermined angular relation, moving said mount assembly along said coincident axes to a predetermined location with respect to the faceplate panel, and then permanently fixing said mount assembly to said bulb assembly.

Assembling the mount assembly to the bulb assembly with direct rotational alignment of the electron-gun structure and one of the major or minor axes of the faceplate portion eliminates any accumulation of error from preassembly of the mount assembly and from clearance tolerances necessary for loading of the mount assembly on a sealing unit. Also, since the rotational alignment is accomplished immediately prior to the sealing of the bulb assembly and the mount assembly, accidental misalignment of the preassembled mount assembly does not affect the final tube alignment. In addition, additional requirements of prior gauging of the rotational alignment of a preassembled mount assembly and subsequent gauging of the finished tube after assembly of the mount may be eliminated. The invention results in accurate rotational alignment of a multiple electron-gun assembly and bulb assembly, eliminates mount rotation scrap and provides economies in manufacture. Furthermore, the accurately rotationally aligned electron-gun assembly and bulb assembly result in a viewed picture of improved quality.

In the drawing:

Figure 1 is an elevational view partly in section of cathode-ray tube assemblies positioned on a main sealing unit used in an embodiment of the invention.

Figure 2 is a plan view of the sealing unit shown in Figure 1.

Figure 3 is an enlarged elevational view of a portion of Figure 1.

Figure 4 is a sectional and plan view along section lines 4-4 of the apparatus shown in Figure 3.

Figure 5 is a showing of apparatus similar to that shown in Figure 4, used in another embodiment of the invention.

Figure 1 illustrates a sectional view of a bulb assembly 21 and mount assembly 22 for a color television picture tube of the apertured-mask type positioned on a main

sealing unit 23 (partially shown). The main sealing unit 23 is used to install the mount assembly 22 in a precise location and orientation within the bulb assembly 21 in the fabrication of a color television picture tube assembly.

The bulb assembly 21 comprises a glass envelope 24, a three-color-phosphor viewing screen structure 25, and an apertured-mask electrode 26. The glass envelope 24 includes a faceplate portion 27, funnel portion 28, and a neck portion 29. The three-color-phosphor viewing screen structure 25 is supported on the inner surface of the faceplate portion 27. The viewing-screen structure 25 is preferably a line-screen structure with phosphor lines extending parallel to the minor axis Y-Y of the bulb assembly 21. The apertured-mask electrode 26 is positioned in the envelope 24 in a predetermined spaced relationship with the viewing-screen structure 25. The apertured-mask electrode 26 used with the line-screen structure 25 includes slot-shaped apertures (not shown). The slot-shaped apertures are positioned parallel to the phosphor lines of the viewing-screen structure 25.

The faceplate panel portion 27 is of a rectangular shape and includes three reference surfaces 30a, 30b and 30c as shown in Figure 2. The reference surfaces accurately define the position of a bulb of a particular size in the sealing unit 23, particularly with respect to the major axis X-X and the minor axis Y-Y of the faceplate portion 27. For a 15VUR90 color television picture tube, the relationship of the position of the major and minor axes to the reference surfaces 30a, 30b and 30c is such that the reference surface 30a is at an angle of 3 degrees 30 minutes clockwise with respect to a plane intersecting the surface 30a and parallel to the plane determined by the Y-Y axis of the faceplate 27 and the tube axis A-A (Figure 2). Similarly, the reference surfaces 30b and 30c are at angles of 4 degrees clockwise and counterclockwise respectively with respect to a plane determined by the faceplate axis X-X and the tube axis A-A. For the tube described, the plane of the axis X-X and tube axis A-A is at a distance 31 of 5.332 inches from a line 32, which intersects the reference surfaces 30b and 30c at points spaced from each other by a distance 33 of 10.396 inches. The plane of the minor axis Y-Y and the tube axis A-A is at a distance 34 of 6.396 inches from the reference surface 30a. The minor axis Y-Y is also perpendicular to the major axis X-X. The central longitudinal axis A-A of the bulb assembly passes centrally through the neck portion 29 and the intersection of the major axis X-X and minor axis Y-Y.

The mount assembly 22 of the tube de-

scribed is shown in Figure 3 and comprises a stem assembly 35 and an electron-gun assembly 36. The stem assembly 35 includes a stem 37, exhaust tubulation 38, and stem leads 39. The stem leads 39 are on a 0.600-inch-diameter pin circle and are made of 0.040-inch-diameter wire. The outside diameter of the stem lead circle is concentric with the central longitudinal axis A_1-A_1 of the mount assembly 22.

The electron-gun assembly 36 includes three electron guns 40 and support means between the stem leads 39 and the electron guns 40. An electron gun 40 includes a cathode 41, a control grid or G1 grid 42, a screen grid or G2 grid 43, a first accelerating and focusing grid or G3 grid 44, a second accelerating and focusing grid or G4 grid 45, and a shield cap 46. The various grids are mounted on glass support rods 47. The shield cap 46 may also include bulb spacers 48 for centering the gun assembly within the neck portion 29.

In the in-line electron-gun assembly 36, the G3 grids 44 are formed in the shape of a lower cup 49a and an upper cup 49b attached at their open ends. Each of the cups includes three in-line apertures 50 (Figure 4), one for each of the three in-line electron guns 40. The cups 49a and 49b are laterally elongated and are formed with sides 51 parallel with the center-line 52 through the centers of the apertures 50 within 0.1 degree of rotation about a central longitudinal axis A_1-A_1 of the mount assembly. The central longitudinal axis A_1-A_1 of the mount assembly 22 is also coincident with the axis of the center electron gun. The sides of the G3 grid cups 49a and 49b are a distance 53 of 0.190 inch from the centerline 52 through the aperture centers, and the spacing between the centers of the apertures 50 of the two end in-line electron guns is 0.563 inch.

The multihead rotary sealing unit 23 includes separate processing stations for loading, preheating, sealing, annealing and unloading. The sealing unit 23 includes a rotatable head assembly 54 for each processing station which includes a support-frame assembly 55, a bulb-alignment assembly 56, a neck chuck 57, a mount-support assembly 58, a tubulation-lock assembly 59 and a sealing-fire assembly (schematically shown by arrow 60).

The support-frame assembly 55 includes a lower support 61 and an upper support 62. The lower support 61 is rotatably mounted on a main sealing unit 23 in bearings (not shown). The lower support 61 includes two vertical support rods 63. The upper support 62 is mounted at the top of the two support rods 63. The upper support 62 includes a bulb-support member 64 formed to hold the

bulb assembly at the yoke reference line as shown in Figure 1.

The bulb-alignment assembly 56 is also mounted on the upper support 62. The bulb-alignment assembly 56 includes a C-shaped support 65 having three reference units 66a, 66b, and 66c for orienting the bulb assembly 21 and a bulb-clamp assembly 67 for retaining the bulb assembly 21 against the three reference units.

The neck chuck 57 is mounted on the two vertical rods 63 as shown in Figure 1. The neck chuck 57 comprises two jaws 68 and actuating means 69 for equally moving the jaws.

The mount-support assembly 58 is mounted on the lower support 61. The mount-support assembly 58 includes a mount-pin support 70 and a mount pin 71. The mount-pin support is slidably mounted in the lower support 61. The lower end of the mount-pin support 70 slides on a vertically displaced track (not shown) during indexing of the sealing unit 23.

An exhaust-tubulation lock 59 is mounted on the mount-support assembly 58. The tubulation lock 59 includes three jaws and means for operating the jaws for equal movement thereof.

The main sealing unit 23 also includes gauging means 72 attached thereto for providing the desired rotational orientation of the mount assembly 22 to the major axis $X-X$ of the bulb assembly 21 prior to the insertion of the mount assembly 22 in the neck portion 29 of the bulb assembly 21. The gauging means 72 (Figures 3 and 4), comprises a movable support frame 73, an alignment member 74, a gauging unit 75, and actuating means 76 (schematically shown in Figure 3). The alignment member 74 includes one V-shaped surface 77 and one flat surface 78. The gauging unit 75 includes two gauges 79 attached to the alignment member 74 and a comparator unit 80.

The alignment member 74 is constructed to contact the two vertical rods 63 when in measurement position. The two gauges 79 are mounted on the alignment member 74 on axes normal to the plane of the parallel longitudinal axes of the vertical rods 63 and centered on the central longitudinal axis A_2-A_2 of the head assembly 54 as established by the engagement of the V-shaped surface 77 with one of the vertical rods 64. In the described main sealing unit 23, the vertical rod spacing 81 is 4.500 inches. The center line 82 perpendicular to the plane of the rod axes is a distance 81a of 2.250 inches from the center of the V-shaped surface 77. The gauges 79 are spaced from each other a distance 83 of 0.562 inch and a distance 83a of 0.281 inch from the line 83. The line 83 passes through the central longi-

tudinal axis A_2-A_2 of the head assembly 54.

The rotatable head assembly 54 is initially set with an alignment gauge (not shown) to align the mount pin 71, the two vertical support rods 63, the neck chuck 57 and the bulb-alignment assembly 56 with the longitudinal axis A_2-A_2 of the head assembly 54. The alignment gauge is also used to locate the reference surfaces 60a, 60b and 60c.

A bulb assembly 21 is positioned in the head assembly 54 on a bulb-support assembly 55 which holds and orients the bulb assembly 21 with respect to the major and/or minor axis of the faceplate-panel portion 27. The reference surfaces 30a, 30b and 30c of the bulb are engaged with the reference units 66a, 66b and 66c respectively, and the bulb clamp assembly 67 and the neck chuck 57 are operated to position the central longitudinal axis $A-A$ of the bulb assembly 21 coincident with the central longitudinal axis A_2-A_2 of the head assembly 54.

The position of the bulb assembly 21 in the head assembly 54 establishes a reference plane 84 (Figures 2, 4 and 5) containing the longitudinal central axis $A-A$ of the bulb assembly 21, the plane of the two support rods 63, the major axis $X-X$, and the central longitudinal axis A_2-A_2 of the head assembly 54.

A mount assembly 22 is then positioned on the mount support assembly 58 which holds and orients the mount assembly 22, with the central longitudinal axis A_1-A_1 of the mount assembly 22 coincident with the central longitudinal axis $A-A$ of the bulb assembly 21 and central longitudinal axis A_2-A_2 of the head assembly 54. The mount assembly 22 is positioned on the mount pin 71 with the bottom of the stem 37 substantially in full surface contact (not tilted) with the top surface of the mount pin 71 (Figure 3). The exhaust tubulation 38 and the stem leads 39 are engaged with the mount pin 71 to substantially center the central longitudinal axis A_1-A_1 of the mount assembly 22 coincident with the central longitudinal axis A_2-A_2 of the head assembly 54, and consequently coincident with the central longitudinal axis $A-A$ of the bulb assembly 21.

An orientation plane 85 (Figure 4) is then defined by the structure of the in-line electron-gun assembly 36 and is at a prescribed angle with the reference plane 84, such that the reference plane 84 will pass through the centers of apertures 50 of at least two of the electron guns 40. Orientation plane 85 is parallel with the central longitudinal axis A_1-A_1 of the mount assembly 22. For an in-line electron-gun assembly 36, it is preferred that the orientation plane 85 is parallel to the reference plane 84.

In the mount assembly 22, the orientation

plane 85 is defined by two points 86a and 86b located on the exterior surface of the upper G3 cup 49b of the multiple in-line electron-gun structure (Figure 4). The two points are spaced from each other and radially spaced around the central longitudinal axis A_1-A_1 of the mount assembly 22. The two points 86a and 86b are equal distances from the reference plane 84 and at equal radial distances from the center of aperture 50 of the center in-line electron gun. The two points 86a and 86b are each on a line substantially parallel to the reference plane 84 and locate the orientation plane 85 parallel to the reference plane 84.

The bulb assembly 21 and the mount assembly 22 are rotated with respect to each other on the coincident central longitudinal axes $A-A$ and A_1-A_1 respectively until the orientation plane 85 is substantially parallel to the major axis, by first manually rotating the mount assembly 22 until the apertures 50 of the three in-line electron guns are substantially aligned with the two vertical rods 63. The gauging means 72 is then operated by engaging the alignment member 74 with the two vertical rods 63, thus moving the two gauges 79 into contact with the flat surface of the upper G3 cup 49b at the two points 86a and 86b, respectively.

If at this time, the mount assembly 22 is not precisely at the desired rotational alignment, the readings of the two gauges 79 on a comparator 80 will disclose any rotational misalignment. The two gauges 79 each measure the actual dimension between the reference plane 84 and one of the two points 86a or 86b on the in-line electron-gun assembly 36. The comparator 80 permits the balancing or equalizing of the two measured dimensions by rotating the electron-gun assembly 22, until the orientation plane 85 defined by the two contact points 86a and 86b is parallel to the reference plane 84, as determined by equal reading of the two gauges 79. With the two points 86a and 86b at equal distances from the reference plane 84, the reference plane 85 is parallel to the major axis $X-X$ within less than 0.5 degree of rotation about the coincident central longitudinal axes.

The mount assembly 22 is then maintained in the aligned position by closing the tubulation lock 59, which clamps the tubulation with respect to the mount pin 71 and the central longitudinal axis A_2-A_2 of the head assembly 54. The gauge means 72 is then retracted to a standby position.

The mount assembly 22 is then moved along the central longitudinal axis A_2-A_2 of the head assembly 54 into the neck portion 29 to a desired longitudinal location with respect to the faceplate portion 27 of the bulb assembly 21. The mount assembly

22 is guided within the neck portion 29 by bulb spacers 48 which substantially maintain the center of the in-line electron-gun assembly on the central longitudinal axis A—A of the bulb assembly 21. The mount assembly 22 is moved into the neck portion 29 during the cycle of the sealing machine 23 by the vertically displace track previously described.

Finally, the bulb assembly 21 and the mount assembly 22 are permanently fixed together. It is preferred that they are fixed by a seal between the stem 37 and the neck portion 29. During the sealing, the lower part of the neck portion 29, known as the collet, is removed. The sealing of the bulb assembly 21 and the mount assembly 22 also includes preheating and annealing of the glass, as is well known.

As described, the location of the reference plane 85 of the in-line electron-gun assembly is parallel to the major axis X—X of the faceplate panel. The position of the in-line gun assembly may also be parallel to the minor axis Y—Y, or at any angle between. This may be accomplished with the two vertical rods 63 rotated 90 degrees or any angle between 0 and 90 degrees with respect to the bulb-alignment assembly 56.

Although the method describes positioning an in-line electron-gun assembly having common electrodes, the invention also may be used for other multiple electron-gun assemblies having separate individual electrodes for each gun. For example, the invention may be used with an in-line or delta electron gun having individual cylindrical electrodes.

Where a mount assembly having three individual cylindrical in-line electron guns is used, the two points which define the orientation of plane 85 for the electron-gun structure are chosen to be at the points of tangency of plane 85 with at least two electron guns. It is preferred that the tangency points be selected with one point on each of the two end in-line electron guns. The cylindrical electrodes must be round and concentric with the electron-gun apertures. Other gauging surfaces may also be selected or formed on the electron-gun structure with the surfaces being precisely positioned at known dimensions from the reference plane 85 and the central longitudinal axis A₁—A₁ of the mount assembly 22.

Where a delta electron-gun assembly 88 (shown in Figure 5) having three cylindrical electron guns surrounding the theoretical center of the mount assembly at 120-degree separation is used, the two points are the points of tangency 89a and 89b on each of the two individual electron guns. For the delta electron-gun assembly 88, it is preferred that the blue gun be at the top or bottom of the viewing-screen structure. The

tangent line 90 defining the orientation plane 91 then contacts the red and green individual electron-gun structure, and a reference plane 92 is defined by the apertures of the individual red and green electron guns. For a delta electron-gun assembly 88, the reference plane 92 is not coincident with the plane of the major axis X—X and the two vertical rods 63 as in the in-line electron-gun assembly 36 previously described, but is parallel to the plane of the major axis X—X and the vertical rods 63. Where the diameters of the two electron guns are different, the orientation plane 91 is tangent to the two electron guns and at a known angle with respect to the reference plane 92 through the apertures of the two electron guns.

The multiple-head main sealing machine is described only as the preferred apparatus for practicing the invention. The invention may also be practiced on a single-head sealing machine. Also, in either apparatus, the head may be held stationary and the fires rotated to make the mount-bulb seal.

WHAT WE CLAIM IS:—

1. A method of assembling a cathode ray tube comprising a bulb assembly, having a central longitudinal axis and including a substantially rectangularly shaped faceplate panel having a transverse axis intersecting said bulb assembly axis, and a mount assembly having a central longitudinal axis and including an electron gun assembly having a plurality of electron guns, a portion of said electron gun assembly spaced from said mount assembly axis defining an orientation plane parallel to said mount assembly axis, said method comprising positioning said mount assembly in a location spaced from the bulb assembly with the mount assembly axis coincident with the bulb assembly axis, measuring the distance between a reference point and a point in said orientation plane, rotating said mount assembly about said coincident axes until the result of said measurement shows that said orientation plane is predeterminedly angularly related to a reference plane defined by said coincident axes and said transverse axis, then, while maintaining said orientation plane in said predetermined angular relation, moving said mount assembly along said coincident axes to a predetermined location with respect to the faceplate panel, and then permanently fixing said mount assembly to said bulb assembly.

2. A method in accordance with claim 1, wherein said orientation plane is defined by two spaced points on the electron gun assembly and wherein said rotation is effected until said two points are equidistant from respective reference points in a plane parallel to said reference plane.

3. The method defined in claim 2, 130

22 is guided within the neck portion 29 by bulb spacers 48 which substantially maintain the center of the in-line electron-gun assembly on the central longitudinal axis A—A of the bulb assembly 21. The mount assembly 22 is moved into the neck portion 29 during the cycle of the sealing machine 23 by the vertically displace track previously described.

Finally, the bulb assembly 21 and the mount assembly 22 are permanently fixed together. It is preferred that they are fixed by a seal between the stem 37 and the neck portion 29. During the sealing, the lower part of the neck portion 29, known as the collet, is removed. The sealing of the bulb assembly 21 and the mount assembly 22 also includes preheating and annealing of the glass, as is well known.

As described, the location of the reference plane 85 of the in-line electron-gun assembly is parallel to the major axis X—X of the faceplate panel. The position of the in-line gun assembly may also be parallel to the minor axis Y—Y, or at any angle between. This may be accomplished with the two vertical rods 63 rotated 90 degrees or any angle between 0 and 90 degrees with respect to the bulb-alignment assembly 56.

Although the method describes positioning an in-line electron-gun assembly having common electrodes, the invention also may be used for other multiple electron-gun assemblies having separate individual electrodes for each gun. For example, the invention may be used with an in-line or delta electron gun having individual cylindrical electrodes.

Where a mount assembly having three individual cylindrical in-line electron guns is used, the two points which define the orientation of plane 85 for the electron-gun structure are chosen to be at the points of tangency of plane 85 with at least two electron guns. It is preferred that the tangency points be selected with one point on each of the two end in-line electron guns. The cylindrical electrodes must be round and concentric with the electron-gun apertures. Other gauging surfaces may also be selected or formed on the electron-gun structure with the surfaces being precisely positioned at known dimensions from the reference plane 85 and the central longitudinal axis A₁—A₁ of the mount assembly 22.

Where a delta electron-gun assembly 88 (shown in Figure 5) having three cylindrical electron guns surrounding the theoretical center of the mount assembly at 120-degree separation is used, the two points are the points of tangency 89a and 89b on each of the two individual electron guns. For the delta electron-gun assembly 88, it is preferred that the blue gun be at the top or bottom of the viewing-screen structure. The

tangent line 90 defining the orientation plane 91 then contacts the red and green individual electron-gun structure, and a reference plane 92 is defined by the apertures of the individual red and green electron guns. For a delta electron-gun assembly 88, the reference plane 92 is not coincident with the plane of the major axis X—X and the two vertical rods 63 as in the in-line electron-gun assembly 36 previously described, but is parallel to the plane of the major axis X—X and the vertical rods 63. Where the diameters of the two electron guns are different, the orientation plane 91 is tangent to the two electron guns and at a known angle with respect to the reference plane 92 through the apertures of the two electron guns.

The multiple-head main sealing machine is described only as the preferred apparatus for practicing the invention. The invention may also be practiced on a single-head sealing machine. Also, in either apparatus, the head may be held stationary and the fires rotated to make the mount-bulb seal.

WHAT WE CLAIM IS:—

1. A method of assembling a cathode ray tube comprising a bulb assembly, having a central longitudinal axis and including a substantially rectangularly shaped faceplate panel having a transverse axis intersecting said bulb assembly axis, and a mount assembly having a central longitudinal axis and including an electron gun assembly having a plurality of electron guns, a portion of said electron gun assembly spaced from said mount assembly axis defining an orientation plane parallel to said mount assembly axis, said method comprising positioning said mount assembly in a location spaced from the bulb assembly with the mount assembly axis coincident with the bulb assembly axis, measuring the distance between a reference point and a point in said orientation plane, rotating said mount assembly about said coincident axes until the result of said measurement shows that said orientation plane is predeterminedly angularly related to a reference plane defined by said coincident axes and said transverse axis, then, while maintaining said orientation plane in said predetermined angular relation, moving said mount assembly along said coincident axes to a predetermined location with respect to the faceplate panel, and then permanently fixing said mount assembly to said bulb assembly.

2. A method in accordance with claim 1, wherein said orientation plane is defined by two spaced points on the electron gun assembly and wherein said rotation is effected until said two points are equidistant from respective reference points in a plane parallel to said reference plane.

3. The method defined in claim 2, 130





wherein said electron-gun assembly comprises three in-line electron guns, said electron guns including at least one common grid, said two spaced points being on said

5 common grid, each of said points being equidistant from said reference plane and of equal radial distance from the central longitudinal axis of said mount assembly.

4. The method defined in claim 2,

10 wherein said electron-gun assembly comprises three electron guns, each of said electron guns having at least one cylindrical electrode, said two spaced points being the points of tangency of a line connecting the

15 cylindrical surfaces of the cylindrical electrodes, respectively of two different guns.

5. The method defined in claim 1,

wherein said mount assembly is rotated until said orientation plane is parallel to the plane determined by the bulb assembly axis and one of said intersecting major or minor panel axes.

6. A method of assembling a cathode ray tube substantially as described with reference to the accompanying drawings.

7. A cathode ray tube made by the method of any of the preceding claims.

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