DISPLAY PANEL ELECTRODE TERMINATION

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ABSTRACT

Display panels including an insulating base plate and a cover plate which extend beyond the display region of the device with electrode terminals disposed on at least one of them to facilitate connection of the device. The devices include a plurality of groups of cathode segments disposed on a base plate with corresponding segments connected in common to cathode terminal pads along an edge of the base plate. The anode electrodes provided for the cathode groups have leads that terminate along an edge of the cover plate which is parallel to the cathode terminals. A connector or a suitably aligned row of protruding contacts establishes electrical connection to the electrodes of the device when mated with the electrode terminals on the cover plate and on the base plate. The contacts are deformed when mated with the device to provide pressure or friction contact with the electrode terminals and the connector may be shaped to receive one or more tabs extending out of the device for securing them together and for providing another electrical connection to the device, if desired.

56 Claims, 9 Drawing Figures
DISPLAY PANEL ELECTRODE TERMINATION
CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation of application Ser. No. 201,655 filed Nov. 24, 1971, now abandoned.

BACKGROUND OF THE INVENTION

Various numerical indicator devices for digital readouts and the like have been available for a long time. The NIXIE numerical indicator tube has been widely utilized as the indicator unit in many of those applications for many years. More recently, various segmented cathode display devices, including the PANAPLEX numeric panel display, have been made available for use in such displays.

The PANAPLEX numeric display device includes a plurality of groups of segmented cathodes arranged in several character display positions in a unitary panel structure, which can be driven in a multiplex mode for displaying any desired series of numbers or the like. Each group of cathode segments is provided with an associated anode electrode and can display any of several different characters.

One form of PANAPLEX display panel is formed like a sandwich and includes a base plate on which a plurality of groups of the cathodes and their leads or connectors are formed, by a screening or printing process or the like. The cathodes are in the form of bars or segments and can display a variety of different characters or symbols. Such panels also include a face plate spaced from the base plate, and carrying transparent conductive anodes, each associated with a group of the cathodes. The anodes are shaped and positioned to properly cooperate with their associated groups of cathodes, yet with minimum cross-talk between different groups of cathodes in adjacent character positions.

The conductors connected to the various cathode segments usually run along the length of the tube and are brought straight out to one or both ends of the base plate on which they lie. Similarly, the leads or conductors connected to the transparent anode electrodes on the under side of the face plate are usually brought out near an edge of the face plate to terminals so that connection can be made to them.

Various techniques such as soldering, the use of a conductive paste or epoxy, or the clamping of connector contacts onto the electrode terminals at the ends of the device have been previously employed for external connection to the electrodes. There has been a need, however, for an improved termination and connection arrangement for display panels and similar devices that would be more simple, reliable, and inexpensive. A termination and connection scheme has also been needed that would be easily securable for maintaining the connection or contact, once established, so that neither clamping nor adhesion of connector contacts to the terminals would be required.

SUMMARY OF THE INVENTION

Accordingly, an object of this invention is to improve the electrode termination arrangement in information display units such as multiple-position character display devices of the segmented electrode type.

Another object of the invention is to improve the electrode terminal arrangement and the connection scheme for the electrodes of bi-planar electrical devices, particularly segmented character display panels.

A further object of the invention is to simplify and reduce the cost of reliably connecting and mounting multiple-position character display panels, with suitably low electrical resistance and requiring only a minimal number of parts.

In accordance with these objects, there is provided a multiple-position character display panel including a plurality of groups of cathode electrode segments disposed on an insulating base plate upon which a plurality of connectors or conductive runs are provided for interconnecting corresponding ones of the cathode segments among the groups in the device. The ends of the cathode connectors or conductors are arranged to terminate along one edge of the base plate. The cathode electrode segments are insulated from the cathode connectors or conductors except where each of them is joined or coupled to one of the cathode connectors. An anode electrode is associated with each group of cathode segments to cooperate with them, when they are energized, to display a desired character or symbol. A cover plate is suitably spaced from the base plate and the assembly is sealed around the edges of them. Leads connected to the anode electrodes are brought out to an edge of the device, preferably the same edge as the terminals of the cathode electrodes, to allow for the insertion of connector contacts to mate with them between the plates.

The connector contacts are shaped resilient spring members which may be supported in a suitable housing or in a printed circuit (PC) board. Tabs may extend out from the display panel to mate with the connector housing or the PC board as a guide for contact insertion, and for maintenance of the connection by a pin, set screw or other means, if desired. With this arrangement the body of the display device may be cantled at any desired angle from the connector housing or from the PC board to which it is connected.

DESCRIPTION OF THE DRAWINGS

Other advantages and features of the invention are made clear in the following description, relating to the attached drawings, wherein:

FIG. 1 is an exploded view of a display panel;
FIG. 2 is a detailed view of the base assembly;
FIG. 3 is a section taken at line 3—3 of FIG. 1;
FIG. 4 is a section of the device taken at line 4—4, and showing connector contacts engaged with it;
FIG. 5 is a section view through the electrode terminals showing connector contacts mated with them;
FIG. 6 is a partial, perspective view of a display panel having a connector engaged with it;
FIG. 7 is a perspective view of a panel connected to and supported by a printed circuit board;
FIG. 8 is a section of another arrangement for connecting and supporting a device from a PC board; and
FIG. 9 is an enlarged view of a portion of a suitable connector for such devices.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The display panels described herein are thin, flat, sheet-like members which may have substantially any desired shaped and size, and may include substantially any number of character display positions. The panels may 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 70 to 120 Torr being a commonly used pressure range.

Referring to FIGS. 1-3, a display device 10 embodying the invention includes an insulating base plate 20 of glass, ceramic, or the like, with an inexpensive glass being suitable and preferred. A plurality of conductive connectors or runs 30A to 30G are formed on the top surface of the insulating plate 20. The runs 30 are parallel to each other and are aligned with the horizontal axis of the base plate. Seven such runs 30A to 30G are shown; however, more or fewer may be provided, the number being determined by the total number and type of characters to be displayed. The runs 30 may be formed by an evaporation process, a silk-screen process, an electrolytic plating process or the like, or they may be discrete strips of metal, heat-sealed, and plasma-sprayed, or otherwise secured to the insulating plate 20. A silk-screen printing process is particularly suitable because it is fast, efficient, and reproducible.

A second thin layer 40 of insulating material such as glass or ceramic is formed on the conductive runs 30, preferably by a silk-screen process, and the second layer 40 includes a plurality of groups of vias or apertures 50A to 50G, each aperture exposing one of the runs 30A to 30G. Thus, each group of apertures includes aperture 50A which exposes run 30A, aperture 50B which exposes run 30B, aperture 50C which exposes run 30C, etc. Four such groups of apertures are illustrated.

Panel 10 includes a group of cathode electrodes 60 (A to G) for each group of apertures 50. The cathodes are generally elongated bars or segments, and they are usually arranged in a figure "8" pattern, as is well known in the art. The cathodes 60 may be formed on insulating layer 40 by means of a silk-screen process using a conductive paste such as palladium-gold, platinum-gold, palladium-silver, or the like. Each cathode element is in contact with one of the runs 30 exposed by one of the apertures or vias 50, and it substantially fills the aperture 50 and covers a portion of layer 40 to achieve the desired shape and size.

The cathodes 60A, 60B, etc. may also be formed of discrete strips of metal, preferably brazed to a conductive run 30 by means of a mass of brazing material deposited in each of the apertures 50 in the insulating layer 40. The brazing material itself may be deposited by a silk-screen process. One suitable brazing material is a gold-germanium substance known as FORMON and sold by E. I. du Pont de Nemours & Co. The cathodes may also be formed in any other suitable manner such as by electrolytic or electrolyless plating of nickel or the like, or by arc plasma spraying through a suitable mask.

Thus, cathodes 60 are preferably thin, flat members which do not project to any significant extent above the top surface of the insulating layer 40.

Panel 10 includes anode electrodes 90 for the groups of cathode electrodes 60. The anode electrodes comprise thin, transparent conductive films of gold, NESA, or the like formed on the lower surface 95 of the panel face plate or viewing plate 100 which is made of glass. The anode films are of the order of a few Angstroms thick and, in effect, are coplanar with the bottom surface 95 of the face plate. Thus, the anodes, for all practical purposes, do not project into the gas discharge space in the panel. The anode films are generally rectangular in shape, or are otherwise shaped, depending on the orientation of the cathodes. Anodes 90 are dimensioned and positioned so that they overlay the total area defined by the associated group of cathode electrodes. If desired, each anode 90 may be somewhat narrower and shorter than the area defined by its cathodes as shown, but in any case, the anode must overlay and be in operative relation with a sufficient portion of each of its cathodes. Other suitable anode shapes may be employed, depending upon the character and symbol configuration of the cathodes to be operated.

Preferably, the spacing between each anode 90 and its group of cathodes 60 should be of the order of 20 to 25 mils, and the spacing between each anode and the adjacent group of cathodes should be of the order of 30 to 40 mils. With this relationship at the usual pressure range, each anode is in a favorable operating position with respect to its own cathodes, but is sufficiently remote from adjacent groups of cathodes so that the panel may be operated over a suitably wide range of potentials without developing cross-talk between adjacent groups of electrodes. Another factor tending to prevent cross-talk is the location of the anodes in substantially coplanar relation with the surface of the glass cover plate and not projecting into the gas space in which cathode glow takes place.

The top glass cover plate 100 is of substantially the same length as the insulating layer 40 and the bottom plate 20, and it is spaced from the base plate 20 by an insulating frame 110 which is disposed between them. The illustrated frame 110 includes a flat metal piece 114 coated with glass or ceramic layers 112 and 116. Alternatively, rectangular frame 110 may be formed entirely of glass or ceramic or it may be an integral part of the top and/or bottom plates. This frame member thus provides the desired spacing between the anodes 90 and the associated groups of cathode electrodes 60. The three glass members 20, 100, and 110 are sealed together in any suitable manner, for example, by means of a seal 120 formed of a glass frit or the like.

In addition to serving as a spacer between top and bottom insulating plates 100 and 20, rectangular frame 110 also serves to define the glow discharge regions for the various character display positions, as illustrated in the embodiment of FIG. 1. Rectangular frame 110 includes an edge or border around its periphery together with several legs connected to its longer sides that lie between adjacent character display positions and electrically separate them from each other. The barriers thus provided between adjacent display positions include metal ribs or "rungs" which are integral with layer 114 of the frame in the preferred embodiment. Rectangular frame 110 also includes protruding ears or tabs 115, preferably at the lower edge of the panel where the runs 30 terminate, which may be used as connector guides and as a means of securing a connector to the device, as will be discussed. The ribs, or rungs, of frame 110 are not illustrated in FIGS. 3 and 4 for convenience and clarity.

The conductive runs 30 which interconnect the cathode segments 60 do not extend out to the ends of the device as has been conventional. The conductive runs 30A-30G are routed instead from the end character display positions in the device around to connector terminals or pads 35A-35G, respectively, on an edge of base plate 20, preferably the lower edge 20L. Conduc-
tive runs 30 are covered by insulating layer 40 except where they connect to cathodes 60 and to terminal pads 35, which prevent those conductors from glowing when the device is operated. The terminals or pads 35 are preferably left exposed so that electrical contact may be made to them easily by a connection arrangement embodying the invention and described below. The terminals 140 of anodes 90 on the underside of the top insulating plate 100 extend out to the same edge of the device as do cathode terminal pads 35, and are offset therefrom as illustrated clearly in FIG. 5. Pads 145 line up vertically with anode terminals 140 as alignment guides during fabrication of the device or when mating the connector with the anode terminals, as described below. Additional pads 135 may be provided to align with tabs 155 extending from spacer frame 110, if desired, to aid alignment in assembling the panel or to provide electrical connection to conductive layer 114 of the frame.

The drawing of FIG. 4 illustrates a section of the device of FIG. 1 taken at line 4-4 cutting through electrodes 60A, 60D, 60G at the fourth display position from the left. Anodes 90 are shown having leads 140 brought out to the front of the device as illustrated in FIG. 1. Sealing frame 110 is preferably narrower than the top and bottom plates so that when they are sealed together, an open space is provided along the lower edge of the panel between the top and bottom plates for the insertion of connector contacts. This configuration is particularly suitable when anode electrodes 90 are formed on the underside of top glass 100 as thin layers of material to provide the desired transparency. Such thin layers are fragile and it is difficult to secure leads to them by welding, soldering, or the like. According to the invention, resilient, shaped contacts 290 formed of beryllium-copper or the like inserted between terminal pads 140 and bottom plate 20 are used for establishing the desired contact to anode 90.

The connectors 290 include an elongated tail portion 290X to be connected to external circuit elements. Contact portion 290A of connectors 290 comprise one or more resilient metal strips which extend from the tail portion and seat against terminals 140 of anode electrodes 90, and a spring-like generally C-shaped arm spaced therefrom which seats against the lower surface of face plate 20.

Resilient metal contacts 230 of similar shape provide friction or pressure contact with terminal pads 35 of cathode connector runs 30 provided for the cathode electrodes 60. The cathodes 60 (A-G) are connected to terminal pads 35 by conductive runs 30A-30G as illustrated in FIG. 1. Connectors 230 include an elongated tail portion 230X to be connected to external drive and control apparatus. Contact portion 230A of connectors 230 also comprise one or more resilient metal strips extending from the tail portion, which make contact with cathode terminal pads 35 and a spring-like arm spaced therefrom which seats against the lower surface of face plate 100.

A modification of the connector arrangement of the invention is shown in the perspective view of FIG. 6. A portion of a display panel 10 and of a connector 200 engaged with it along the lower edge thereof is illustrated. Panel 10 includes base plate 20 having cathode terminal pads 35 along an edge of its top surface. Pads 145 on plate 20 are for indicating alignment of the anode terminals on the underside of the top plate during assembly and the mating of contacts with them. Connector 200 includes a housing 210, a plurality of terminal pins or tails 220 extending from one edge, and a plurality of shaped, resilient electrical contacts 225 similar to contacts 230 and 290 protruding from the opposite edge. Contacts 225 each include bent or formed strip portions of spring-like metal which join together in a plane at their ends. The strips are placed apart so that they frictionally engage the electrode terminals of the device when inserted between them and top plate 100 or bottom plate 20. The pins 220 extending from the back of connector 200 may be wire-wrapped, soldered or crimped to external conductors, so they may be inserted into a PC board and soldered to its conductors or connected in any other suitable manner to external driving and control circuits.

Housing 210 of connector 200 facilitates the handling of the contacts and the mating of them with the panel. It may be molded with them as one piece or it may have receptacles for receiving them. Housing 210 may be approximately as thick as display panel 10 as shown by solid lines in FIG. 6, or it may also include the raised portion 212 shown in dotted lines for mounting the panel which it connects. Housing extension 212 may include a lug 205 having an aperture 207 suitable for receiving a bolt or the like. Also, housing portion 210 may include a slotted aperture 215 for receiving ears or tabs 115 extending from the spacer frame 110 between the top and bottom plates 100 and 20 of the display panel 10. A bolt or set screw 217 may be provided for engaging the tab 115 and thus securing the connector and display panel together once they are mated. Fastener 217 may be utilized also for making electrical connection to the spacer frame of the panel for applying a bias potential or for sensing operation of the device, for example.

One advantage of the connector arrangement of the invention is that it permits display panel 10 to be mounted at different, selectable viewing angles. This feature of the invention is illustrated in FIG. 7 wherein the tail portions of the contacts are shown bent at the desired angle. The display panel 10 is connected to and supported from a PC board 300, and is cantilevered or otherwise connected to conductive runs 320 by soldering, for example. No connector housing is required for the connector contacts 225, which simply are inserted into PC board 300 at one end and inserted into the slot between plates 20 and 100 of the panel at the other end. The display panel may be tilted at any desired angle from PC board 300, or it may be horizontal or perpendicular to the board, if desired.

The tilting of display panel 10 may facilitated by means of a simplified connector housing 260 shown in FIG. 8 which supports the tail ends 220 of connector contacts 225 and takes lateral (bending) stress off the contacts and the panel itself. Housing 260 also facilitates the insertion of the contacts into the slot in the panel and the insertion of the tails 220 into apertures 270 in the housing. The contact tails 220 are soldered to conductors 320 on PC board 300 as shown at 325. Different connector contacts 225 establish connection to cathode electrode terminals 35 and to anode terminals 140. The contacts frictionally engage the terminal pads within the slot between the top and bottom plates 100 and 20, the width of which is determined by the
thickness of spacer frame 110. The contacts 225 each include spaced, resilient strip portions 226 and 227 which join at one end, the other end 228 of strip 227 being extended outwardly away from strip 226.

FIG. 9 is an enlarged view of a portion of simplified connector housing 260 for supporting the tail ends of contacts 225 within apertures 270. Tail ends 220' of contacts 225 include lances 245 which protrude from them for engaging the walls of apertures 270 in housing 260, thus retaining them in the housing. Contacts 225 are pierced or formed with center portions 227 separated from integral peripheral portions 226 of the contacts. These portions of the contacts 225 are formed or bent away from each other to provide the desired frictional engagement with the electrode terminals of the display panel into which they are inserted. Each contact 225 includes an elongated tail portion 220' attached to an enlarged generally flat or slightly curved portion 226 to which is resiliently secured a curved portion 227 at one end 229. Curved portion 227 is bent away from flat portion 226, with its other end 228 curved back toward or against the flat portion. Curved portion 227 thus can flex with respect to the flat portion 226.

In use, connector contacts 225 are positioned between plates 20 and 100 with portion 226 and 227 of them in contact with cathode and anode electrode terminals 35 and 140, respectively. The tail end portions 220’ extend away from the panel and can be used to make contact with external circuitry. Due to the resiliency of curved portion 227, the connector is held securely in place between the plates and the respective electrode terminals.

The subject electrode termination and connection arrangement is applicable to a large variety of multilayer electrical devices including multilayer printed circuit boards as well as many different kinds of display devices. Such devices include two or more spaced-apart insulating plates or the like, and terminals for the conductors or electrodes thereof which can be disposed on inside surfaces of the plates for receiving and mating with connector contacts between them. The conductors themselves may be on the inside or outside surfaces of the plates or boards, as required, so long as the terminals for the conductors or electrodes thereof are on the inside surface along or near adjacent edges for connection between them.

Display devices for which the subject electrode termination and connection arrangement is suitable include those which utilize liquid crystal material, various suspensions or emulsions, or semiconductor or luminescent material between energizing electrodes, as well as gas-filled display panels and the like. In such devices the display-supporting substance or medium is generally disposed between insulating members or plates and the terminals for the electrodes thereof may be disposed on the inside surfaces of the plates along or near adjacent edges thereof for connection between them.

What is claimed is:

1. A display device comprising an envelope including a pair of flat, insulating plates which are parallel to each other and spaced apart to define a gas-filled electric discharge region between them, a plurality of cathode electrodes seated on one of the plates and a plurality of different electrical conduc-

tors connected to them and terminating along an edge of this first plate, at least one anode electrode seated on the other of said plates in association with selected ones of the cathode electrodes and having a lead terminating along an edge of this other plate, which edge is parallel to an adjacent edge of the first plate, the terminals of the cathode connectors and of the anode lead(s) being on opposing surfaces of the respective plates for receivably mating with external connecting means between the plates, and

means for sealing the gas discharge region between the plates along a predetermined perimeter and leaving the cathode and anode terminals exposed for receiving the connecting means.

2. The display device of claim 1 wherein the edges of the plates on which the terminals of the cathode connectors and the terminals of the anode lead(s) are disposed are parallel to each other, and the connecting means comprise connector contacts for engaging the anode and cathode terminals between the plates.

3. The display device of claim 2 wherein the cathode connector terminals and the anode lead terminals on the respective plates are offset from each other for mating with horizontally spaced resilient contacts for the anodes and for the cathodes to be inserted between such terminals.

4. The display device of claim 1 wherein the plurality of cathode electrodes comprises a plurality of groups of cathodes arranged along a predetermined line, and wherein there is one electrode associated with each such group, and the terminals for the cathode connectors and for the anode leads are disposed along edges of the respective plates which are parallel to said predetermined line and are adjacent each other.

5. The display device of claim 4 wherein corresponding cathodes of the groups are interconnected, and the edges of the plates along which the terminals of the cathode connectors and the terminals of the anode leads are disposed are adjacent to each other for receiving shaped, resilient contact members, both for making connection with the anode and cathode terminals and for supporting the device.

6. An electrical display device comprising an envelope defined by a pair of flat, insulating plates which are parallel and spaced from each other, a plurality of first electrodes seated on one of the plates and having a plurality of associated connectors terminating along an edge of the first plate, at least one second electrode seated on the other of the plates and having a lead terminating along an edge of this other plate, which edge is parallel to an adjacent edge of the first plate, the terminals of the connectors and the lead(s) of the first and second electrodes being an opposing surfaces of the respective plates for receivably mating with external connecting means between the plates, and

means for sealing a display-supporting medium in the envelope between the plates along a predetermined perimeter and leaving the terminals of the electrodes exposed for mating with the connecting means.

7. The electrical display device of claim 6 wherein the edges of the plates on which the terminals of the electrodes are disposed are parallel to each other, and the connecting means comprise connector contacts for
9 engaging the first and second electrodes at the respective terminals thereof between the plates.

8. The electrical display device of claim 7 wherein the connector terminals for the first electrodes and the second electrodes on the respective plates are horizontally offset from each other for mating with horizontally spaced resilient contacts for the first and second electrodes to be inserted between them and the opposing plate.

9. The electrical display device of claim 6 comprising a plurality of groups of first electrodes disposed in a row and a plurality of second electrodes associated with them, and the terminals for the electrodes are disposed along edges of the respective plates which are parallel to the rows of said electrodes.

10. The electrical display device of claim 9 wherein corresponding ones of the first electrodes are interconnected and the edges of the plates along which the terminals for the electrodes are disposed are adjacent each other for receiving the connecting means which comprise shaped, resilient contact members both for making connection with the electrode terminals and for supporting the device.

11. A panel-type display device comprising a cover plate and a base plate defining a display space between them, but extending beyond said display space, electrically responsive light-emitting means in said display space, a plurality of electrodes associated with said light-emitting means for operation thereof and including a set of first electrodes adjacent said base plate and a set of second electrodes, a plurality of connector contacts disposed on the facing surfaces of said plates, adjacent a peripheral edge of each of them, outside of the area of said display space, and a plurality of conductors each electrically connecting one of said connector contacts to one of said electrodes.

12. The device of claim 11 further comprising a conductor housing supporting each of said conductors in spaced apart relationship and aligned for insertion between the plates.

13. The display device of claim 12 wherein said common edges of the plates are adjacent each other and further comprising a rigid frame situated between the plates and having at least one tab extending out from between the plates for engagement with the conductor housing.

14. A panel-type display device comprising a base plate and a cover plate defining a display space between them, but extending beyond said display space, a glow-supporting medium disposed in said display space, a plurality of electrodes associated with said glow-supporting medium for excitation thereof and including a set of first electrodes adjacent said base plate and a set of second electrodes, said first and second electrodes having terminals situated along a common edge of the associated plates but offset from each other, the terminals of said first and second electrodes being disposed on opposing surfaces of the respective plates for receivably mating with external connecting means between them, and

15. A panel-type display device as in claim 14 wherein said common edges of the plates are parallel and adjacent each other and the terminals for the first and second electrodes are horizontally offset from each other for receivably mating with connecting means between the plates.

16. The device defined in claim 14 wherein said connector includes flexible portions which extend out of said insulating body, said flexible portions being insertible in a support plate at a selected angle whereby said device is disposed at a selected angle with respect to said support plate.

17. A display device comprising an envelope containing a display medium, two plates of insulating material integral with and extending from said envelope, said plates being spaced from one another and having the facing surfaces thereof substantially parallel, a plurality of electrodes within said envelope, and means for selectively energizing different combinations of said electrodes to produce different display patterns within said envelope, said energizing means including a plurality of electrical contacts disposed on the facing surface of at least one of said plates, outside of said envelope, and a plurality of conductors each connected from one of said contacts into said envelope to a different one of the electrodes, said plates having a recess between their facing surfaces in the region of said contacts to receive an electrical connector device to make electrical connection with said contacts.

18. A combination including the display device of claim 17 and an electrical connector device having a plurality of outwardly projecting resilient contact fingers for insertion into the recess between the facing surfaces of the plates to establish electrical contact between said fingers and the electrical contacts on said facing surfaces.

19. The combination of claim 18 wherein said electrical connector device includes a plurality of mounting members which project therefrom to mount said display device in a substantially vertical plane.

20. The combination of claim 19 wherein said mounting members each include an inclined section to mount said display device at an angle inclined from a vertical plane.

21. A display device as in claim 17 wherein the energizing means includes a plurality of the electrical contacts on the facing surfaces of each of said plates, and wherein said conductors are also located on said plates, one extending from each contact, through the envelope wall, to one of said electrodes.

22. A display device as in claim 21 wherein the contacts are located along the outer edges of the plates to provide readily accessible terminals.

23. An electrical display device as in claim 22 wherein the electrical contacts on each of said plates are offset laterally from the contacts on the other plate.
24. A display device as in claim 17 wherein said plates are closely spaced in the region of the contacts to retain an electrical connector device in place.

25. A display device as in claim 17 wherein said display medium constitutes an ionizable gaseous atmosphere at a pressure capable of sustaining a glow discharge, wherein said electrodes are selectively energizable to establish a glow discharge between selective combinations of said electrodes, to provide different glow discharge patterns within said envelope, and wherein said energizing means includes a plurality of electrical contacts on the facing surfaces of each of said plates.

26. A display device as in claim 25 wherein said electrodes comprise a plurality of cathode and anode electrodes, wherein each of the contacts on the facing surface of one of said plates is connected by one of said conductors to one of said cathode electrodes, and wherein each of the contacts on the facing surface of the other one of said plates is connected by one of said conductors to one of said anode electrodes.

27. A display device comprising two plates of insulating material extending substantially parallel to one another with the facing surfaces thereof spaced from one another, a display medium located between the facing surfaces of said plates over a portion of their area, a plurality of electrodes in operating relationship to said display medium, and means for selectively energizing different combinations of said electrodes to provide different display patterns in said medium; said energizing means comprising a plurality of electrical contacts disposed on the facing surface of at least one of said plates, outside of the area containing the display medium, and a plurality of conductors each connected from one of said contacts to a different one of said electrodes, said plates forming a recess between them in the area of said contacts to receive an electrical connector device to make electrical connection with said contacts.

28. A display device as in claim 27 wherein the energizing means includes at least one of the electrical contacts on the facing surface of one of said plates and the remainder of the electrical contacts on the facing surface of the other of said plates, with a conductor extending from each of said contacts to a different one of said electrodes.

29. A display device as in claim 28 wherein said electrical contacts are located adjacent one of the peripheral edges of said plates.

30. A display device as in claim 27 wherein at least certain of said electrodes are disposed on a first one of said plates, and at least a like number of said conductors and electrical contacts are located on the same plate, and wherein each such electrode is connected by one of said conductors on the same plate to one of said electrical contacts on the same plate.

31. A display device as in claim 30 wherein said certain electrodes constitute cathode electrodes and the remaining electrodes constitute anode electrodes, and wherein each such remaining electrode is connected by one of said conductors to an electrical contact located on the facing surface of the second one of said plates.

32. A display device comprising a display medium, a peripheral member surrounding said display medium, a pair of spaced parallel plates, one above and one below the display medium, said plates being joined to said peripheral member to form an enclosure about said display medium, with one edge of each of said plates extending beyond said peripheral member to provide an inner surface for supporting electrical contacts, a plurality of electrodes within said enclosure, and means for selectively energizing different combinations of said electrodes to provide different display patterns within said medium, said energizing means comprising a plurality of electrical contacts disposed on the inner surface of at least one of said parallel plates, outside of said enclosure, and a plurality of conductors each connected from one of said electrical contacts through said peripheral member to a different one of said electrodes, said plates forming a recess between them in the area of said electrical contacts to receive an electrical connector device to make electrical connection with said contacts.

33. A display device as in claim 32 wherein said electrical contacts are all substantially aligned adjacent one edge of at least one of said plates.

34. A display device as in claim 32 wherein said enclosure is rectangular in shape, having a short side at each end of the display medium and two long sides along the length of the display medium, and wherein said plates extend beyond the peripheral member only along one of the long sides of the rectangle, and wherein said electrical contacts are all aligned adjacent said one long side of the rectangle.

35. A display device as in claim 34 wherein at least certain of said electrodes are disposed on a first one of said plates, and at least a like number of said conductors and electrical contacts are located on the same plate, and wherein each such electrode is connected by one of said conductors on the same plate to one of said electrical contacts on the same plate.

36. A display device as in claim 35 wherein said certain electrodes constitute cathode electrodes and the remaining electrodes constitute anode electrodes, and wherein each such remaining electrode is connected by one of said conductors to an electrical contact located on the facing surface of the second one of said plates.

37. A gas discharge display device comprising an envelope containing an ionizable gas at a pressure capable of sustaining a glow discharge, two insulating plates extending from said envelope, said plates being spaced from one another and having facing surfaces which are substantially parallel, a plurality of first electrodes spaced apart from one another along a surface within said envelope, a plurality of second electrodes spaced apart from one another and from said first electrodes within said envelope,
means for selectively energizing different combinations of said first and second electrodes to produce different glow discharge patterns within the ionizable gas between said first and second electrodes, said energizing means including a plurality of electrical contacts disposed on the facing surface of at least one of said parallel plates, outside of said envelope, and a plurality of conductors each connected from one of said contacts, through said envelope, to a different one of the electrodes, the said plates having a recess between their facing surfaces in the region of said contacts to receive an electrical connector device to make electrical connection with said contacts.

38. A combination including the display device of claim 37 and an electrical connector device having a plurality of outwardly projecting resilient contact fingers for insertion into the recess between the facing surfaces of the plates to establish electrical contact between said fingers and the electrical contacts on said facing surfaces.

39. A display device as in claim 37 wherein said first and second electrodes are cathode and anode electrodes, respectively, and wherein said cathode electrodes are located along a facing surface of one of said plates, and at least a like number of said conductors and electrical contacts are located on the same surface, and wherein each such cathode electrode is connected by one of said conductors on the same surface to one of said electrical contacts on that surface.

40. A display device as in claim 37 wherein the energizing means includes a plurality of the electrical contacts on the facing surfaces of each of said plates, and wherein said conductors are also located on said plates, with one extending from each contact through the envelope wall, to one of said electrodes.

41. A gas discharge display panel having a plurality of side-by-side character positions along a predetermined line, in each of which any one of a predetermined number of characters can be displayed, comprising

- an envelope formed of front and rear plates sealed together along a closed perimeter surrounding the line of character positions to establish a gas tight enclosure about said character positions;
- both of said plates extending beyond the closed perimeter in at least one direction, and having their facing surfaces spaced apart outside of said envelope to provide a recess for receiving a connector device for supplying electrical energy to said envelope,
- an ionizable gas within said envelope at a pressure capable of sustaining a glow discharge,
- a plurality of groups of cathode electrodes arranged side-by-side along a surface within said envelope to form the side-by-side character positions, each cathode electrode being in the shape of a segment of a character to be displayed,
- a plurality of anode electrodes spaced from each other and from said cathode electrodes, each such anode electrode being located adjacent and operatively associated with one of said cathode electrode groups,

means for selectively energizing said anode and cathode electrodes to form a side-by-side character display over said character positions, said energizing means including a plurality of electrical contacts disposed on the facing surface of at least one of said plates, outside of said envelope, and a plurality of conductors each connected from one of said contacts through said envelope to a different one of said electrodes.

42. A display panel as in claim 41 wherein the energizing means includes a plurality of the electrical contacts on the facing surfaces of each of said plates, and wherein said conductors are also located on said plates, one extending from each contact through the envelope wall to one of said electrodes.

43. A display panel as in claim 41 wherein said plates extend beyond the closed perimeter in a direction perpendicular to the line of character positions to provide said facing surfaces outside the envelope along a region parallel to the line of characters, and wherein said electrical contacts are aligned along at least one of said facing surfaces substantially parallel to the line of characters.

44. A display panel as in claim 43 wherein the energizing means includes a plurality of the electrical contacts on the facing surfaces of each of said plates, and wherein said conductors are also located on said plates, one extending from each contact through the envelope wall to one of said electrodes.

45. A display panel as in claim 41, further including a plurality of elongated conductive runs extending along the inside surface of the rear plate within the envelope in the direction of the line of character positions, a layer of insulating material over said conductive runs with a group of apertures therethrough for each character position, the respective apertures in each such group being aligned with the respective conductive runs, wherein each cathode electrode has a portion thereof aligned with one of said apertures, and is connected through said aperture to the aligned conductive run, and wherein each of said conductive runs in connected by one of said conductors to one of the electrical contacts.

46. A gas discharge display panel having a plurality of side-by-side character positions along a predetermined line, in each of which any one of a number of characters can be displayed, comprising

- an envelope formed of front and rear plates sealed together along a closed perimeter surrounding the line of character positions to establish a gas tight enclosure about said character positions;
- at least said rear plate extending beyond the closed perimeter in a direction perpendicular to the direction of said predetermined line,
- an ionizable gas within said envelope at a pressure capable of sustaining a glow discharge,
- a plurality of groups of cathode electrodes arranged side-by-side along said predetermined line, said cathode electrode groups being supported along the surface of the rear plate which faces the front plate to form the side-by-side character positions,
each cathode electrode being in the shape of a segment of a character to be displayed, means for selectively energizing different combinations of said cathode electrodes in each of said cathode electrode groups to provide a multi-character display, the width of each such character, as displayed, being in the direction of said predetermined line, and the height thereof being perpendicular to such line,
said energizing means comprising a plurality of anode electrodes, one located adjacent and operatively associated with each of said cathode electrode groups, and a plurality of conductive runs extending in insulatingly spaced relation to one another along the surface of the rear plate, each such conductive run being electrically connected to one of the cathode electrodes in each of said cathode electrode groups, and
a plurality of electrical contacts spaced along the edge of the portion of the rear plate which extends outside of said closed perimeter perpendicular to the direction of said predetermined line, said contacts being disposed along a line which is generally parallel to said predetermined line,
said conductive runs extending along the surface of the rear plate in the direction of said predetermined line throughout the full length of said character positions, and then continuing along said surface beyond said character positions to the closed perimeter of the envelope, and beyond said closed perimeter in spaced relation to one another on the surface of said rear plate, and onto the surface of the portion of said rear plate which extends beyond the closed perimeter in the direction perpendicular to said predetermined line,
said conductive runs then continuing along said surface portion to the respective electrical contacts.
47. A display panel as in claim 46, wherein said closed perimeter has portions above and below and on the sides of said character positions, and
wherein the electrical contacts are positioned along a line below said character positions, and said conductive runs pass thru the portion of the perimeter below the character positions and extend to said electrical contacts.
48. A display panel as in claim 47, wherein said conductive runs extend from the character positions at least at one side thereof, and then bend abruptly to pass through the portion of the closed perimeter below the character positions.
49. A gas discharge display panel having a plurality of side-by-side character positions along a predetermined line, in each of which any one of a number of characters can be displayed, comprising
an envelope formed of front and rear plates sealed together along a closed perimeter surrounding the line of character positions to establish a gas tight enclosure about said character positions; at least one of said front and rear plates extending beyond the closed perimeter in a direction perpendicular to the line of side-by-side character positions,
an ionizable gas within said envelope at a pressure capable of sustaining glow discharge,
an assembly supported on the surface of the rear plate which faces the front plate including a plurality of conductive runs extending along said surface in the direction of the line of side-by-side character positions, a plurality of groups of cathode electrodes positioned side-by-side along said direction, each such group forming one of said character positions and each cathode electrode being in contact with at least one of said conductive runs, and an insulating layer covering said conductive runs and said surface in the area of the character positions, said insulating layer having a plurality of apertures therethrough, each aligned with one of said cathode electrodes, the cathode electrodes in each of said cathode electrode groups being disposed in substantially the same pattern, such pattern having a predetermined height to display characters of that height, and each cathode electrode being shaped in the form of a segment of a character to be displayed, each such conductive run being electrically connected to a correspondingly positioned cathode electrode in each of said cathode electrode groups, so that selective combinations of said cathode electrodes in each such group can be energized by a predetermined energization of said conductive runs to provide a multi-character display, a plurality of electrical contacts spaced along the edge of the portion of the rear plate which extends outside of said closed perimeter perpendicular to the line of the side-by-side character positions, said contacts being disposed along a line which is generally parallel to the line of character positions, at least the majority of said conductive runs extending along said surface within the height of said cathode electrode groups and then continuing along said surface beyond said character positions to the closed perimeter of the envelope, and beyond said closed perimeter in spaced relation to one another on the surface of said rear plate, and onto the surface of the portion of said rear plate which extends beyond the closed perimeter in the direction perpendicular the line of character positions, said conductive runs then continuing along said surface portion to the respective electrical contacts.
50. A gas discharge display panel having a plurality of side-by-side character positions along a predetermined line, in each of which any one of a number of characters can be displayed, comprising
an envelope formed of front and rear plates sealed together along a closed perimeter surrounding the line of character positions to establish a gas tight enclosure about said character positions; at least one of said front and rear plates extending beyond the closed perimeter in a direction perpendicular to the line of side-by-side character positions, an ionizable gas within said envelope at a pressure capable of sustaining glow discharge, an assembly supported on the surface of the rear plate which faces the front plate including a plurality of conductive runs extending along said surface in the direction of the line of side-by-side character positions, a plurality of groups of cathode electrodes positioned side-by-side along said direction, each such group forming one of said character positions and each cathode electrode being in contact with at least one of said conductive runs, and an insulating layer covering said conductive runs and said surface in the area of the character positions,
said insulating layer having a plurality of apertures therethrough, each aligned with one of said cathode electrodes,
the cathode electrodes in each of said cathode electrode groups being disposed in substantially the
same pattern, such pattern having a predetermined height to display characters of that height, and
each cathode electrode being shaped in the form of a segment of a character to be displayed,
each such conductive run being electrically connected to a correspondingly positioned cathode electrode in each of said cathode electrode groups, so that selective combinations of said cathode electrodes in each such group can be energized by a predetermined energization of said conductive runs to provide a multi-character display,
a first plurality of electrical contacts spaced along the edge of the portion of one of said plates which extends outside of said closed perimeter perpendicular to the line of side-by-side character positions, said contacts being disposed along a line which is generally parallel to the line of character positions, at least the majority of said conductive runs extending along said surface within the height of said cathode electrode patterns throughout the length of said cathode electrode groups and then continuing along said surface beyond said character positions to the closed perimeter of the envelope, and beyond said closed perimeter in spaced relation to one another on the surface of said rear plate, and onto the surface of the portion of said one plate which extends beyond the closed perimeter in the direction perpendicular the line of character positions,
said conductive runs then continuing along said surface portion to the respective electrical contacts of said first plurality, and
a plurality of anode electrodes each positioned in operative relation with one of said cathode electrode groups and having a conductive lead extending therefrom,
a second plurality of electrical contacts spaced along the edge of one of said plates outside of said closed perimeter, in line with said first plurality of electrical contacts,
each of said anode leads extending to a conductor which passes along one of said plates outside of said closed perimeter to one of the electrical contacts of said second plurality.

51. A connector device for supporting and making electrical connection to a flat display panel formed of two spaced plates hermetically sealed together along a predetermined closed periphery, with a series of electrical contact pads along the facing interior surfaces of the plates outside of the sealed periphery, comprising a series of electrically conductive members disposed side-by-side and spaced to coincide with the spacing of the electrical contact pads along the interior surfaces of the spaced plates, each of said conductive members including a resilient contact portion dimensioned to fit in pressing engagement between the interior surfaces of said spaced plates and an elongated tail portion extending from the contact portion to be inserted into an aperture of a support member for connection to an external conductor,