

[54] MULTIBEAM SINGLE GUN ELECTRON DISCHARGE DEVICE

[75] Inventors: **Alfred D. Johnson; Donald L. Say; Harry E. Smithgall**, all of Seneca Falls, N.Y.

[73] Assignee: **GTE Sylvania Incorporated**

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[51] **Int. Cl.**.....H01j 29/02, H01j 29/50, H01j 19/42

[58] **Field of Search**.....313/69 R, 69 C, 70 R, 80

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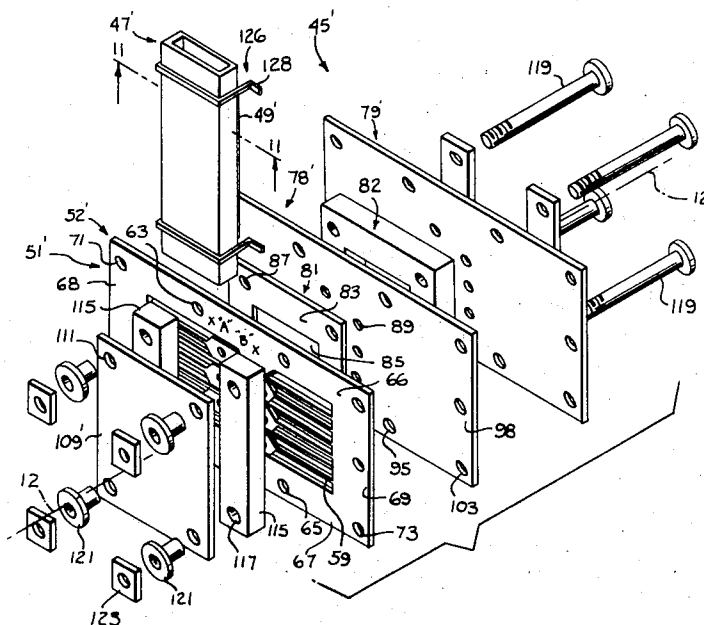
Primary Examiner—Robert Segal

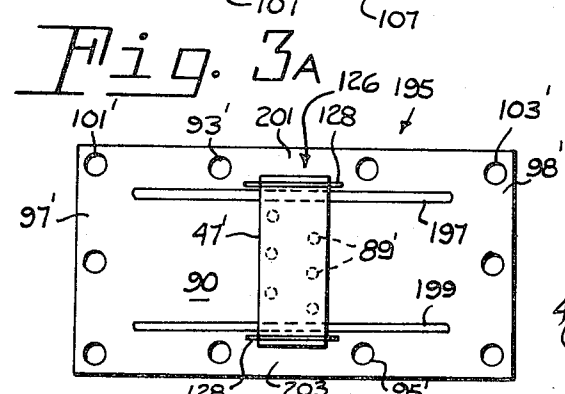
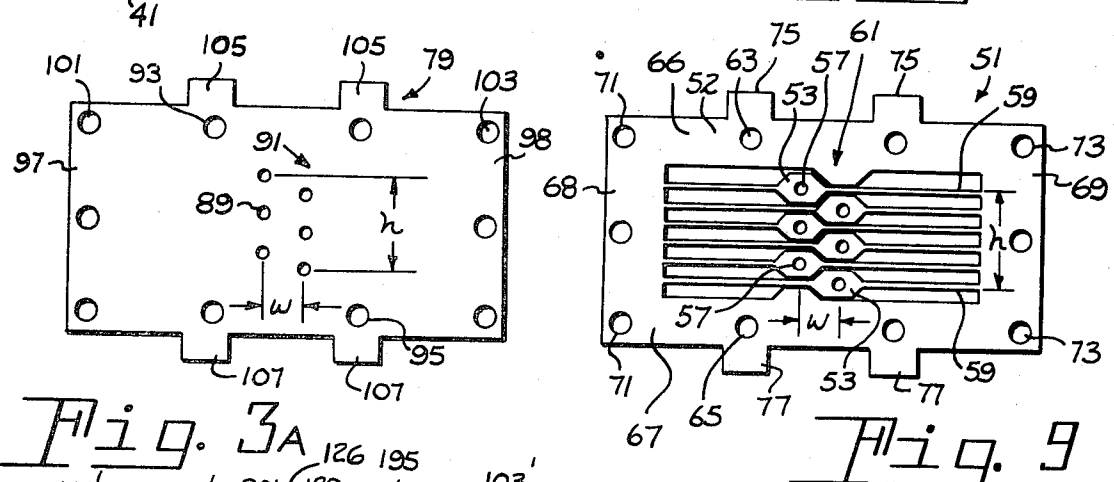
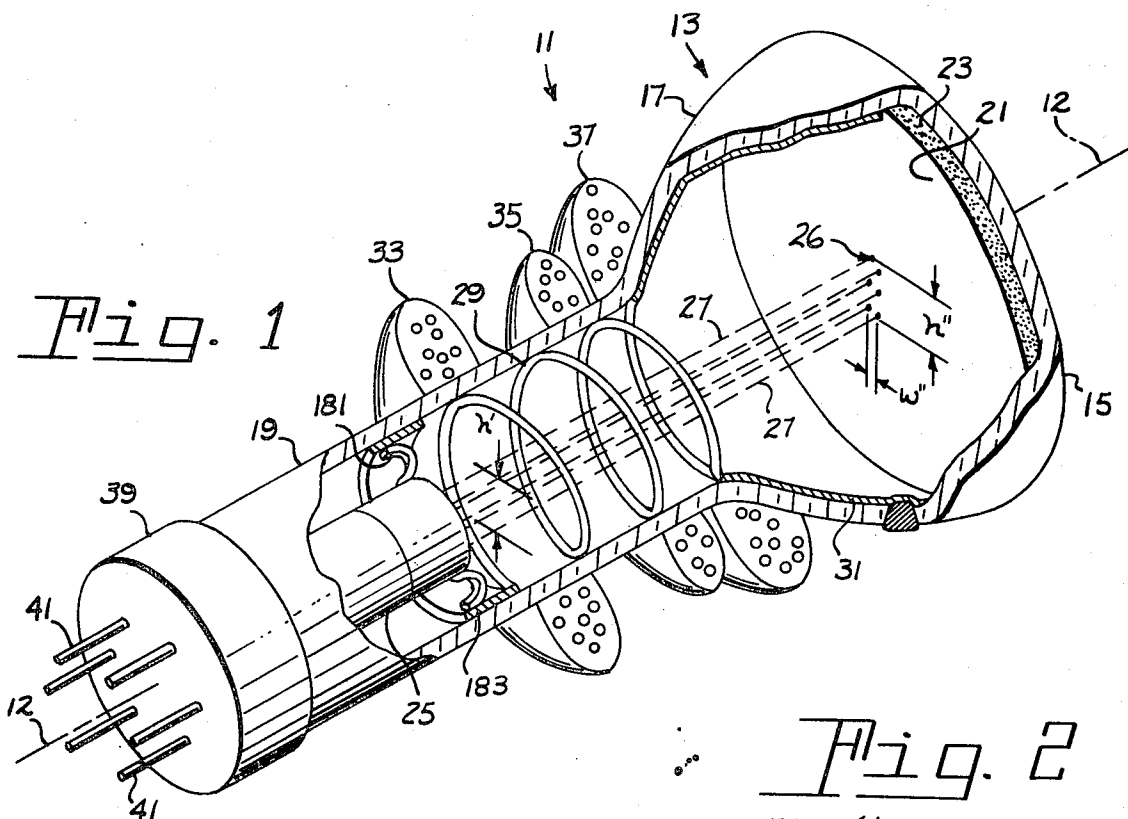
Attorney—Norman J. O'Malley, Donald R. Castle and Frederick H. Rinn

[57] **ABSTRACT**

An electron discharge device, such as a high resolution cathode ray tube, utilizes an array of electron beams provided by a multibeam single electron gun structure. The plurality of beams emanating from a common emission plane are separately modulated by a planar arrangement of separate control electrode members each having a beam aperture therein forming an aperture array. At least one accelerating-collimating electrode plane having a similar array of apertures is oriented in spaced and substantially parallel relationship with the control grid plane to provide a collimated array of beams directed to impinge the cathodoluminescent screen in a defined pattern array.

12 Claims, 15 Drawing Figures





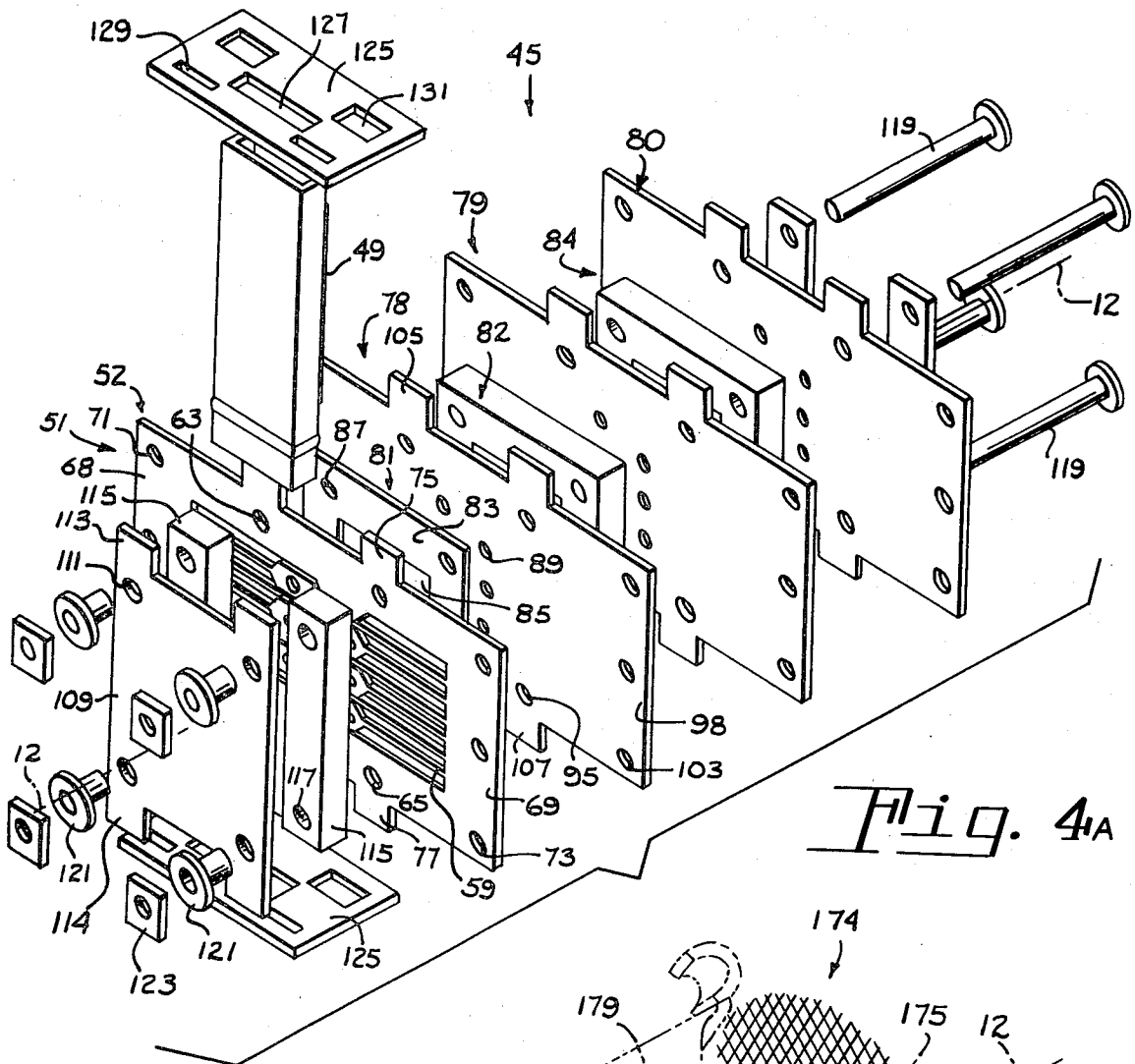


Fig. 4A

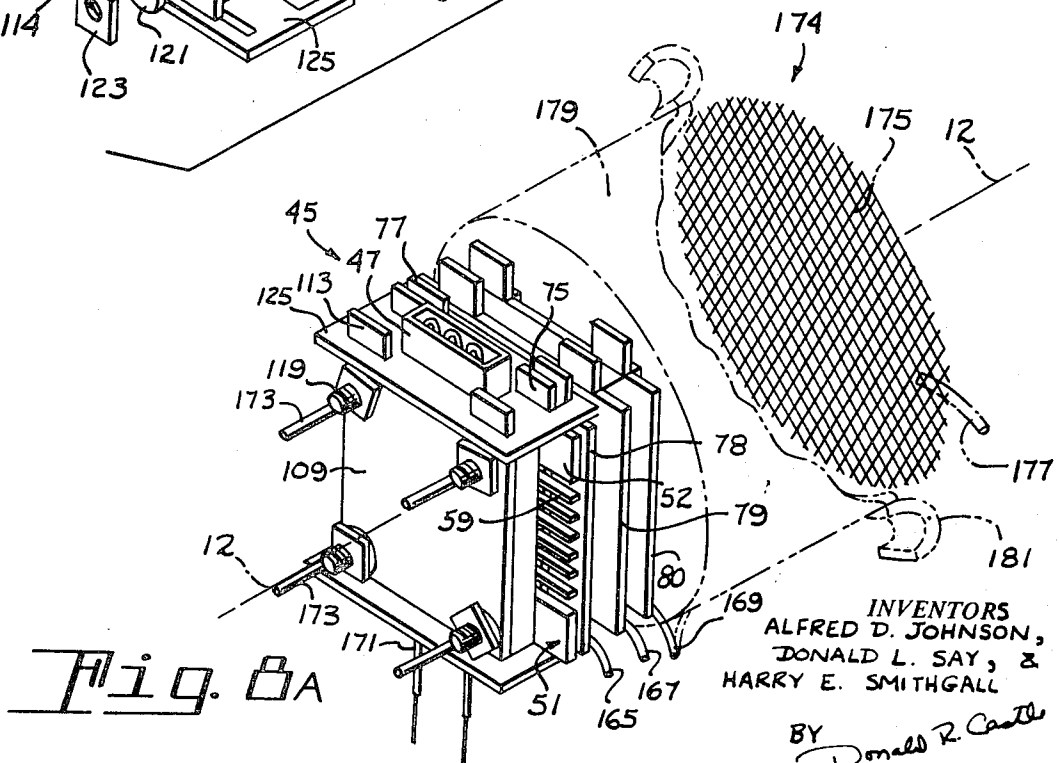


Fig. 4B

INVENTORS
ALFRED D. JOHNSON,
DONALD L. SAY, &
HARRY E. SMITHGALL

BY *Donald R. Castle*
ATTORNEY

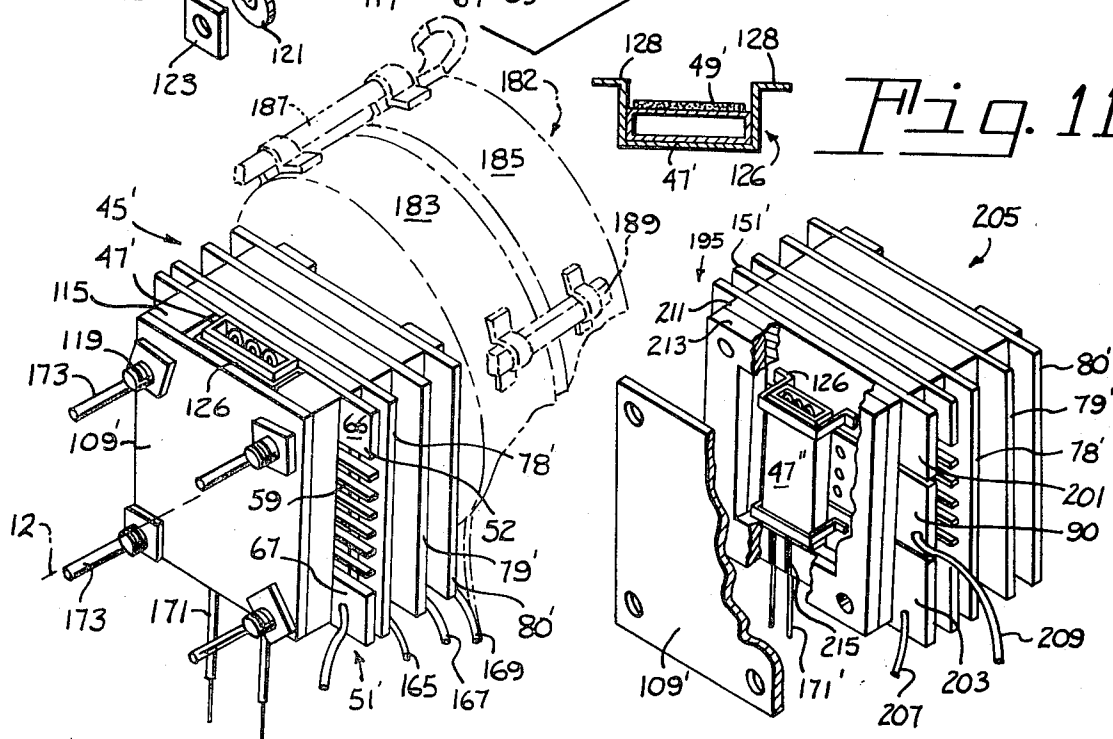
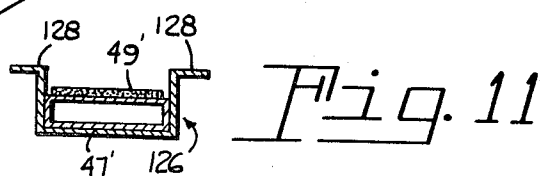
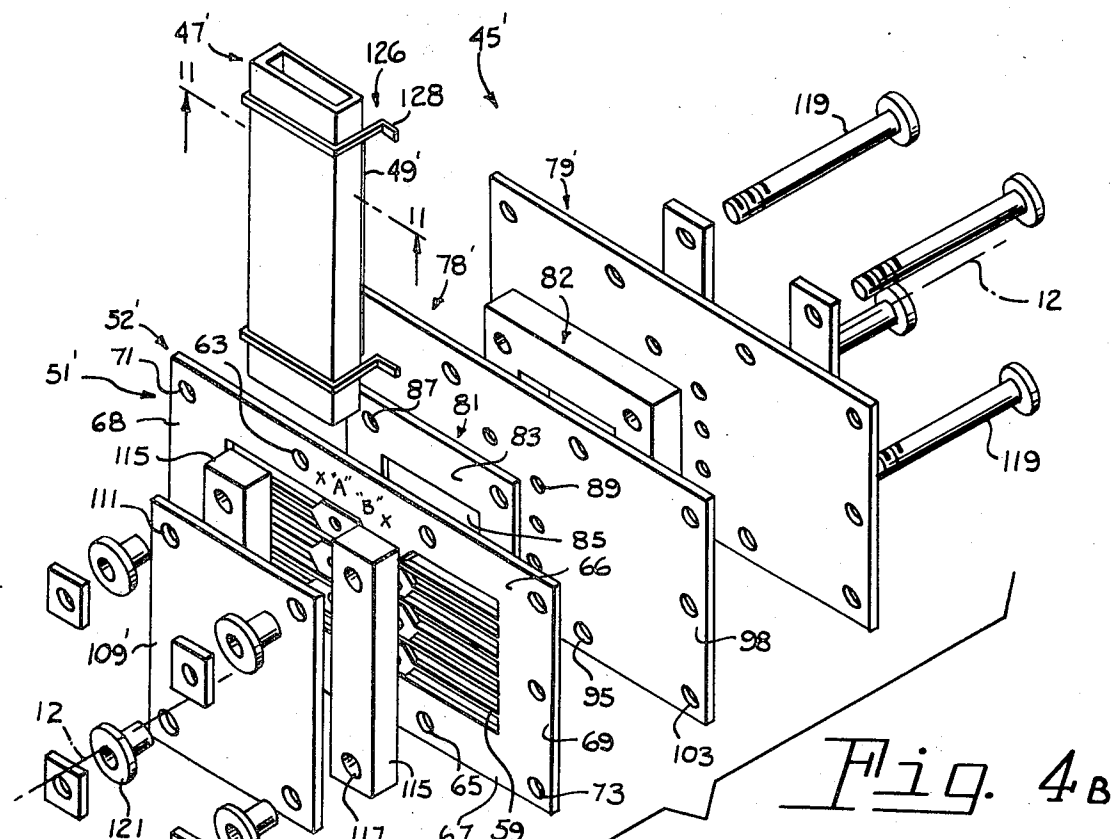


Fig. 8B

Fig. 10

MULTIBEAM SINGLE GUN ELECTRON DISCHARGE DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of application Ser. No. 860,621, filed Sept. 24, 1969, now abandoned, and contains matter disclosed but not claimed in a related continuation-in-part of application Ser. No. 860,626 filed concurrently herewith and assigned to the assignee of the present invention. This related continuation-in-part application is Ser. No. 126,610, now U.S. Pat. No. 3,686,727, "Method of Fabricating A Multibeam Electron Gun Structure." A previously filed application Ser. No. 860,625 "Electrode Alignment and Assembling Device" contains matter disclosed but not claimed in the above-identified applications Ser. No. 860,621 and Ser. No. 860,626.

BACKGROUND OF THE INVENTION

This invention relates to a multibeam cathode ray tube and more particularly to a single electrode gun multibeam cathode ray tube and the gun structure included therein.

In certain types of high resolution cathode ray tube displays such as may be used in alpha-numeric graphing or mapping presentations, it has been found advantageous, from the standpoint of achieving improved brightness, enhanced resolution and increased writing speed, to utilize a multibeam tube having a plurality of substantially parallel and separately modulated electron beams therein. The disadvantages of a single beam system is that display brightness is low due to sweep speeds and time sharing of the beam. It has been found that the use of a plurality of individual electron guns within a common envelope is limited by the size of the respective guns and the internal dimension of the tube neck portion wherein the guns are positioned.

Some known single gun multibeam tubes comprise intricate electron gun assemblies including electrodes having ceramic substrates and wire formed structures.

OBJECTS AND SUMMARY OF THE INVENTION

It is an object of the invention to reduce the aforementioned disadvantages and to provide an improved high resolution single gun multibeam cathode ray tube. Another object is to provide an improved multibeam electron gun structure wherein the electron beams are substantially parallel and individually modulated. A further object is to provide an improved multibeam gun structure that can be expeditiously fabricated.

The foregoing objects are achieved in one aspect of the invention by providing an improved multibeam single gun electron discharge device such as a high resolution cathode ray tube wherein the multibeam gun structure comprises a common emission plane wherefrom a plurality of electron beams are individually modulated by a planar arrangement of separate control electrode members each having a beam aperture therein to form an aperture array. At least one plural-apertured metallic planar electrode member having a similar aperture array is positioned in spaced and parallel relationship with the control electrode array to form an accelerating-collimating electrode plane. The collimated beams therefrom are directed to impinge the cathodoluminescent screen of the tube in an array pattern as determined by the array of beam apertures in the multibeam electron gun structure.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partially cut-away perspective illustrating a cathode ray tube incorporating the invention;

FIG. 2 is an enlarged plan view of the control electrode plan showing the plurality of control electrode members;

FIGS. 3a and 3b are enlarged plan views of two embodiments of a plural-apertured planar electrode member;

FIGS. 4a and 4b are exploded views illustrating two embodiments of the multibeam electron gun structure;

FIGS. 5a and 5b are perspective views showing pertinent aspects of multibeam gun structure assemblies;

FIGS. 6 and 7 are side views showing two embodiments of multibeam gun structures during assembly;

FIGS. 8a and 8b are perspective views illustrating additional details of two multibeam gun assemblies;

FIG. 9 is an enlarged partial cut-away illustration detailing electron beam formation is one embodiment of the invention;

FIG. 10 is a partial cut-away view showing another embodiment of the invention; and

FIG. 11 is a plan view of a cathode stand-off positioner.

BRIEF DESCRIPTION OF THE PREFERRED EMBODIMENTS

For a better understanding of the present invention, together with other and further objects, advantages and capabilities thereof, reference is made to the following specification and appended claims in connection with the aforescribed drawings.

With reference to FIG. 1, there is shown one embodiment of a cathode ray tube 11 having an axis 12 therethrough and an envelope 13 including a face panel or viewing portion 15, a funnel portion 17, and a neck portion 19. Suitably disposed on the inner surface of the face panel 15 is a cathodoluminescent screen 21 comprising at least one electron excitable phosphor material 23. Oriented within the tube neck portion 19 is multibeam single electron gun structure 25, the component parts of which are not detailed in FIG. 1. This single gun structure 25 is fabricated to produce a beam pattern array 26 of a defined plurality of similar substantially collimated electron beams 27 which are directed to impinge the screen 21. By way of example, a discrete pattern array 26 comprised of six beams 27 is shown, but such number of beams is not intended to be limiting as the single multibeam gun 25 can be constructed to produce few or many substantially collimated beams 27. In the beam pattern array 26 thus formed, each beam 27 can be separately modulated without need for convergence correction as the pattern array is scanned over the screen 21. Thus, the pattern of plural beams, as shown, potentially increases by 6 times, the brightness potential of the particular display tube 11. Also, since the beam array 26 is handled as a bundle, there is a reduction of writing rate for each beam 27 by a factor equal to the number of beams.

Electrical conductive means are applied to the interior surface of the neck 19 and funnel 17 portions of the

tube envelope 13 to effect an electrical connection between the electron gun structure 25 and the screen 21.

In this first embodiment, the electrical conductive means is in the form of a spiral accelerator or resistive helix 29 applied to the inner surface of the neck portion 19 in a manner to extend from the low potential of the final electrode of the gun 25 to the internal conductive coating 31 disposed on the interior surface of the funnel portion 17, thus making connection with the high potential of the screen 21. In this way the resistive helix 29 serves to build a long gradual accelerating field which in conjunction with magnetic lensing effects faithful imaging of the beam pattern array 26 on the screen 21.

The plural beam pattern array 26 has an object height (h') and width (w'), not shown, as it leaves the electron gun 25 and an image height (h'') and width (w'') when it impinges the screen 21. In certain display applications it is desired to effect magnification, demagnification or substantially maintain the image height (h'') and width (w'') relative to the object height (h') and width (w'). Such is effected by gun structure and magnetic lensing as will be described later in this specification.

To ensure that the beam pattern array 26 impinges the screen 21 in desired rotational alignment, a pattern rotation coil 33 is usually exteriorly positioned on the neck portion 19 of the tube 11 near the low voltage end of the helix 29. Thus, by adjustment of the pattern rotation coil 33 rotational shifting of the beam pattern array 26 is provided, as for example, in writing italics in a character generating application. In utilizing magnetic focusing and deflection, a focusing coil 35 is mounted on the exterior of the tube neck portion 19 at the high voltage end of the helix 25, and a deflection coil 37 is formed to encompass the envelope transition region 18 where the funnel portion 17 joins the neck portion 19.

The single electron gun structure 25 has a number of electrical connections, not shown, which are brought out through the tube base 39 to external connective means 41, several of which are shown.

In detailing one embodiment of a multibeam single gun structure 45, particular reference is made to FIGS. 1, 2, 3a, and 4a wherein the defined gun structure comprises a common electron emission plane and an assembly of related parallel conductive electrode planes each having an array of beam apertures therein corresponding to the number and patterned configuration 26 of the desired array of beams 27 impinged upon screen 21.

To provide greater detail and clarity, an exploded view of the gun structure 45, during construction, is shown in FIG. 4a. A source of electrons such as thermionic electron emission means 47, for example, a tubular cathode having electron emissive material disposed on at least part of one surface thereof, forms a common emission plane 49. Spaced from and parallel with the emission plane 49, and substantially normal to the axis 12, is a metallic substantially planar control electrode mat 51 which is further detailed in FIG. 2. This control electrode mat 51 is discretely formed, as for example, by chemical milling, to provide a framing member 52 encompassing a plurality of substantially

strip-like self-supporting control electrode members 53 each having a substantially hexagonal shaped central portion with a beam aperture 57 therein and a separate electrical connection 59. The framing member 52 therearound comprises two opposed horizontal extremital portions 66, 67 and two related vertical extremital portions 68 and 69. The several electrode members 53 are positioned in laterally spaced relationship with one another whereof the hexagonal central portions of adjacent electrode members are spatially nested in staggered orientation in two parallel columns to form a substantially centrally oriented planar control electrode aperture array 61. As shown, the aperture array 61 comprises two substantially parallel rows of beam apertures 57. To achieve array compactness, the electrode members 53 present a staggered aperture array 61 having a height (h) and a width (w). These dimensions are substantially the same as object height (h') and width (w') of the aforementioned beam pattern array 26 as it leaves the electron gun. Spaced from either side of the aperture array 61 is a set of similarly oriented control electrode affixal perforations 63 and 65 oriented in each of the horizontal extremital portions 66, 67; and further spaced therefrom, in each of the two opposed vertical extremital portions 68 and 69 of the control electrode mat 51, is a set of similarly located control electrode alignment perforations 71 and 73. Protruding laterally from the control electrode framing member 52 are two sets of control electrode tabs 75 and 77 which in this embodiment are utilized in gun structure assembly 45.

Spaced from and substantially parallel with said plurality of control electrode members 53 is at least one plural-apertured metallic planar electrode mat 78, forming an accelerating-collimating electrode plane, which is further detailed in FIG. 3a. The spacing between the plurality of control electrode members 53 and the accelerating-collimating electrode plane 78 is an insulative electrode spacer means 81 in the form of a substantially rectangular-shaped member having a peripheral spacing framing member 83 defining a central cut-out portion 85. Affixal perforations 87 are suitably oriented in the peripheral framing member 83 to provide definite placement in the gun structure assembly 45. In addition to serving as an electrode spacing means, the peripheral framing member 83 serves as a support means across which the plurality of laterally spaced control electrode members 53 are bridged.

With reference to FIG. 3a, the plural-apertured metallic planar electrode mat 78 has a plurality of beam apertures 89 formed therein, as for example, by discrete chemical milling to provide a planar electrode aperture array 91 which corresponds in array configuration and number with the respective beam apertures 57 in the control electrode array 61, having substantially similar height (h) and width (w) dimensions. Spaced on either side of the planar electrode aperture array 91 is a set of similarly oriented planar electrode affixal perforations 93 and 95. In each of the two opposed vertical extremital portions 97 and 98 of the planar electrode mat 78 is a set of similarly located planar electrode alignment perforations 101 and 103. Protruding laterally from the accelerating-collimating planar electrode mat 78 are two sets of planar electrode tabs 105 and 107 which are utilized in gun structure assembly 45.

It has been found that in small size plural beam arrays enhanced focusing and collimation can be achieved by incorporating additional plural-apertured electrode planes to the gun structure. For example, in referring to FIG. 4a, additional accelerating-collimating electrode planar mats G-3 and G-4, forming additional lens planes, are designated as 79 and 80 respectively, and are not specifically detailed as they are substantially the same as aforescribed planar electrode mat 78. The insulative electrode spacer means 82 and 84 are rectangular framing means having greater thickness than insulative electrode spacer means 81, otherwise they are substantially similar to what has been described.

Cathode shielding means 109 having corner oriented affixal perforations 111 and protruding tabs 113 is positioned in spaced relationship with and substantially parallel to the control electrode mat 51, being discretely spaced therefrom by insulative spacing means 115 which has a plurality of affixal perforations 117 therein. The resultant spacing between the shielding means 109 and the control electrode mat 51 accommodates the spaced positioning of the electron emission means such as cathode 47 therebetween. The several related planar electrode mats and respective spacers are joined together in a compact gun structure assembly 45 by affixal means such as cement, rod-like clamping means or bolts. For example, a plurality of threaded bolts 119, extending through the numerous affixal perforations and insulative washers 121, are suitably secured by nuts 123. By this arrangement, the related plurality of apertures in the several respective electrode mats are predeterminedly aligned in the manner substantially related to the axis 12.

In this embodiment cathode spacer means in the form of a pair of apertured wafer-like insulative members 125 are individually positioned on either side of the gun structure assembly. Each has a cathode aperture 127 therein to accommodate and orient the cathode 47 relative to the control electrode mat 51; the planes of said wafer-like members 125 being substantially parallel with the axis 12. Sets of apertures or perforations 129 and 131 are also contained in the wafer-like members 125 to accommodate the shielding means protruding tabs 113 and the several tabs 75, 77, 105 and 107 protruding from electrode mats 51 and 78, respectively.

Expeditious assembling of the aforescribed multibeam electron gun structure 45 is accomplished by utilizing an electrode alignment device 133 as illustrated in FIGS. 5, 6 and 7. The alignment device is comprised of several parts, one of which is a movable base portion 135. A cap portion 137 is shaped for fixed attachment to the base portion 135, as for example by bolt means 136 which seat in the base 135 to form a cap-base assembly 138 wherein there is provided spaced apart longitudinal guide channel means 139. The cap portion has an upper surface 141 whereof the leading edge portion 143 has a plurality of vertical pins 145 oriented adjacent thereto. The pins 145 are spaced in a manner to match one set of the respective electrode mat alignment perforations, for example 73 and 103. A slide portion 147 has a pair of longitudinal member means 149 formed to slide in the guide channel means 139 in the cap-base assembly 138. The slide portion 147 has a bridge member 151 formed substan-

tially normal to the longitudinal member means 149. The bridge member 151 has an upper surface 153 with a forward edge portion 155 oriented in adjustably spaced relationship to the cap portion leading edge portion 143. Adjacent to the forward edge portion 155 are a plurality of vertical pins 157 oriented in a manner to match an opposed set of electrode mat alignment perforations, for example, 71 and 101. The respective sets of pins 145 and 157, which are oriented in a common lateral plane, have sufficient vertical length to accommodate a plurality of planar electrode mats in spaced apart stacked arrangement. Lateral movement means 159 is incorporated in the cap-base assembly 138 to provide lateral uniform adjustable movement to each of the longitudinal member means 149 to effect controlled movement of the two respective pluralities of pins 145 and 157 and provide lateral tautness and alignment to the electrode mats accommodated thereon.

In assembling a multibeam single gun electron gun structure of the type described an electrode assembly is first fabricated. With reference to FIGS. 5 and 6, there is shown one embodiment of an electrode assembly 161 comprising a control electrode mat 51 and a planar electrode mat 79. Such is facily assembled by positioning an accelerating-collimating electrode mat 79 on the alignment device 133 with the sets of alignment perforations 101 and 103 mating with the corresponding sets of vertical pins 157 and 145 on the device. An insulative electrode spacer means 81 is positioned upon the accelerating-collimating electrode mat 79 with the respective affixal perforations substantially aligned. A control electrode mat 51 is positioned atop the spacer means 81 on the device 133 with the alignment perforations 71 and 73 mating with the sets of pins 157 and 145 thereon. Alignment of the respective beam apertures in the two electrode mats 79 and 51, is accomplished by discretely activating the lateral movement means 159 in the device 133 to carefully move the sets of pins 157 and 145 and provide lateral tautness to the mats. Care is exercised to avoid deformation of the respective alignment perforations. Insulative spacing means 115 are placed atop the control electrode mat 51 with the respective affixal perforations in alignment; whereupon the cathode shielding means 109 is suitably positioned. With the componental elements thus arranged, affixation is effected to form a unified electrode assembly 161. As previously mentioned, affixation is accomplished in several ways, as for example, by applying a suitable ceramic bonding material to the region of the affixal perforations, or by inserting rod-like clamping means, such as bolts, through the aligned affixed perforations. As shown, bolts 119 are utilized, being inserted up through the assembly with the insulative washers 121 and mating nuts 123 applied adjacent to the cathode shielding means 109 to provide affixation. If ceramic bonding material is utilized for affixation, the electrode assembly 161 is retained in the device 133 until the bonding is set. When employing ceramic bonding for affixation, the cemented electrode assembly 161 is removed from the alignment device 133 and placed in a sealed enclosure, not shown, for outgassing which is accomplished by a conventional heating and exhaust procedure.

The fabrication of another embodiment of electrode assembly 163 is shown in FIG. 7 wherein additional pluralapertured metallic planar electrode mats 79 and 80 are also included along with the necessary insulative spacer means 82 and 84. The afore-mentioned assembling and affixation procedures utilized for the first embodiment 161 also apply equally as well to this second embodiment 163. To simplify description, further consideration is substantially confined to the second embodiment 163.

After affixation, the extremital portions of the several electrode mats, such as 67, 69, and the pluralities of 97, 99 are removed adjacent to the several electrode spacer means 77, 82 and 84. Such removal provides separate lead connections 59 for the individual electrode members 53 of the control electrode plane 51 as illustrated in FIG. 8a. A multiple apertured waterlike insulative member 125, such as mica or ceramic, is positioned on either side of the electrode assembly 163 with the planes of the spacer members 125 being substantially parallel with the axis 12. Electron emission means such as a thermionic cathode 47 is positioned in cathode apertures 127 of the members 125 in a manner that the emission plane 49 is adjacent the array of control electrode apertures 57; whereupon, the members 125 are secured to the respective tabs, for example 75, 77 and 113 as shown in FIG. 8. In this manner, the gun structure 45 is unitized. Separate electrical connections 165, 167, and 169 are provided for planar electrode planes 78, 79, and 80, respectively. A formed heater 171 is positioned within the cathode 47. The gun structure 45 is positioned relative to a multi-lead stem means, not shown, and secured to support leads 173 extending therefrom and attached, for example, to bolt means 119. Electrical connections from the component parts of the gun structure 45 are made to appropriate stem connective leads in a conventional manner.

In another embodiment of the multibeam gun structure 45', as illustrated in FIGS. 4b, 8b and 11, the cathode spacer means employed is in the form of a pair of spaced-apart angular-shaped stand-off positioners 126, for example, tungsten wire or strip, shaped to substantially cradle the cathode 47' in a manner to expedite attachment thereto. Seating portions 128 are formed for affixation, such as by welding, to portions of the adjacent electrode mat which subsequently become isolated elements in the electrode plane adjacent to the cathode. For example, the several seating portions 128 are welded to the respective horizontal extremital portions 66 and 67 of control electrode mat 51, such as at areas A and B. When the vertical extremital portions 68 and 69 are subsequently removed, the horizontal extremital portions 66 and 67 become separate elements in the gun structure electrically isolated from the center portion of the mat.

Since the laterally protruding tabs 75, 77, 105, 107 and 113, 114 on the respective electrode planes and cathode shielding means are not required when the pair of cathode stand-off positioners 126 are employed, they are eliminated in the gun structure embodiment 45' shown in FIGS. 4b and 8b, thereby reducing the size of the resultant gun structure. The tab-less electrode planes 51' and 78' and shield means 109' have elemental structural features that are similar to those noted in

FIGS. 4a and 8a and therefore are numerically designed in like manner.

When the stand-off cathode positioners 126 are utilized, the cathode 47' is attached to the adjacent electrode plane prior to the gun structure assembling operation. This is shown in FIG. 5b wherein electrode assembly 161' replaces electrode assembly 161 in FIG. 5a, the respective electrode mats and spacer being sequentially oriented in stacked order.

To achieve high resolution images with multibeam array, it has been found advantageous in some instances to position an image array size control electrode means 174 forward of the final electrode plane to provide an additional control feature in the neck region where the beams enter the accelerating helix if such is used. One electrode embodiment is in the form of a field forming mesh lens so positioned to effect the advantage of being either convergent or divergent depending on whether it is operated above or below its surroundings. With reference to FIG. 8a, the mesh lens 175, if desired, is positioned in a substantially parallel manner forward of and spaced from the final accelerating-collimating electrode plane 80 and has a separate electrical connection 177. A cylindrical metallic shield 179 operating at the potential of the final electrode plane 80 encompasses the space between the final electrode plane and the mesh. In referring to FIGS. 1 and 8, the electron gun structure, in this instance the cylindrical shield 179, has resilient electrical connective means 181 formed to contact a conductive band 183 disposed on the inner surface of the neck portion 19 and connected to the helix 29.

Another embodiment of an image array size control electrode 182 is partially shown in FIG. 8b wherein spaced apart first and second cylindrical electrode members 183, and 185, forming a bi-potential lens having substantially like diametrical dimensions, are positionally aligned relative to the final of the accelerating-collimating electrode planes in the electron gun structure 45'. Suitable orientation is provided by at least three longitudinal insulative supports, two of which are shown 187, 189. The first electrode member 183 is of the same potential as the final electrode plane 80'. The second or forward positioned electrode member 185, which has a separate electrical connection 191, is operable at a potential usually above that of the first member 183 to provide control of the array image as may be desired.

While the two embodiments of the image array size control electrode means 174 and 182 are shown in FIGS. 8a and 8b as being associated with the respective multibeam gun structures 45 and 45', they are equally adaptable to any of the gun structures described herein.

Another gun structure embodiment is illustrated in FIG. 9 wherein another plural-apertured metallic planar electrode mat 78*, which is dimensionally similar to planar electrode mat 78, is positioned between the common electron emissive plane 49 and the control electrode plane 51 to provide shielding effects and a pre-formed beam pattern array which is discretely beamed to the respective control electrode apertures 57. Spacings between the electron emission means 47, the planar electrode plane 78* and the control electrode plane 51 are effected by either embodiment of spacer means 125 or 126, which for purposes of clarity are not shown.

When employing the cathode stand-off positioning means 126, a modified plural-apertured planar electrode mat 195 is utilized, such being shown in FIG. 3b. The modified mat 195, which may be tab-less, comprises two vertical extremital portions 97' and 98' and two spaced-apart horizontal slots 197 and 199 that define the two horizontal extremital portions 201 and 203 which are removed from the array of beam apertures 89'. The two cathode stand-off positioners 126, with the cathode 47' cradled in and attached thereto, have their respecting seating provisions 128 welded to the respective horizontal extremital portions 201 and 203. When the vertical extremital portions 97' and 98' are subsequently removed during the gun structure assembling procedure, the remaining horizontal extremital portions 201 and 203, with the cathode positioners 126 affixed thereto, are electrically isolated from the beam aperture portion 90 of the electrode mat 195. This is further illustrated in the partial gun assembly 205 shown in FIG. 10. A cathode connection 207 is made to either of the isolated horizontal extremital portions 201 and 203. If desired, an electrical connection 209 can be made to the common aperture portion 90.

A modified cathode orientation is also illustrated in FIG. 10; wherein a shorter cathode 47'', mounted by positioner means 126 as aforescribed, is located in a manner to be encompassed by a pair of insulative frame-like spacer means 211 and 213, partially detailed. These are superjacently integrated as elements in the gun structure 205 replacing insulative spacing means 115. The legs of cathode heater 171' are positionally oriented sandwich-like in appropriate grooves or channels 215 in the spacer means 211 and 213. This construction, which substantially encloses the cathode 47'' within the gun structure, has been found to be advantageous in reducing warm-up time and effecting enhanced control of spurious electron emission.

There is thus provided an improved high resolution single gun multibeam cathode ray tube which incorporates one of several related embodiments of an improved multibeam gun structure that can be expeditiously fabricated.

While there have been shown and described what are at present considered the preferred embodiments of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the scope of the invention as defined by the appended claims.

What is claimed is:

1. In a multibeam cathode ray tube having an axis and a cathodoluminescent screen, a related electron gun structure comprising:

thermionic electron emission means in the form of a cathode having a common emission plane oriented substantially normal to said axis;

a metallic control electrode plane formed of a plurality of substantially self-supporting control electrode members positioned in laterally spaced relationship with one another to form a substantially planar control electrode array spaced from and substantially parallel with said electron emission means and substantially normal to said axis, each of said individual electrode members having a substantially hexagonal shaped central portion

wherein a beam aperture is defined, said electrode members being positioned in a manner whereof the hexagonal central portions of adjacent members are spatially nested in staggered orientation to provide a compact array of two parallel rows of apertures, each of said hexagonal portions having a supportive member extending longitudinally from either side thereof, at least one of said supportive members being a substantially ribbon-like formation, one of said supportive members effecting a separate electrical connection for each electrode member to provide a plurality of spaced individually controlled electron beams;

at least one plural-apertured metallic planar electrode member having a plurality of affixal perforations therein and oriented in spaced and substantially parallel relationship with said control electrode array to form an accelerating-collimating electrode plane wherein said plurality of beam apertures corresponds in array and number to the respective beam apertures in said control electrode array to provide acceleration and collimation of said plural electron beams, said accelerating-collimating electrode plane having a common electrical connection;

insulative electrode spacer means having a plurality of affixal perforations therein and formed as a substantially planar member for contiguous parallel positioning between said control electrode array and said accelerating-collimating electrode plane to provide predetermined spacing therebetween, said electrode spacer means having framing means defining a central open portion, said individual members of said control electrode array being tautly bridged across said framing means;

affixal means formed to provide aligned retention of said planar control electrode array, said accelerating-collimating electrode plane, and said insulative electrode spacer means by effecting alignment of the respective affixal perforations therein; and cathode spacer means having provisions for supporting said cathode in a plane substantially parallel to said control electrode array to provide predetermined spacing between said electron emission means, and said control electrode array.

2. A multibeam electron gun structure according to claim 1 wherein a plural-apertured metallic planar electrode member is spacedly positioned between said common emission plane and said metallic control electrode plane to pre-form said electron beam array.

3. An electron gun structure according to claim 1 wherein said cathode spacer means is in the form of a pair of wafer-like insulative spacers positioned in separate planes parallel with said axis and having a plurality of apertures therein to accommodate the positioning of said electron emission means in spaced relationship to said control electrode array.

4. An electron gun structure according to claim 1 wherein said cathode spacer means are in the form of a pair of spaced-apart angular-shaped stand-off positioners attached to said cathode and affixed to isolated elements in the electrode plane adjacent to said emission means.

5. A multibeam cathode ray tube having a longitudinal axis extending through an encompassing envelope

formed of an integration of an extended neck portion having a stem closure with electrical connective leads therethrough, a funnel portion and a face panel having a viewing area, said tube internally comprising:

- a multiple beam electron gun structure positioned within said envelope neck portion adjacent said stem closure in a manner substantially normal to said axis and comprising: thermionic electron emission means in the form of a cathode having a common emission plane; a metallic control electrode plane spaced from and substantially parallel with said electron emission plane, said control electrode plane being an array formed of a plurality of substantially self-supporting individual control electrode members positioned in laterally spaced relationship to one another with each individual electrode member having a substantially hexagonal shaped central portion with a beam aperture therein, said electrode members being positioned in a manner whereof the hexagonal central portions of adjacent members are spatially nested in staggered orientation to provide a compact array of two parallel rows of apertures, each of said hexagonal portions having a supportive member extending longitudinally from either side thereof, one of said supportive members effecting a separate electrical connection to provide a plurality of spaced individually controlled electron beams; shielding means spaced relative to said electron emission means to control stray electron emission; at least one plural-apertured metallic planar electrode having a plurality of affixal perforations therein and oriented in spaced and substantially parallel relationship to said control electrode array to form an accelerating-collimating electrode plane wherein said plurality of beam apertures corresponds in array and number to the respective beam apertures in said control electrode array, said accelerating-collimating electrode plane having a common electrical connection; insulative electrode spacer means having a plurality of affixal perforations therein and formed as a substantially planar member for contiguous parallel positioning between said control electrode array and said accelerating-collimating electrode plane to provide predetermined spacing therebetween, said electrode spacer means having a peripheral framing member defining a central cut-out portion, said individual members of said control electrode array being tautly bridged across said peripheral framing member; affixal means formed to provide aligned retention of said planar control electrode array, said accelerating-collimating electrode plane, and said insulative electrode spacer means by effecting alignment of the respective affixal perforations therein; cathode spacer means having provisions for supporting said cathode relative to said control electrode array to provide predetermined spacing between said shielding means, said electron emission means, and said control electrode array;
- a cathodoluminescent screen disposed relative to said viewing area in said face panel whereupon a plural beam array is displayed; and

electrical conductive means applied to the interior surface of said neck and funnel portions to effect an electrical connection between said electron gun structure and said screen.

6. A multibeam cathode ray tube according to claim 5 wherein said electrical conductive means associated with said neck portion is in the form of a spiral accelerator of resistive material applied to the interior surface of said neck portion in a helical manner to extend substantially from the forward portion of said multiple beam electron gun to said funnel portion.
7. A multibeam cathode ray tube according to claim 5 wherein said cathode spacer means are in the form of a pair of wafer-like insulative spacers positioned in separate planes parallel with said axis, said wafer-like spacers having apertures therein to effect support of said emission means.
8. A multibeam cathode ray tube according to claim 5 wherein said cathode spacer means are in the form of a pair of spaced-apart angular shaped stand-off positioners attached to said cathode and affixed to isolated elements in the electrode plane adjacent to said emission means.
9. A multibeam cathode ray tube according to claim 5 wherein said cathode is laterally encompassed by frame-like insulative spacer means to reduce heater warm-up time and enhance control of spurious electron emission.
10. A multibeam cathode ray tube according to claim 9 wherein said frame-like insulative spacer means is in the form of a pair of superjacent positioned spacers, and wherein the leads of the cathode heater are extended exteriorly of the gun structure by sandwich orientation between said superjacent spacers.
11. A multibeam cathode ray tube having a longitudinal axis extending through an encompassing envelope formed of an integration of an extended neck portion having a stem closure with electrical connective leads therethrough, a funnel portion and a face panel having a viewing area, said tube internally comprising:
 - a multiple beam electron gun structure positioned within said envelope neck portion adjacent said stem closure in a manner substantially normal to said axis and comprising: thermionic electron emission means in the form of a cathode having a common emission plane; a metallic control electrode plane spaced from and substantially parallel with said electron emission plane, said control electrode plane being an array formed of a plurality of substantially self-supporting individual control electrode members positioned in laterally spaced relationship to one another with each individual electrode member having a substantially hexagonal shaped central portion with a beam aperture therein, said electrode members being positioned in a manner whereof the hexagonal central portions of adjacent members are spatially nested in staggered orientation to provide a compact array of two parallel rows of apertures, each of said hexagonal portions having a supportive member extending longitudinally from either side thereof, one of said supportive members effecting a separate electrical connection to provide a plurality of spaced individually controlled electron beams; shielding means spaced relative to said

electron emission means to control stray electron emission; a plurality of plural-apertured metallic planar electrodes each having a plurality of affixal perforations therein and oriented sequentially in spaced and substantially parallel relationship to said control electrode array to form a series of accelerating-collimating electrode planes wherein said respective plurality of beam apertures corresponds in array and number to the respective beam apertures in said control electrode array, each of said accelerating-collimating electrode planes having a respective electrical connection; a plurality of insulative electrode spacer means each having a plurality of affixal perforations therein and formed as substantially planar members for contiguous parallel positioning between said control electrode array and between said accelerating-collimating electrode planes to provide predetermined spacings therebetween, each of said electrode spacer means having framing means defining a central open portion, said individual members of said control electrode array being tautly bridged across said contiguous framing means; affixal means formed to provide aligned retention of said planar control electrode array, said plurality of accelerating-collimating electrode planes, and said plurality of insulative electrode spacer means by effecting alignment of the respective affixal perforations therein; cathode spacer means having provisions for supporting said cathode relative to said control electrode array to provide predetermined spacing between said shielding means, said electron emission means, and said control electrode array; a mesh lens element insulatively spaced from and positioned substantially parallel with the final of said accelerating-collimating electrode planes;

a cathodoluminescent screen disposed relative to said viewing area in said face panel whereupon a plural beam array is displayed; and electrical conductive means applied to the interior surface of said neck and funnel portions to effect an electrical connection between said electron gun structure and said screen.

12. A multibeam cathode ray tube having a longitudinal axis extending through an encompassing envelope formed of an integration of an extended neck portion having a stem closure with electrical connective leads therethrough, a funnel portion and a face panel having a viewing area, said tube internally comprising:

a multiple beam electron gun structure positioned within said envelope neck portion adjacent said stem closure in a manner substantially normal to said axis and comprising: thermionic electron emission means in the form of a cathode having a common emission plane; a metallic control electrode plane spaced from and substantially parallel with said electron emission plane, said control electrode plane being an array formed of a plurality of substantially self-supporting individual control electrode members positioned in laterally spaced relationship to one another with each individual electrode member having a substantially

hexagonal shaped central portion with a beam aperture therein, said electrode members being positioned in a manner whereof the hexagonal central portions of adjacent members are spatially nested in staggered orientation to provide a compact array of two parallel rows of apertures, each of said hexagonal portions having a supportive member extending longitudinally from either side thereof, one of said supportive members effecting a separate electrical connection to provide a plurality of spaced individually controlled electron beams; shielding means spaced relative to said electron emission means to control stray electron emission; a plurality of plural-apertured metallic planar electrodes each having a plurality of affixal perforations therein and oriented sequentially in spaced and substantially parallel relationship to said control electrode array to form a series of accelerating-collimating electrode planes wherein said respective plurality of beam apertures corresponds in array and number to the respective beam apertures in said control electrode array, each of said accelerating-collimating electrode planes having a respective electrical connection; a plurality of insulative electrode spacer means each having a plurality of affixal perforations therein and formed as substantially planar members for contiguous parallel positioning between said control electrode array and said accelerating-collimating electrode plane to provide a predetermined spacing therebetween, each of said electrode spacer means having framing means defining a central open portion, said individual members of said control electrode array being tautly bridged across said contiguous framing means; affixal means formed to provide aligned retention of said planar control electrode array, said plurality of accelerating-collimating electrode plane, and said plurality of insulative electrode spacer means by effecting alignment of the respective affixal perforations therein; cathode spacer means having provisions for supporting said cathode relative to said control electrode array to provide predetermined spacing between said shielding means, said electron emission means, and said control electrode array; a bi-potential lens in the form of spaced apart first and second cylindrical electrode members having substantially like diametrical dimensions being positionally aligned relative to the final of said accelerating-collimating electrode planes; said first and second cylindrical electrode members being spatially supported by at least three longitudinal insulative supports, said first electrode member being electrically connected to said final electrode plane to be of a common potential;

a cathodoluminescent screen disposed relative to said viewing area in said face panel whereupon a plural beam array is displayed; and electrical conductive means applied to the interior surface of said neck and funnel portions to effect an electrical connection between said electron gun structure and said screen.

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