

Oct. 14, 1958

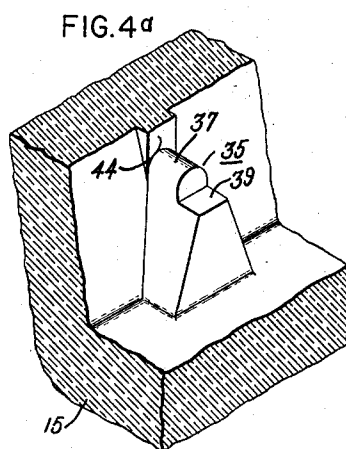
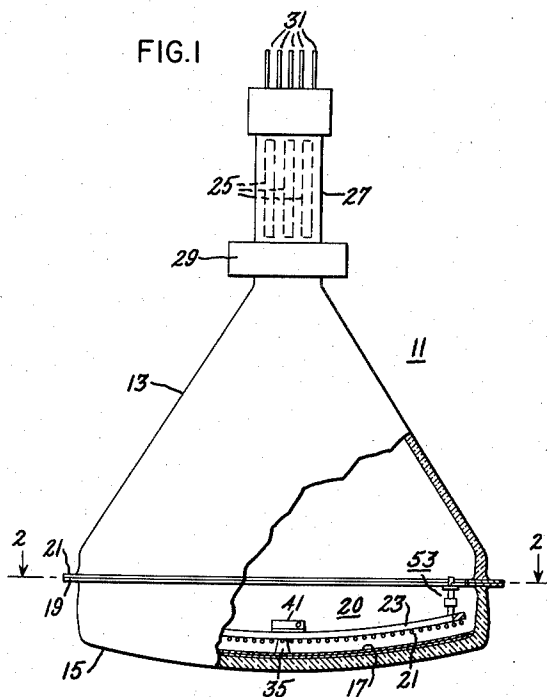
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2,856,552

GRILLE STRUCTURE FOR TELEVISION PICTURE TUBES

Filed March 15, 1956

3 Sheets-Sheet 1



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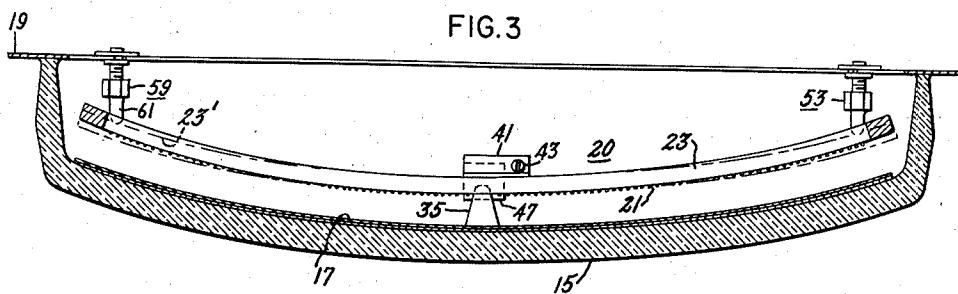
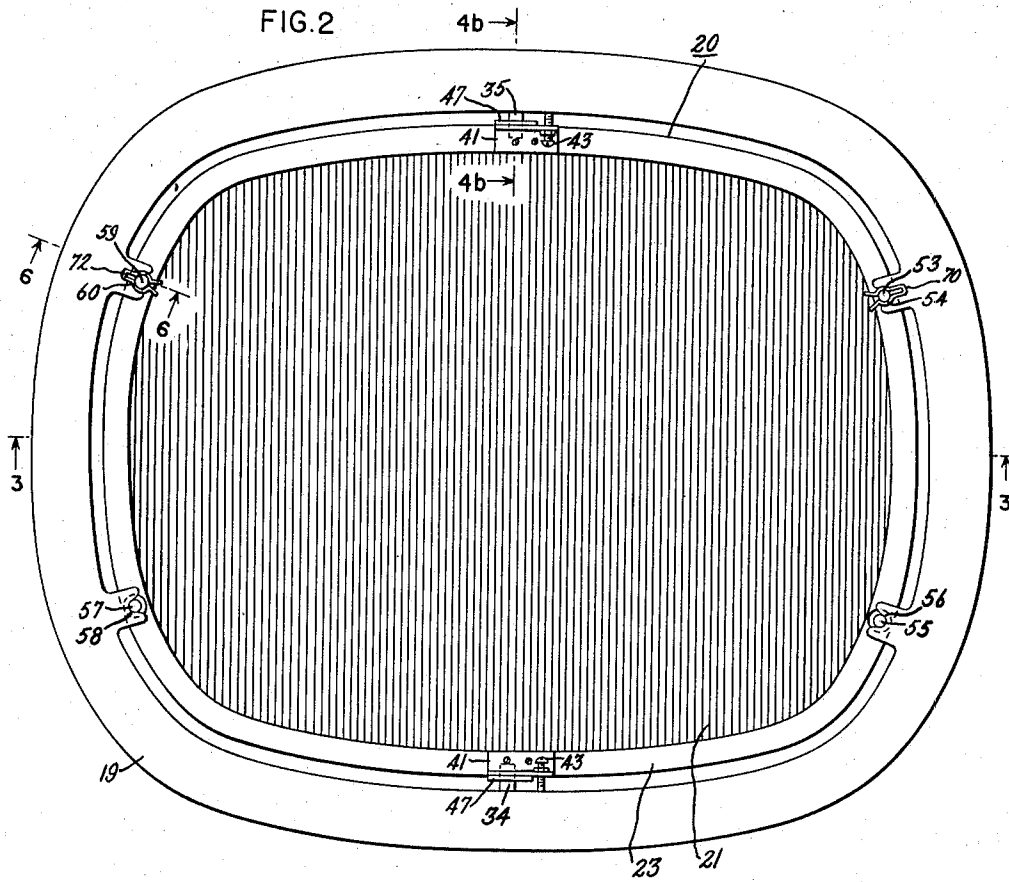
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GRILLE STRUCTURE FOR TELEVISION PICTURE TUBES

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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

FIG. 4b

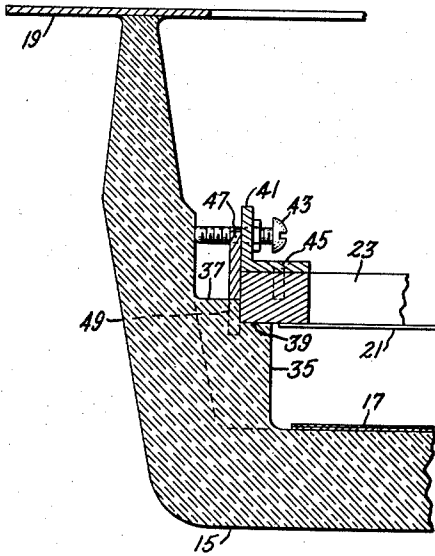


FIG. 5

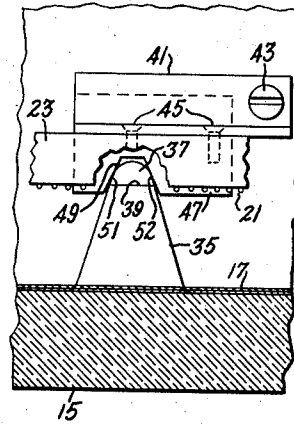


FIG. 6

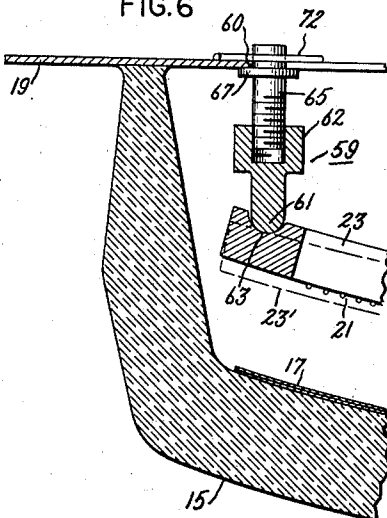
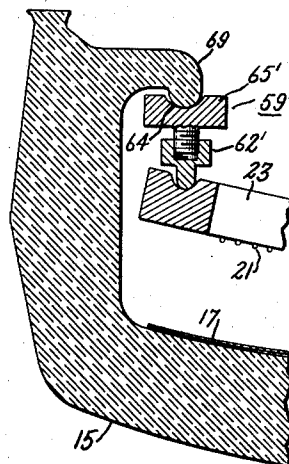


FIG. 7



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GRILLE STRUCTURE FOR TELEVISION PICTURE TUBES

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9 Claims. (Cl. 313—85)

The present invention relates to television picture tubes of the post acceleration type and more particularly to new and novel means for positioning grille structures in post acceleration tubes.

Certain color television picture tubes of the post acceleration type include an image reproducing structure including a viewing screen having a plurality of triplets of luminescent elements disposed in predetermined arrangement thereon and adapted to be impinged upon by electron beams, and a grille structure or apertured mask interposed between a source of electron beams and the viewing screen. The grille structure or apertured mask serves as a lens means to focus the electron beams onto the luminescent elements.

Because of various factors relating to the better operation of post acceleration type color television picture tubes, an embodiment of this type tube has been selected which employs a screen composed of a plurality of triplets of luminescent stripes disposed in vertical orientation, and having a grille structure composed of a plurality of wires in parallel relation to each other and substantially parallel to the screen and aligned with the luminescent stripes thereon.

For proper operation of post acceleration tubes the grille structure must be positioned accurately at a predetermined distance from the screen of the picture tube. Further, each of the wires of the grille structure must be aligned with respect to the luminescent stripes in order that electron beams modulated by a given color signal impinge on the corresponding color producing luminescent elements. Misalignment of the grill structure with relation to luminescent elements, or improper distance positioning of the grille with relation to the screen results in color impurities.

Accordingly, it is a principal object of the present invention to provide a new and novel support structure for accurately positioning and maintaining the position of the grille structure of post acceleration type color television tubes.

It can be appreciated that because vertical stripes are used in this selected embodiment of the post acceleration tubes, close alignment between the grille and the screen in the vertical direction is not essential. Small errors in the vertical direction can be tolerated, inasmuch as a small vertical variation of the point at which the beam impinges will not result in any color impurity. However, alignment in the horizontal direction is still critical since each of the luminescent stripes is approximately 0.012 inch in width and the electron beam spot is approximately 0.006 inch wide. The beams should normally impinge at the center of each stripe; an error of more than three mils will show some degree of color impurity.

It is therefore another object of the present invention to provide a new and novel structure for aligning the grille wires with the luminescent stripes.

Further, the grille wires must be maintained in position even though the tube containing the grille wires there-

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within is subjected to shocks and vibrations due to, for example, handling and the shipping operations required to place a television set incorporating said tube in the customer's home.

It is therefore yet another object of the invention to provide a novel support for the grille structure of a post acceleration type tube which is resistive to shock and vibration forces.

It has been found advantageous for reasons of economy and strength to manufacture face panels for picture tubes having a curved viewing area which has a radius of curvature along a vertical axis perpendicular to the horizontal axis of a tube and a second radius of curvature along an axis normal to the vertical axis. The curvature around a vertical axis, for example, in one embodiment of a rectangular shaped 22 inch picture tube has a radius of about 33 inches. The aforementioned viewing area also has a second but a more slight radius of about 250 inches in a direction normal to the vertical axis.

Another advantage of a curve face panel is that positioning of the grille structure with respect to the face panel becomes less critical due to the curvature of the face panel, as will be explained hereinbelow. Various configurations have heretofore been attempted to accurately, efficiently, and economically position and align the grille structure with relation to the face panel. All the previous solutions have limitations in one or more of the above respects.

In the luminescent stripe arrangement employed in the present tube an error in the horizontal direction causes color impurity while an error in the vertical direction does not have serious deleterious effects on color purity. As is well known, six constraints are required to completely determine a solid body. Since small displacements parallel to the luminescent stripes can be tolerated in the embodiment of my invention, only five constraints are required to be accurately fixed when positioning the grille structure with relation to the luminescent stripes. Rigidity and accuracy normal to the luminescent stripes is emphasized. The constraining forces are disposed such that all said force vectors are either parallel or normal to the luminescent stripes and each of said force vectors have no components in an orthogonal direction.

One embodiment of the prior art of which I am aware employs a three point support provided on the face panel for corresponding engaging points on a frame member. The three supports are disposed more or less symmetrically around the frame member. If for example a rectangular frame is employed, one support is disposed at the center of one side of the rectangle and the other two points are on the opposite side of the rectangular frame. It can be appreciated that if this prior art frame is to be aligned with the face panel, all three points of the frame member must be perfectly aligned with the three points of the face panel. The three point system of the prior art depends for alignment on constraints which are actually at rather large angles, of about 30°, with the luminescent stripes due to the triangular geometry of the support. Each of such constraints have components of force in a direction parallel to the stripes as well as components normal to the stripes, and consequently have to be accurately positioned in both directions, needlessly adding one extra position which has to be accurately determined. Thus, such a three point system is more critical to align since an error of alignment in either direction may result in color impurity. Further, in said three point support system no means are readily available for correcting the alignment of the frame with relation to the viewing area nor for readily adjusting the distance spacing between the frame and the viewing area.

It is therefore yet another object of the invention to provide a novel means for positioning and supporting

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the grille structure in a tube having a curved viewing area.

Further objects and advantages of my invention will become apparent from the following description and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

In carrying out the objects of my invention, I provide a novel face panel structure for a picture tube, said face panel having a curved viewing area and providing a two location support for a grille structure, said structure being constrained by screw means affixed to the face panel to conform substantially to the shape of the viewing area surface.

For a detailed explanation of my invention, reference is made to the accompanying drawings in which:

Figure 1 is an elevation view, partly in cross section of a picture tube constructed in accordance with one embodiment of my invention;

Figure 2 is an enlarged plan view taken along the line 2—2' of Figure 1;

Figure 3 is a cross sectional side view taken along the line 3—3' of Figure 2;

Figure 4a is an enlarged isometric view partly in cross section of the land member of the preceding figures;

Figure 4b is a side view partly in cross section of the land structure of the preceding figures;

Figure 5 is a front view partly in cross section of the land structure of Figure 4b;

Figure 6 is an enlarged cross sectional side view of the aligning screw structure of Figure 3; and

Figure 7 is another embodiment of the aligning screw structure of Figure 6.

In Figure 1, a color television picture tube 11 of the post acceleration type is shown including a cone or funnel portion 13, a face panel member 15 having disposed in the inner face thereof a viewing area 17 consisting of a screen of a luminescent material including a conductive coating thereon, and flange members 19 and 21 for joining panel 15 to cone 13. Tube 11 further includes a grille structure 20 including a wire grille pattern 21, and a frame member 23 disposed adjacent screen 17. Beam forming means 25 located in the neck portion 27 of tube 11 provide a source of electron beams which are suitably deflected by yoke 29. Connectors 31 couple the tube to suitable energy providing means. A source of voltage, not shown, is coupled between grille 20 and screen 17 to provide an electron beam accelerating potential therebetween.

Figure 2 is a plan view of the face panel along line 2—2' of Figure 1. The grille pattern 21 consists of a plurality of spaced parallel wires affixed to the lower side of the frame 23. The wires 21 are affixed to the lower side of frame 23 so that there be no metallic elements between the frame 23 and the viewing area 17. The wires are affixed to frame 23 prior to inserting the structure into the face panel 15.

When the wires are affixed to the frame member there is a slight compression of the frame which is compensated for by pre-stressing the frame. If this pre-stressing is correct, there will be no deformation of the frame from an initially predetermined form when the load is shifted from the pre-stressing rods to the grille wires.

Figure 3 is a side view partly in cross section along lines 3—3' of Figure 2. It can be seen in Figure 3 viewing area 17 of the face panel 15 has a curvature along a vertical axis perpendicular to the axis of the tube.

The fact that the viewing area is curved makes positioning and aligning of the grille structure 20 a less complex problem than it would be the case in a tube employing a flat viewing area.

Assuming a straight face panel perpendicular to the tube axis, it can be appreciated that as a distance on the face panel between the point where the tube axis intersects the face panel and the point at which a beam impinges

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increases, the more critical the positioning becomes. A beam impinging on the face panel a large distance from the tube axis has a large component of velocity parallel to the face panel and therefore a small error in positioning will cause a relatively large variation of the point at which the electron beam impinges due to the component of velocity parallel to the face panel. If the face panel is curved then the entire surface of the face panel on which the electron beams impinges is more nearly the same distance from the source of the electron beams, and all surfaces are more nearly perpendicular to the electron beams. Any error in positioning is thus less accented by errors due to electron beam velocity components parallel to the face panel surface as is the case for a flat viewing area.

The grille structure 20 must be positioned at a predetermined distance from the phosphor screen throughout the entire area of the grille wires 21. Lands 34 and 35 are molded into the face on the mid-point of the long sides of the rectangular sides of the face panel. An isometric view of one land 35 is shown in Figure 4a. The lands have a cylindrical boss 37 whose axis is parallel to the wires in the grille. A portion of the land 35 is precision ground to obtain a flat surface 39 to determine the exact distance of the wires from the phosphor surface. The frame 23 rests on the surface 39; but the wires 21 are affixed to the frame such that the wires do not rest on surface 39, Figure 4b. An L shaped tab member 41 having a lateral adjustment screw 43 is affixed to the frame 23 by a pair of screws 45 at the mid-point of the long side of the frame 23, as shown in detail in Figure 5.

The grille wires 21 may conveniently be aligned with the luminescent stripes by employing a mask member (not shown) cut in the shape of the viewing area 17 and having six apertures cut in spaced parallel position on the surface thereof. Two of the apertures in the mask are in vertical alignment with the axis of the tube. A pair of apertures in vertical alignment with each other are cut to either side of the apertures aligned with the axis. The mask member is placed in predetermined position between a light source and the viewing area 17. The apertures admit light to impinge on the grille and produce shadows on the luminescent stripes to which shadow point particular grille wires should be aligned. Thus, the grille structure is adjusted such that three symmetrically spaced groups of wires are aligned at each end with the stripes on the viewing area at predetermined points. Any errors in the viewing area of the face panel and also any errors in the grille structure generally vary in a smooth and not in an abrupt manner. Thus, if alignment is made for three symmetrically spaced groups of parallel grille wires with relation to the viewing area, corrective alignment of the entire grille structure with the relation to the viewing area is readily obtained.

An alternating method of positioning the grille wires with relation to the luminescent stripes may be employed. If in laying down the grille wires onto the frame, the lathe jig (not shown) on which the grille frame may be wound has cylindrical indexing bosses similar to the bosses on the face panel as reference positions for winding the wires, then the frames become interchangeable provided the printing is referenced with respect to the bosses on the face panel. The advantages of this method are interchangeability of frames, with consequent economy and speed of production.

As shown in Figure 5, a tab 47 having a trapezoidal cutout 49 is placed securely over surface 37 and is welded to tab 41. Because of the respective geometries of the surface 37 and the cutout 49 the cutout portion bears against the land 35 along two points 51 and 52 to prevent any lateral motion of the grille structure 23.

The lateral adjustment screw 43 bears against a surface 44 on the side of the face panel 15 to avoid translation of frame 23 in a direction parallel to the grille wires.

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Preferably the surface 44 is perpendicular to the axis of screw 43. The end of the lateral screw 43 has a ball-shaped nose so that the force on the frame 23 is transmitted solely along the axis of the screw.

Land structures 34 and 35 are similar and the frame is affixed to both land structures in the same manner. Therefore, only land structure 35 is described in detail.

For quantity production it is important that the assembly use a minimum amount of jigs for positioning the grille at the predetermined distance from the screen and that positioning be rapid and relatively free from any complications. In the present embodiments, precision screws bear against face panel supports to position the frame and may be readily adjusted and locked in place as will be presently discussed.

Frame 23 is initially fabricated to have a radius as shown by the solid lines, Figure 3. The frame 23 is made to a smaller radius than is the face panel 15, taking into consideration also any tolerance variations which the face panel may have. In the embodiment of the invention, the frame is overdetermined, so to speak, by the multiplicity of constraints employed, and the additional constraints are advantageously employed to bend or force the frame to conform substantially to the viewing area of the face panel. As is well known, a solid body requires three constraints to determine its translation and three more constraints to determine its rotation. In the embodiment of my invention there are nine constraints, one constraint each at the two points where the trapezoid contacts the boss on each of the lands, one constraint provided by the lateral screws, and one constraint on each of the four corners. Therefore, three constraints are available to provide deformations of the frame to conform said frame to the viewing area as well as for corrections of malformations in manufacture or processing of either or both the viewing area and the grille structure.

After the frame 23 is secured with references to the lands 34 and 35, the distance adjustment screws 53, 55, 57 and 59 are inserted in the open end apertures of protrusions 54, 56, 58 and 60 respectively, of the flange 19. Each of the four distance adjustment screws and each of the four protrusions are similar so that only one will be described.

In Figure 6, the distance adjustment screw includes a female portion 62 having ball-shaped nose 61 which engages the frame member 23 in an oversized recess 63; thus, the screw 59 exerts pressure against the frame 23 only in a downward direction. The female portion 62 threads to the male portion 65 which includes shoulder 67 which bears against protrusions 60 of flange member 19. From Figure 2 it can be seen that the screw 59 can be easily slipped in on the side of protrusion 60 and is maintained in position while tightening by spring clips 72 welded to the protrusions. Each of the protrusions has spring clips although only two clips 70 and 72 are shown in the drawing.

The correct distance from the luminescent screen having been determined, screw 59 is adjusted until the frame is brought to predetermined position, for example, at a position indicated by dot-dash line 23' (Figure 3). After adjustment, screw 59 may be locked into place by a nut, not shown, or by brazing the screw at the point at which the two portions join.

After the four screws 53, 55, 57 and 59 are adjusted, the frame 23 is now at a correct distance from the phosphor screen at six points. Because of the variation of the frame from the correct distance between these six reference points tends to be smooth rather than abrupt, a very close approximation to the exact spacing distance between the screen 17 and the frame 23 will be attained all along the frame 23.

Figure 7 shows another embodiment of the invention. A small glass protrusion 69 may be molded and shaped to have a downward L-shaped extension with a substantial-

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ly round end. The female portion 62' of screw 59' is similar to that of the embodiment of Figure 6. The male portion 65' includes an oversized flange having a round recess 64 on the top which engages the round end of the protrusion 69. Thus, no flange protrusion is needed to provide positioning and securing means for frame 23. A principal advantage of this embodiment is that a minimum of metallic parts extend toward the viewing area and no metal flange is required for closure of the face panel and the cone.

Although the description has been directed primarily to curved surfaces, it will be understood that either or both of the radii of the viewing area may be infinite, or in other words, forming cylindrical or flat surfaces or surfaces of any desired curvatures.

While specific examples have been given in describing details of this invention, it will be understood that they have been given merely by way of illustration and that the invention is not limited thereto.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination, a face panel for a television picture tube having a viewing area, a grille structure adapted to be disposed adjacent said viewing area, said grille member including a frame member configured to bound said viewing area, a first and second supporting means engageable with said frame respectively disposed upon said panel at diametrically opposed bounds of said viewing area and arranged to partially define the position of said frame with respect to said panel when said frame is held in engagement therewith by pressure perpendicular to said panel, and a plurality of additional supporting means also disposed along said bounds and disposed respectively to one side and to the other of said first two recited supporting means arranged to press perpendicularly to said panel to hold said frame into engagement with said first two recited supporting means for positioning said grille on said panel.

2. In the combination set forth in claim 1 wherein said first two recited supporting means, when engaging said frame, are arranged to constrain said frame to permit freedom of motion thereof only in rotation about and translation along a line between said first two recited supporting means.

3. In the combination set forth in claim 1 wherein said first two recited supporting means, when engaging said frame, are arranged to constrain said frame to permit freedom of motion thereof only in rotation about a line between said first two recited supporting means.

4. In the combination as set forth in claim 1 wherein said first two recited supporting means, when engaging said frame, are arranged to constrain said frame to permit freedom of motion thereof only in rotation about a line between said first two recited supporting means, and said additional supporting means, while constraining said frame in a direction perpendicular to said panel to prevent said rotation, exert relatively no constraint upon said frame in a plane parallel to said panel.

5. In combination, a face panel for a television picture tube having a viewing area, a grille structure adapted to be disposed adjacent said viewing area, said grille member including a deformable frame member configured to bound said viewing area, said frame member having a natural radius of curvature dissimilar from that ultimately desired, a first and second supporting means engageable with said frame respectively disposed upon said panel at diametrically opposed bounds of said viewing area and arranged to partially define the position of said frame permitting freedom of motion thereof only in rotation along a line between said supporting means when said frame is held in engagement therewith by pressure perpendicular to said panel, and a plurality of additional adjustable supporting means also disposed along said bounds and disposed respectively to one side and to the other of said first two recited supporting means, arranged

to press perpendicularly to said panel to hold said frame into engagement with said first two recited supporting means to completely determine the position of said frame and to deform said frame to the desired curvature.

6. In combination, a cylindrically curved face panel for a television picture tube having a viewing area, a cylindrically curved grille structure adapted to be disposed adjacent said viewing area, said grille member including a deformable frame member configured to bound said viewing area, said frame member having a natural radius of curvature smaller than that ultimately desired, a first and second supporting means engageable with said frame respectively disposed upon said panel at diametrically opposed bounds of said viewing area and arranged to partially define the position of said frame at a predetermined distance with respect to said panel when said frame is pressed toward said panel into engagement with said supporting means, and a plurality of additional adjustable supporting means also arranged along said bounds and disposed respectively to one side and to the other of said first two recited supporting means, arranged to exert a force towards said panel upon said frame to completely determine the position of said frame and to deform said frame into the desired curvature.

7. A color television picture tube comprising a substantially rectangular cup-shaped face panel including a curved viewing area thereon, a flange member affixed to the open ends of said face panel, a grille structure disposed adjacent said curved viewing area, said grille structure comprising an initially curved frame member of a smaller radius than said face panel, a grille wire pattern affixed to said frame member, support means for said frame member disposed in the center of two opposite sides of said rectangular face panel, said support means comprising a raised land having a flat surface thereon, said land including a rounded boss, a tab member affixed to said frame, a second tab member having a trapezoidal cutout portion, said portion being adapted to bear against said boss, said first tab affixed to said second tab for determining translation of said frame in a lateral direction, said frame having bowl-shaped depressions disposed on the four corners thereof, screw members adapted to engage said frame at each of said depressions to exert a force parallel to the axis of said screw between said flange member and said frame member to constrain said frame member to conform substantially to the surface of said viewing area at a predetermined distance from said viewing area, means affixed to said first tab bearing against the sides of said face panel to determine translation of said frame in a direction normal to said lateral direction.

8. A color television picture tube comprising a face panel including a curved viewing area thereon, a grille

structure disposed adjacent said curved viewing area, said grille structure comprising an initially curved frame member of a smaller radius than said face panel, a grille wire pattern affixed to said frame member, support means for said frame member disposed in the center of opposite sides of said face panel, said support means comprising a raised land having a flat surface thereon, said land including a cylindrical boss, a tab member affixed to said frame, a second tab member having a trapezoidal cutout portion bearing against said boss, said first tab affixed to said second tab for determining translation of said frame in a lateral direction, an extension formed on the sides of said face panel, said frame having bowl-shaped depressions disposed on the four corners thereof, screw members adapted to engage said frame at each of said depressions to exert a force along the axis of said screw between said extensions and said frame member to constrain said frame member to conform substantially to the surface of said viewing area at a predetermined distance from said viewing area, means affixed to said first tab bearing against the sides of said face panel to determine translation of said frame in a direction normal to said lateral direction.

9. A color television picture tube comprising a face panel including a curved viewing area thereon, a grille structure disposed adjacent said curved viewing area, said grille structure comprising an initially curved frame member of a smaller radius than said face panel, a grille wire pattern affixed to said frame member, support means for said frame member disposed in the center of opposite sides of said face panel, said support means comprising a raised land having a flat surface thereon, said land including a cylindrical boss, a tab member affixed to said frame, a second tab member having a trapezoidal cutout portion bearing against said boss, said first tab affixed to said second tab for determining translation of said frame in a lateral direction, an L-shaped extension formed on the sides of said face panel screw members positioned to exert forces between said flange member and said frame member such that said frame member is constrained to conform substantially to the surface of said viewing area at a predetermined distance from said viewing area, means affixed to said first tab bearing against the sides of said face panel to prevent translation of said frame in a direction normal to said lateral translation.

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