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Harvey et al.

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[54] **MULTIPLE POSITION DISPLAY PANEL HAVING SPURIOUS GLOW SUPPRESSOR**

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[21] Appl. No.: **434,614**

Related U.S. Application Data

[63] Continuation of Ser. No. 217,781, Jan. 14, 1972, abandoned, which is a continuation of Ser. No. 78,045, Oct. 5, 1970, abandoned.

[52] **U.S. Cl.** **313/519**, 313/190, 313/217

[51] **Int. Cl.** **H01j 61/66**

[58] **Field of Search** ..... 313/109.5, 190, 210, 188, 313/217, 220; 315/169 TV

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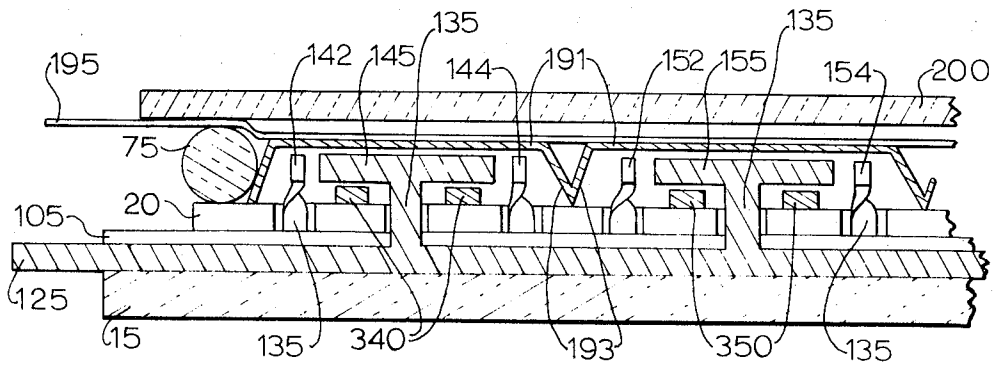
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[57] **ABSTRACT**

Display devices adapted to display one or more characters side-by-side in one or more rows and including several groups of display cathode segments positioned in a row, with corresponding segments in each group connected in common, an anode electrode associated with each group of the display segments, and an auxiliary electrode partially surrounding and electrically isolating each group of display segments. The cathode segments, together with an anode, can be selectively energized to display a character at any desired cathode group or position. The auxiliary electrode can be energized to inhibit electrical discharge between the display cathode segments and any other than the associated anode.

23 Claims, 6 Drawing Figures



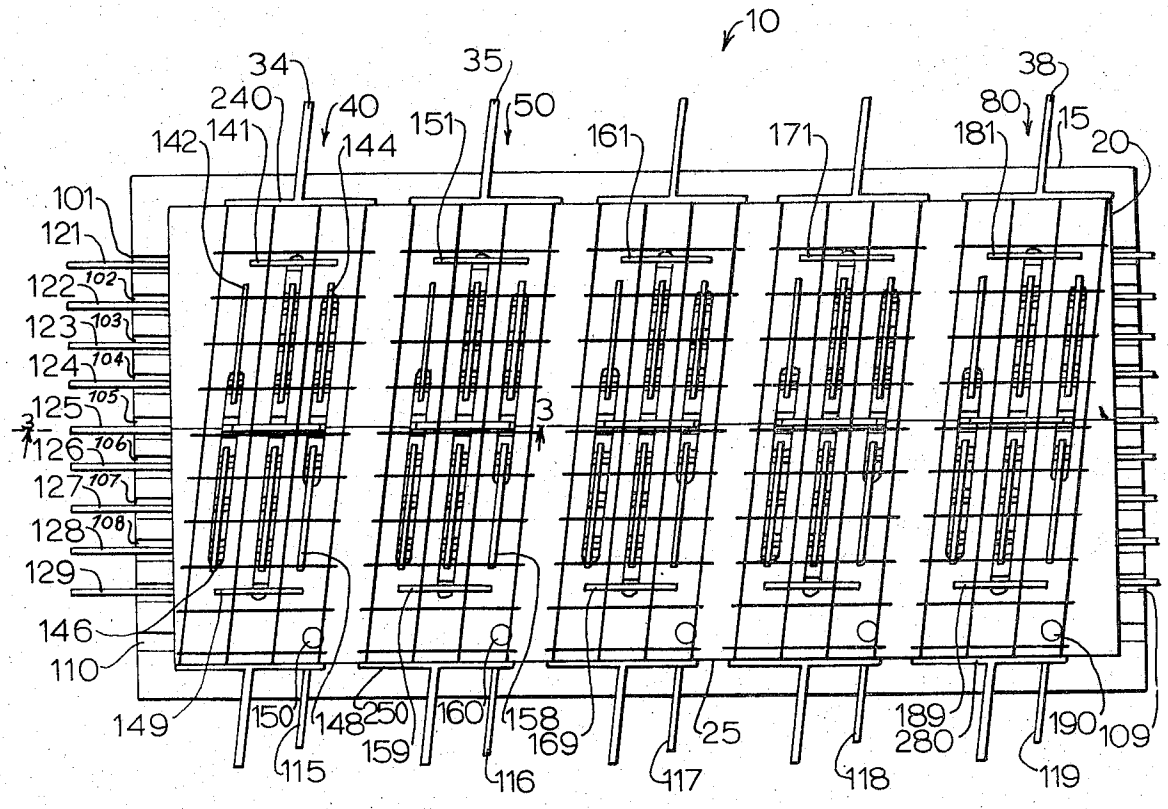


Fig. 1

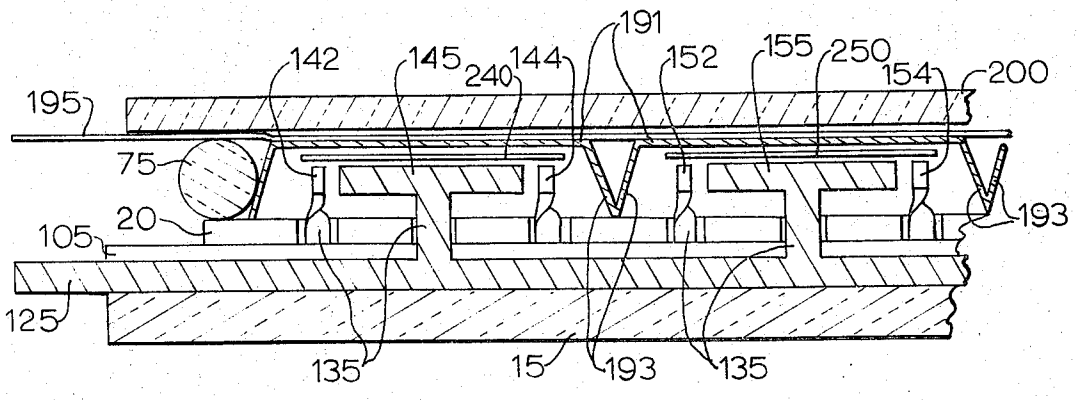


Fig. 3

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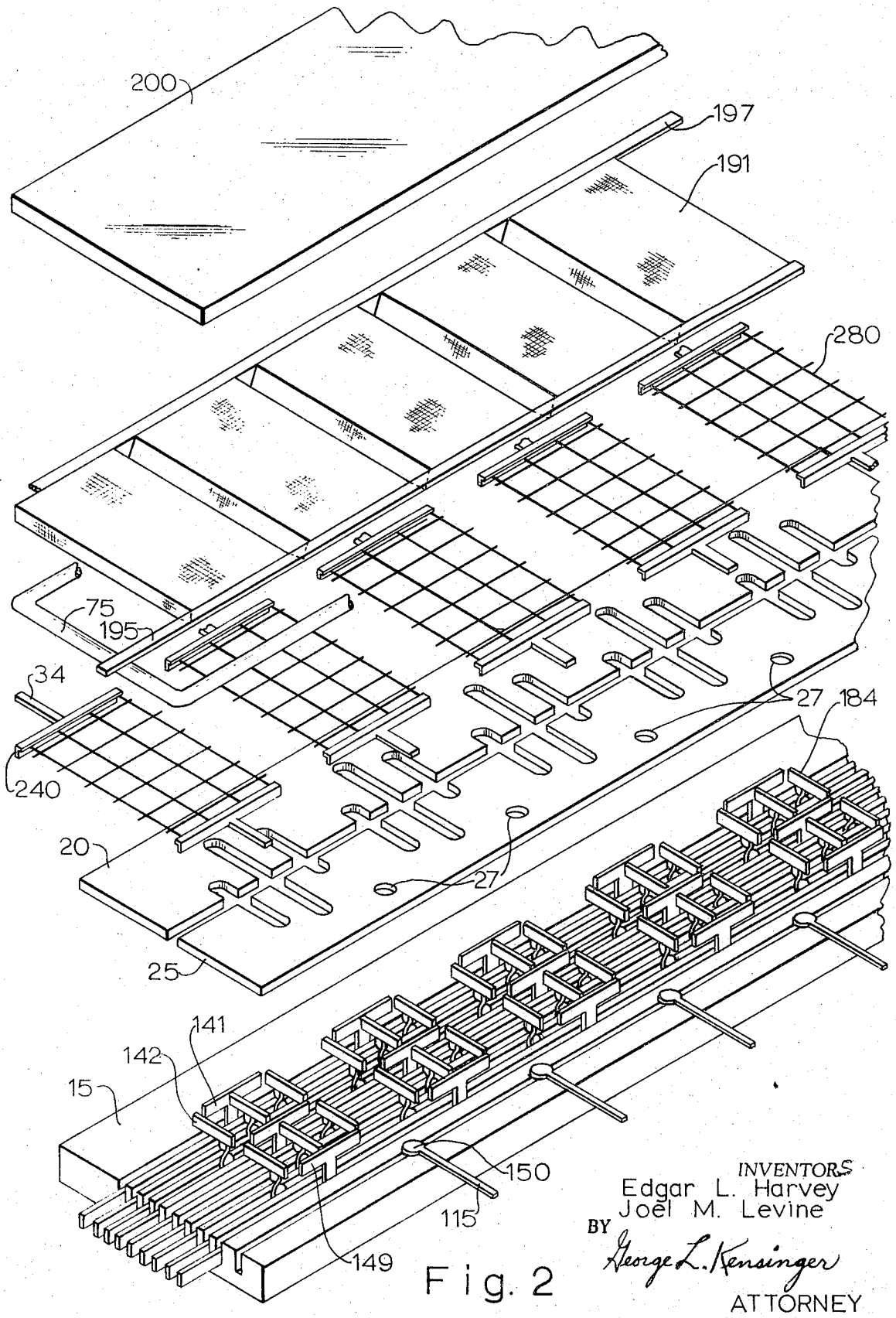


Fig. 2

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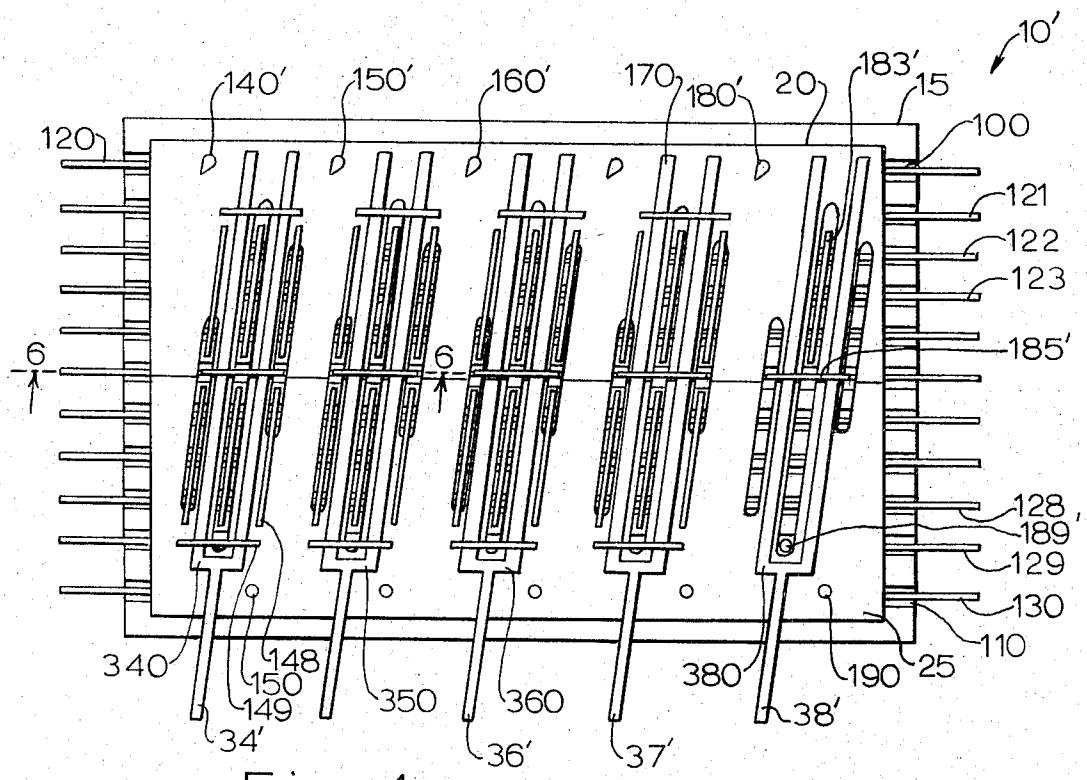


Fig. 4

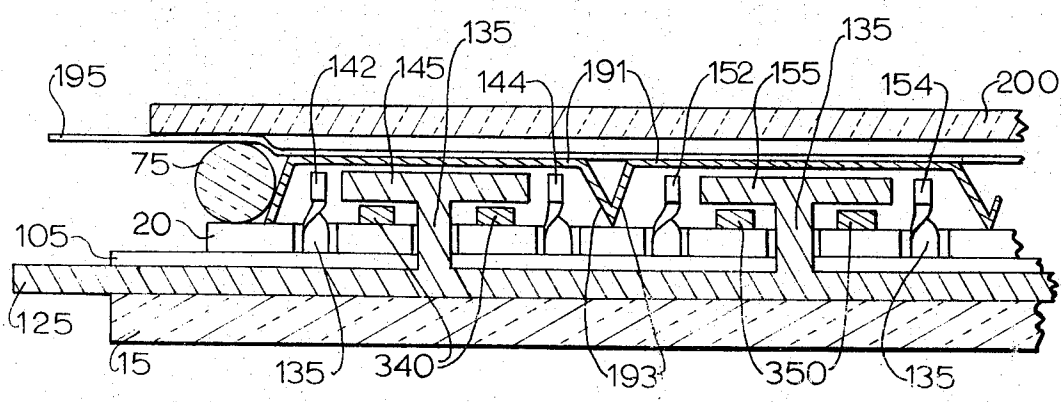


Fig. 6

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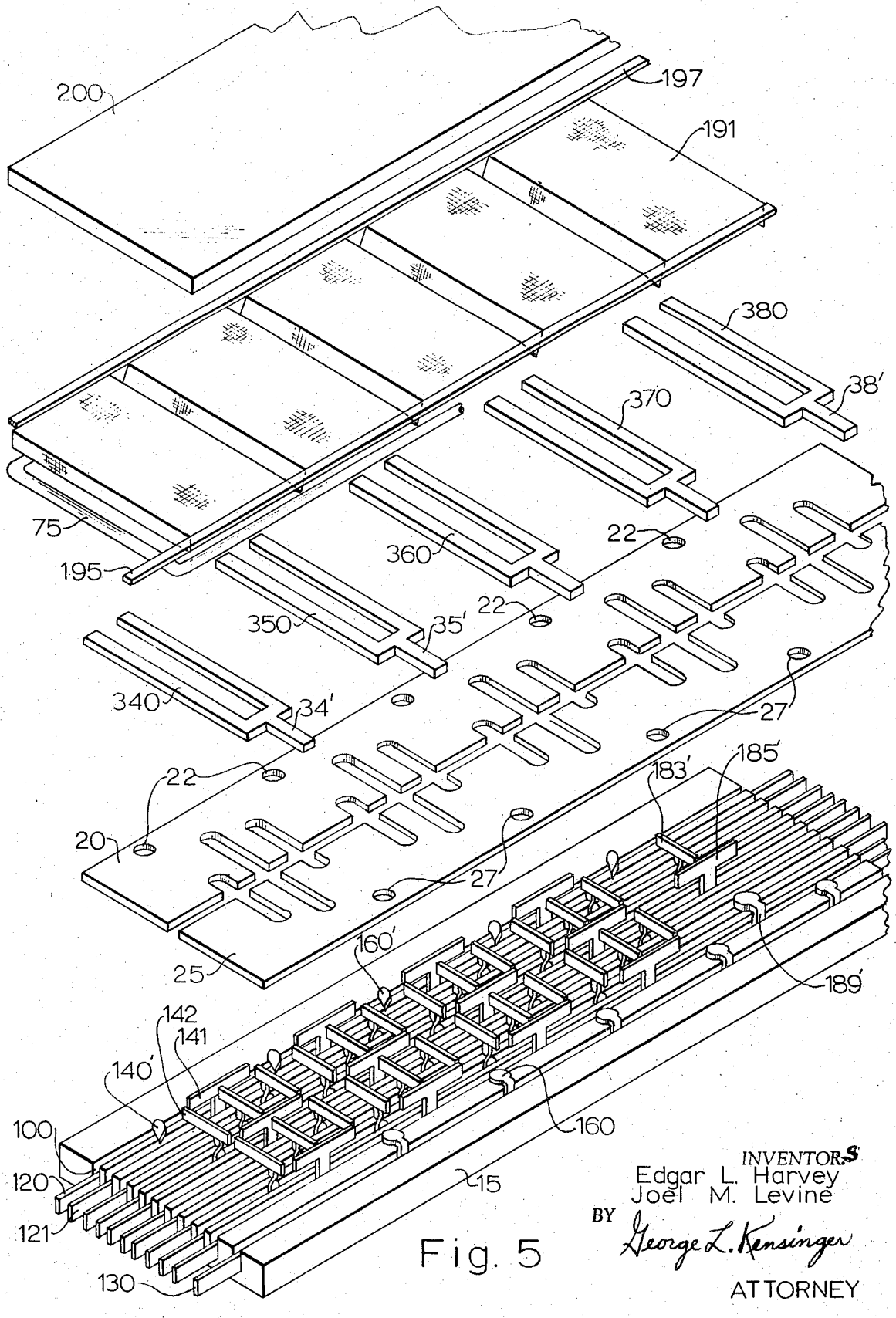


Fig. 5

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MULTIPLE POSITION DISPLAY PANEL HAVING SPURIOUS GLOW SUPPRESSOR

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of application Ser. No. 217,781, filed Jan. 14, 1972, and now abandoned, as a continuation of application Ser. No. 78,045, filed Oct. 5, 1970, and now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to electrical discharge display devices having multiple display positions.

Several such devices have been developed recently having a plurality of groups of display electrode segments positioned in a row in either a tube or a flat panel. These devices generally include electrical connections between corresponding display electrode segments in the display envelope and an anode electrode for each display position to enable a time-sharing mode of operation.

In operating such devices, the cathode electrode segments are selectively energized, together with an anode electrode, to provide an electrical discharge at a selected group of cathode segments to display a desired number or symbol. The electrical discharge between them ionizes the enclosed gas and results in cathode glow adjacent the selected cathode segments which displays the desired character.

It is desirable that the ionization discharge between the selected groups of display segments and the associated anodes be isolated from affecting the ON or OFF state of the other groups of display segments and their respective anodes.

Under some circumstances when one group of electrode segments is glowing and representing a character, spurious glow sometimes develops in an adjacent group of electrodes. Such spurious glow is, of course, undesirable.

Selected anode electrodes tend sometimes to discharge with energized cathode electrode segments in adjacent cathode groups as well as with the cathode segments with which they are associated. This develops spurious cathode glow in the adjacent position. Moreover, the discharge path between the energized anode electrode and the more distant cathodes of the adjacent position is relatively long and sometimes results in spurious positive column glow to them.

Also, in some multiple position display devices, exposed tabs are used to connect the cathode electrodes to common conductors or to terminal pins. The cathode glow on the selected cathode elements tends to spread over the exposed portions of these tabs. This spurious glow on the cathode connecting tabs is bright and distracting to the viewer.

SUMMARY OF THE INVENTION

Accordingly, an object of this invention is to suppress spurious glow in multiple position display devices having cathode electrodes connected in common.

Another object of the invention is to prevent cathode glow at unselected positions in such devices and positive column glow to energized anodes.

A further object is to prevent cathode glow at selectively energized cathode electrodes from spreading over the associated connection tabs when exposed in such devices.

According to the invention, an improved multiple position display panel includes a plurality of groups of display cathode elements, a screen-like or a shaped anode electrode associated with each group of the cathode elements, and spurious glow suppressing means electrically isolating the cathode elements from other than the associated anode, all disposed in an ionizable gas at a pressure capable of sustaining cathode glow.

The invention is applicable to multiple position display devices containing character-shaped cathodes, as well as to segmented electrode display devices. An additional feature of the invention is that the subject glow suppressor operates to reduce the deposit of sublimed cathode material onto the viewing window or envelope of the device.

Other advantages and features of the invention will become clear from the following detailed description, relating to the accompanying drawings, in which:

FIG. **1** is a plan view of the base assembly of a segmented cathode display panel having overlying anode screen electrodes;

FIG. **2** is an exploded view of a multiple position display panel utilizing the structure of FIG. **1** in the invention;

FIG. **3** is an elevational view of a longitudinal section of the display panel of FIG. **2**;

FIG. **4** is a plan view of the base assembly of a segmented cathode display panel having shaped anode electrodes positioned beneath the display electrode segments;

FIG. **5** is an exploded view of a multiple position display panel utilizing the structure of FIG. **4** in the invention; and

FIG. **6** is an elevational view of a longitudinal section of the display panel of FIG. **5.**

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The display panels described herein are thin, flat, sheet-like members which may have substantially any desired size and shape, and may include substantially any number of display positions. The panels may also include any suitable ionizable gas such as neon, argon, xenon, etc., singly or in combination, with a vapor of a metal such as mercury usually included in the gas to minimize cathode sputtering. A wide range of gas pressures may be used, for example from about 20 to about 250 Torr at ambient temperature, with about 75 Torr being a pressure which is commonly used.

A display device or panel **10** embodying the invention has a plurality of character display positions **40, 50, 60, 70** and **80,** at each of which a character, number, letter, symbol or the like can be displayed in a manner to be described. Five such positions are shown in FIG. **1.** It should be understood, however, that fewer or more positions may be provided and that, for convenience, five positions are not shown in all of the figures of the drawing. Each display position includes a plurality of display cathode segments **141–150, 151–160, 161–170, 171–180,** and **181–190** and anode mesh electrodes **240, 250, 260, 270** and **280,** respectively, one anode being provided for each group of cathode segments.

Display device **10** includes an insulating base plate **15** of glass, ceramic or the like, having a top surface in

which a plurality of parallel horizontal slots or grooves **101, 102, . . . 109** are formed. The top surface of bottom plate **15** may be coated with a dark, light-absorbent insulating material in order to improve optical contrast.

The cathode segments **141–149, 151–159,** etc., are secured to elongated cathode connectors or conductors **121, 122, 123, 124, 125, 126, 127, 128,** and **129** by means of cathode tabs **135,** the length of which determine the spacing of the cathode segments from the respective conductors. The elongated conductors **121** to **129** are seated in the slots **101** to **109** in base plate **15** and the tabs raise the segments above the top surface of plates **20** and **25** the desired distance.

The insulating plates **20** and **25** are formed of two slotted pieces which are inserted from opposite edges toward the center of the device. This insulating plate structure shields the cathode segment connectors from the anodes. The shield plate assembly comprises two identical insulating plates of mica or the like **20** and **25** which are darkened for improving optical readability. Each plate is approximately half the size of the base plate and the two, when fitted together, substantially completely cover the base plate and the cathode connectors.

Plates **20** and **25** are seated on the base plate with their facing inner edges meeting and abutting along the center line of the bottom plate. The plates are provided with suitable groups of slots which extend into the bodies of the plates from their facing edges respectively, and permit the plates to be inserted under the cathode segments, with the segment tabs **135** (FIG. **2**) entering the slots and one being positioned at the apex of each slot. The slots in sheets **20** and **25** and segment tabs **135** are properly dimensioned so that they mate with each other. As shown, the slots in plate **25** receive the tabs **135** of the lower group of cathode segments and the slots in plate **20** receive the tabs **135** of the upper group of cathode segments and they share the tabs of each of the center cathode segments. The slots are as narrow as possible so that they provide optimum shielding for the cathode conductors **121–130** beneath them as in FIG. **4.**

The cathode conductors **121** to **130** are of a glass-sealable metal such as one of the known nickel-iron alloys or the like and they may be relatively flat strip material or they may be wire-like, and each carries one of the cathode segments of each group. The cathode segments are suitably spaced apart along each conductor so that each occupies the same relative position at each display position in the panel. The cathode segments and the tabs **135** may be integral with the conductors **121** to **130** or they may be separate pieces welded or otherwise secured together. An integral construction is preferred and can be achieved with a photochemical etching process or a stamping process which produces conductor strips having cathode segments spaced apart and all oriented parallel to the conductor. The cathode segments which are to be oriented at an angle to their conductors, as shown, are twisted in any suitable fashion after the conductors are set into the slots in the base plate or before.

To summarize, and referring to FIG. **2,** cathode conductor **121** is seated in slot **101** and carries cathode segments **141, 151, 161,** etc.; conductor **122** is seated in slot **102** and carries cathode segments **142, 152, 162,** etc.; conductor **123** is seated in slot **103** and carries cathodes **143, 153, 163,** etc.; conductor **124** is seated in slot **104** and carries cathodes **144, 154, 164,** etc; conductor **125** is seated in slot **105** and carries cathodes **145, 155, 165,** etc.; conductor **126** is seated in slot **106** and carries cathodes **146, 156, 166,** etc.; conductor **127** is seated in slot **107** and carries cathodes **147, 157, 167,** etc.; conductor **128** is seated in slot **108** and carries cathodes **148, 158, 168,** etc.; conductor **129** is seated in slot **109** and carries cathodes **149, 159, 169,** etc. Conductor **130** is seated in slot **110** and carries cathodes **150, 160, 170,** etc. in the embodiment of FIGS. **4** and **5.**

As illustrated and as well known, each group of segments described is arrayed in a segment pattern and these can be used to form the numerals zero to nine, many alphabetic letters, and other characters or symbols. Electrode segments **150, 160, 170,** etc., are usable to represent auxiliary characters such as decimal points, commas or the like.

The grooves **101** to **108** are sufficiently deep so that cathode conductors **121** to **128** lie below the top surface of plates **20** and **25** and are substantially completely hidden therein with only the cathode segments and portions of their tabs **135** extending above the top surface of the plates as illustrated in FIG. **3.** The grooves are sufficiently narrow so that, in operation of the panel, the cathode connectors or conductors do not glow beneath them. However, under some circumstances, the top surfaces of these conductors which "see" the anode electrodes **140, 150,** etc., may glow. This glow can be prevented by coating the top surfaces of these cathode conductors with glass or the like or by filling the grooves with an insulating material such as a glass frit, or by means of insulating shield plates.

Slotted insulating sheets **20** and **25** are inserted between the protruding display segments **141–149, 151–159,** etc. and the common elongated cathode conductors **121–129** either before they are placed in slots **101–109** of the base plate **15** or afterwards. Apertures **27** are provided in the slotted insulating piece **25** in registration with decimal point electrodes **150, 160, 170,** etc. to accept and expose them to the mesh screen anode electrodes **240, 250, 260,** etc.

The series of holes **27** lie near the lower edges of insulating plate **25** and of the display panel and at the lower right-hand portions of each group of cathode segments. These apertures accept or expose additional cathodes useful, for example, to represent a decimal point, comma, or the like. Such cathodes comprise conductive disks **150** to **190** located at the ends of conductors **115** to **119** in the embodiment of FIGS. **1** and **2** and positioned beneath the holes **27.** This cathode electrode assembly is positioned and held in place between the mica plate or sheet **25** and the bottom plate **15.** Each cathode conductor or lead **115** to **119** extends out of the panel and is accessible to external circuit connection.

The anode electrodes **240** to **280** may be rectangular members etched from thin metal sheets and supported over the groups of cathodes in one embodiment, as shown schematically in FIGS. **1** and **2.** They are large-area screens or other foraminous members, each overlaying its group of cathode segments. Each anode screen or mesh electrode has contact tabs or leads **34, 35, . . . 38,** respectively, which extend from opposed portions thereof. The anode screens may be supported on base plate **15** and insulating plates **20** and **25** to raise

them above and insulate them from the cathode segments as shown in FIGS. 2 and 3. Alternatively, the anodes might be provided with the end walls (FIG. 2) which rest on the top surface of the bottom plate 15. The anodes' end walls might also include tabs which can be inserted in holes in the base plate or in an apertured plate such as plates 20 and 25.

An insulating ring 75 of glass or the like, formed of one or more pieces, is seated on the mica plates and extends around the edge of the panel. Anode screens 240 to 280, generally as described above, are seated on insulating plates 20 and 25, each overlying and in operative relation with one group of cathode segments 40 to 80.

The device also incorporates an auxiliary electrode structure 191 positioned above the anode electrodes 240 to 280 and having downwardly extending ridges or side walls 193 which rest against insulating plates 20 and 25 between adjacent groups of the cathode segments. Electrode terminals or leads 195 and 197 are affixed at opposite ends as indicated in FIGS. 2 and 3, although only one such external lead is necessary. Auxiliary electrode 191, having leads 195, 197, is thus a conductor to be used to establish electrical contact, from outside the device if desired, with the non-metallic circuit between the energized cathodes and anodes.

Auxiliary electrode structure 191 is preferably a foraminous electrode since the cathode glow is ordinarily viewed through it, and it is preferably formed of a thin flat sheet of nickel-iron alloy suitably etched or stamped, although it may be formed of sections shaped and welded together, for example. In one embodiment, auxiliary electrode 191 is etched or chemically milled from a single sheet of metal with integral leads 195 and 197 and then suitably deformed to provide ridges 193. In another embodiment, auxiliary electrode 191 is fabricated from an etched metal screen suitably folded to form ridges 193 and welded to electrode leads 195 and 197.

The function of auxiliary electrode 191 is to prevent or inhibit the development of spurious cathode glow and the sometimes attendant positive column glow in multiple position display devices. To achieve this suppression of spurious discharge and glow, electrode 191 is preferably biased with a reference potential greater in magnitude than the potentials applied to the cathode electrodes and less than that applied to the anode electrodes. The potential difference between electrode 191 and both the anode and the cathode electrodes should not exceed the ionization or breakdown voltage characteristic of the particular device.

In summary, auxiliary electrode 191 partially surrounds each group of cathode electrode segments 40, 50, 60, 70, 80, and electrically isolates each of them from discharge with anode electrodes of adjacent display positions. For example, anode electrode 240 is limited to discharging with only cathode segment group 40, anode electrode 250 is limited to discharging with only cathode segment group 50, etc. This is assured by electrode 191 since it effectively shields and electrically suppresses discharge between adjacent display positions. Auxiliary electrode 191 operates to conduct leakage current arising from spurious discharge or conduction in the display device and thus suppresses or prevents spurious glow therein.

A transparent or translucent glass cover plate 200 (FIG. 6) completes the panel 10, and plates 15, 20, and 25 are hermetically sealed together along their adjacent edges by a seal formed with a glass frit or a ceramic material such as Pyroceram (not shown). The panel is filled with the desired gas through a tubulation (not shown) secured to base plate 15, or in any other suitable manner.

In the operation of display device 10 to display a plurality of numerals, relatively negative information signals are applied to one or more cathode conductors 21, 22, 23, . . . 28 from a suitable data source, and a generally positive potential may be applied to the first anode 240. The selected ones of cathode segments 41–47 which are thus energized, glow and display a first numeral at the first display position 40. A second group of information signals is applied to selected ones of the cathode conductors 21–27, and the second anode 250 is energized, and a second numeral is displayed by the selected ones of cathode segments 51–57 at second display position 50. In the same way, the successive application of different information signals to selected cathode conductors and to the anodes, in turn, causes a character to be displayed at each character position. If this sequence is repeated through the display device from one end to the other at a sufficiently high rate, a stationary but changeable series of numerals can be displayed in the panel, one at each character position. As the cycling operation is carried out, if the information signals on the cathode conductors change, then the characters at the respective display positions also change.

The above-described mode of operation utilizes sequential time-shared driving of anode electrodes 240–280 of the device. This sequentially energizes the successive display positions 40–80, for example, along the device. Another mode of operation involves time-shared driving of the cathode electrode segments. The anode electrodes 240–280 are selectively energized from a data source, for example, and cathode connectors 121–129 (connectors 120–130 in FIGS. 4 and 6) are energized successively for sequencing the display. The energization of the anode electrodes 240 to 280 may be changed as desired for varying the pattern of the display. The anodes and cathodes may be energized in any other desired order also, depending upon the desired mode of display.

In the embodiment of FIGS. 4–6, additional cathode elements 140', 150', 160', 170', and 180', are connected in common to cathode conductor 120 seated in groove 100 in base plate 15. Cathode elements 140'–180' are useful for marking off decimal orders of thousands, millions, etc. in a numerical display or for representing a prime, apostrophe, or the like. Also, decimal point electrodes 150, 160, 170, 180, and 190 are connected in common to cathode conductor 130 seated in groove 110 in base plate 15. Special symbol segments may also be incorporated in the device as illustrated by cathode elements 183', 185', and 189', in the right-most position of display device 10' of FIGS. 4–6.

The anode electrodes 340, 350, 360, 370, and 380 of the embodiment of FIGS. 4–6 are generally rectangular, and each is shaped to have an axial slot along part of its length to enable it to be inserted under the corresponding cathode segments 140'–150, 150'–160, 160'–170, 170'–180, 180'–190. Anode leads 34', 35',

. . . 38' are affixed to the bases of anodes **340 350, . . 380,** respectively, and extend out of the device, as shown. The anodes **340–380** are formed of thin pieces of suitable metal and, with the attached or integral leads **34'–38'**, resemble the configuration of thin tuning forks, although other shapes and configurations may, of course, be used.

The slots in anode electrodes **340–380** are made wide enough to admit cathode segment tabs **135** with clearance as shown in FIG. **6.** The prongs or legs of anode electrodes **340–380** are shaped, however, to lie close enough to segment tabs **135** so that cathode glow on tabs **135** is inhibited during operation of the device.

Apertures or holes **22** are provided in insulating sheet **20** to accept or expose cathode elements **140', 150', 160', 170',** and **180'** as shown in FIG. **5.** Otherwise, the structure and operation of the embodiment illustrated in FIGS. **4–6** is similar to that of the embodiment of FIGS. **1–3.**

Although the preferred embodiments of the invention have been described in detail, it should be understood that the present disclosure has been by way of example only. Many modifications and variations of the invention are possible in light of the above teachings. It is, therefore, to be understood that the invention may be practiced otherwise than as specifically disclosed.

What is claimed is:

1. A display panel comprising

a sealed gas-filled envelope having a viewing window and including an insulating base plate having top and bottom surfaces,

a plurality of elongated conductors supported on said base plate and each carrying a plurality of cathode electrode segments spaced apart along its length and spaced from the surface of the base plate,

said segments being arrayed in groups on said conductors, with a segment of different conductors being included in each group and each group comprising a display position in said panel,

an anode electrode positioned beneath said cathode segments and adjacent the base plate in operative relation with each said group of cathode segments, and

an auxiliary electrode electrically isolating the segment groups with their associated anode electrodes from each other.

2. The display panel of claim **1** further comprising slotted insulating means for supporting the plurality of elongated conductors along at least a portion of their lengths.

3. A multiple-position character display panel comprising

an insulating plate having top and bottom surfaces,

a plurality of electrode connectors disposed on said plate,

a plurality of cathode electrode segments spaced apart and coupled to each of the said connectors,

an anode electrode for each character position situated proximate a corresponding group of the cathode segments,

slotted insulating means positioned about the junctions of said cathode segments and said electrode connectors,

a spurious glow inhibiting electrode electrically isolating the cathode segments from all anodes other than their associated anode electrodes, and

a gaseous atmosphere sealed in a light-transmitting envelope surrounding the cathode segments and the anode electrodes, including an ionizable gas at a pressure capable of sustaining cathode glow discharge.

4. The display device of claim **3** wherein the cathode electrode segments are carried by the electrode connectors and the anode electrodes comprise a plurality of slotted conductive members having slots for receiving said junctions of the display segments.

5. A segmented electrode character display panel comprising

an insulating plate having top and bottom surfaces and a plurality of grooves therein,

a plurality of elongated conductors, each disposed in one of said grooves and carrying a protruding cathode electrode segment for each character position,

second insulating means providing a light-transmitting enclosure with the insulating plate over the cathodes,

an anode electrode for each character position situated proximate the corresponding group of display segments,

an auxiliary electrode partially surrounding and electrically isolating the cathode electrode segments from all anodes other than the associated anode electrodes, and

a gaseous atmosphere sealed in the enclosure between the insulating members, including an ionizable gas at a pressure capable of sustaining cathode glow discharge.

6. The segmented electrode character display panel of claim **5** wherein the anode electrodes comprise planar mesh screen members situated proximate the associated groups of cathode segments and third insulating means isolates the elongated conductors between cathode segments from discharges in the panel.

7. The segmented electrode character display panel of claim **5** in which the anode electrodes comprise slotted conductive members inserted beneath the associated groups of cathode segments and the auxiliary electrode comprises an elongated foraminous member overlying the cathode segments and having ridges extending downwardly between adjacent segments on the elongated conductors.

8. A multiple position display panel comprising

a sealed gas-filled envelope having a viewing window and including an insulating base plate having top and bottom surfaces,

a plurality of elongated conductors supported on said base plate and each having a plurality of cathode electrode segments coupled to it along its length by connecting tabs,

the segments being positioned on said conductors in groups, with one segment of each conductor included in a group and each group comprising a display position in said panel,

a pair of slotted insulating plates which abut against each other over said conductors, with segment connecting tabs situated within the slots,

an anode electrode positioned in operative relation with each group of the cathode segments, and

an auxiliary electrode partially surrounding and electrically isolating each cathode segment group with its associated anode electrode.

9. The multiple position display panel of claim 8 in which the cathode electrode segments are metal strips carried by the elongated conductors and selected ones of the strips and their connecting tabs are twisted at angles to said conductors to form character display matrixes in the panel.

10. The multiple position display panel of claim 8 wherein the slotted insulating plates are positioned with their slots opposing one another over the elongated conductors and the anode electrodes are slotted for receiving connecting tabs beneath the cathode segments but above the opposed insulating plates, the auxiliary electrode overlying the segments.

11. A display device comprising

a sealed envelope having a viewing window and including an insulating base plate,

a plurality of groups of cathode segments, said groups being disposed side-by-side along a surface of the base plate,

a plurality of elongated conductors extending along that surface of the base plate and being coupled to the cathode segments by connecting stems,

an insulating layer situated over the elongated conductors and having openings through which pass the connecting stems for the cathode segments,

an anode for each group of cathode segments having at least two substantially flat members separated by a slot and being positioned beneath the cathode segments of the associated group about their connecting stems above the insulating layer so that the slot(s) receive the stems and the anode is spaced from the cathode segments and their stems, and

a gaseous atmosphere sealed in the region surrounding the cathode segments and the anodes, including an ionizable gas at a pressure capable of sustaining cathode glow discharge.

12. A display device comprising

a sealed envelope having a viewing window and including an insulating base plate,

a plurality of groups of cathode segments, said groups being disposed side-by-side along a surface of the base plate,

a plurality of elongated conductors extending along that surface of the base plate and being coupled to the cathode segments by connecting stems,

an insulating layer situated over the elongated conductors and having openings through which extend the connecting stems for the cathodes,

an anode for each group of cathode segments disposed beneath the cathode segments of the associated group about their connecting stems and above the insulating layer and spaced from the cathode segments and their connecting stems, and

a gaseous atmosphere sealed in the region surrounding the cathode segments and the anodes, including an ionizable gas at a pressure capable of sustaining cathode glow discharge.

13. The display device of claim 12 wherein the anodes comprise substantially flat conductive members situated on the insulating layer and having at laeast one slot for receiving the connecting stems of associated cathode segments without contact.

14. The display device of claim 12 wherein the anodes comprise slotted conductive members having at least two substantially flat fingers separated by a slot of suitable shape for receiving the connecting stems of associated cathode segments in spaced-apart relationship.

15. A display device comprising

a sealed gas-filled envelope including an insulating base plate and a face plate having a viewing window,

a plurality of groups of cathode segments disposed side-by-side above the top surface of said base plate,

a plurality of elongated conductors which extend adjacent to the top surface of said base plate and are coupled to the cathode segments, corresponding cathode segments in each group being connected to the same conductor,

an insulating layer disposed between said elongated conductors and said cathode segments, and

an anode electrode for each group of cathode segments positioned beneath the cathode segments of each group and between said cathode segments and said insulating layer.

16. The display device of claim 15 wherein said anode electrodes have terminals disposed along a side of said base plate, and said elongated conductors extend from at least one end of said base plate as terminals for the cathode segments to which each is connected.

17. The display device of claim 15 wherein said device includes relatively long opposed top and bottom edges and opposed ends, and said anode electrodes have their terminals disposed along one of said long edges, and said elongated conductors are externally accessible at at least one of said ends.

18. A display device comprising

a sealed gas-filled envelope including an insulating base plate and a face plate having a viewing window,

a plurality of groups of cathode segments disposed side-by-side above the top surface of said base plate,

a plurality of elongated conductors which extend adjacent to the top surface of said base plate and are coupled to the cathode segments, corresponding cathode segments in each group being connected to the same conductor,

an insulating layer disposed between said elongated conductors and said cathode segments,

an anode electrode for each group of cathode segments positioned beneath the cathode segments of each group and between said cathode segments and said insulating layer, and

a shield electrode having a portion in operative relation with each of said groups of cathode segments.

19. A display panel comprising

a sealed gas-filled envelope including an insulating base plate and a face plate having a viewing window,

a plurality of groups of cathode segments disposed side-by-side above the top surface of said base plate,

a plurality of elongated conductors which extend adjacent to the top surface of said base plate and are coupled to the cathode segments, corresponding cathode segments in each group being connected to the same conductor, and

an anode electrode for each group of cathode segments positioned beneath the cathode segments of

each group and between said cathode segments and said base plate.

20. The display panel of claim **19** wherein said anode electrodes having terminals disposed along a side of said base plate, and said elongated conductors extend from at least one end of said panel as terminals for the cathode segments to which each is connected.

21. The panel defined in claim **19** wherein said cathodes comprise metal strips and each said anode comprises at least one metal strip.

22. The display device of claim **19** wherein said panel includes relatively long opposed top and bottom edges and opposed ends, and said anode electrodes have their terminals disposed along one of said long edges, and said elongated conductors are externally accessible at at least one of said ends.

23. A display panel comprising

a gas-filled envelope having a viewing window and a base plate hermetically sealed thereto along a predetermined perimeter, said base plate having a top surface facing said viewing window,

an ionizable gas within said envelope at a pressure capable of sustaining glow discharge,

a plurality of groups of cathode segments disposed along said base plate and adjacent to the top surface thereof facing said viewing window, each group of segments comprising a character position at which a character can be displayed by selected glowing cathode segments,

a plurality of common cathode conductors for making contact to said cathode segments and for connecting said cathode segments to external circuit elements,

said cathode segments comprising metal strips, each secured to a common cathode conductor, each common cathode conductor thus being connected to the same cathode strip in each said group, and

an anode electrode associated with each group of cathode segments, each such anode electrode including a metal strip disposed beneath its group of cathode segments remote from said viewing window.

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