

- [54] **BUTTABLE, GASEOUS DISCHARGE,
DISPLAY PANEL INCLUDING
ELECTRODES PROVIDING A DOT MATRIX
DISPLAY**

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- [52] **U.S. Cl.** **313/217**; 313/220; 313/491;
313/493

- [51] **Int. Cl.**..... **H01j 61/06; H01j 61/42**

- [58] **Field of Search** 313/188, 217, 220, 484,
313/491, 493

[56] **References Cited**

UNITED STATES PATENTS

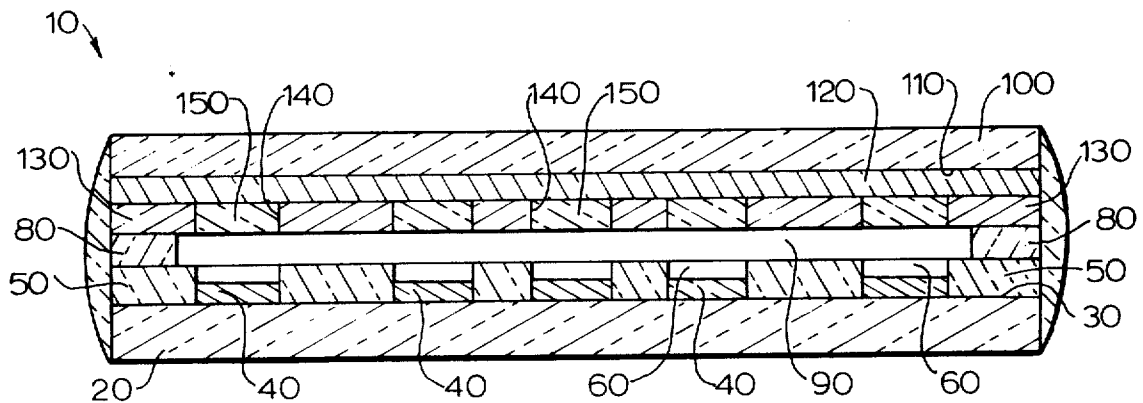
3,600,626	8/1971	Kupsky	313/220 X
3,701,917	10/1972	Kupsky	313/188
3,704,386	11/1972	Cola.....	313/484
3,743,879	7/1973	Kupsky	313/484

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[57] **ABSTRACT**

The display panel is a dot matrix panel and comprises relatively large gas-filled cells which are arrayed in rows and columns and are adapted to be energized in different combinations to display characters. The cells are formed by strip-like column cathode electrodes having localized active areas formed therein to comprise the active cathodes, the localized areas of all of the cathodes being arrayed in rows and columns. The cathode electrodes and their localized areas are shaped and spaced apart so that, in the final panel, a suitable seal area is provided and panels can be butted together. An insulated plate having horizontal apertures, each aligned with a row of cells, overlays the cathodes, and a face plate is seated on the insulating plate carrying horizontal anodes formed with localized active areas arrayed in rows and columns, each aligned with one of the cathode areas and each carrying a quantity of a phosphor material. Electrical energization of selected anodes and cathodes causes selected cells to glow and display a character.

5 Claims, 8 Drawing Figures



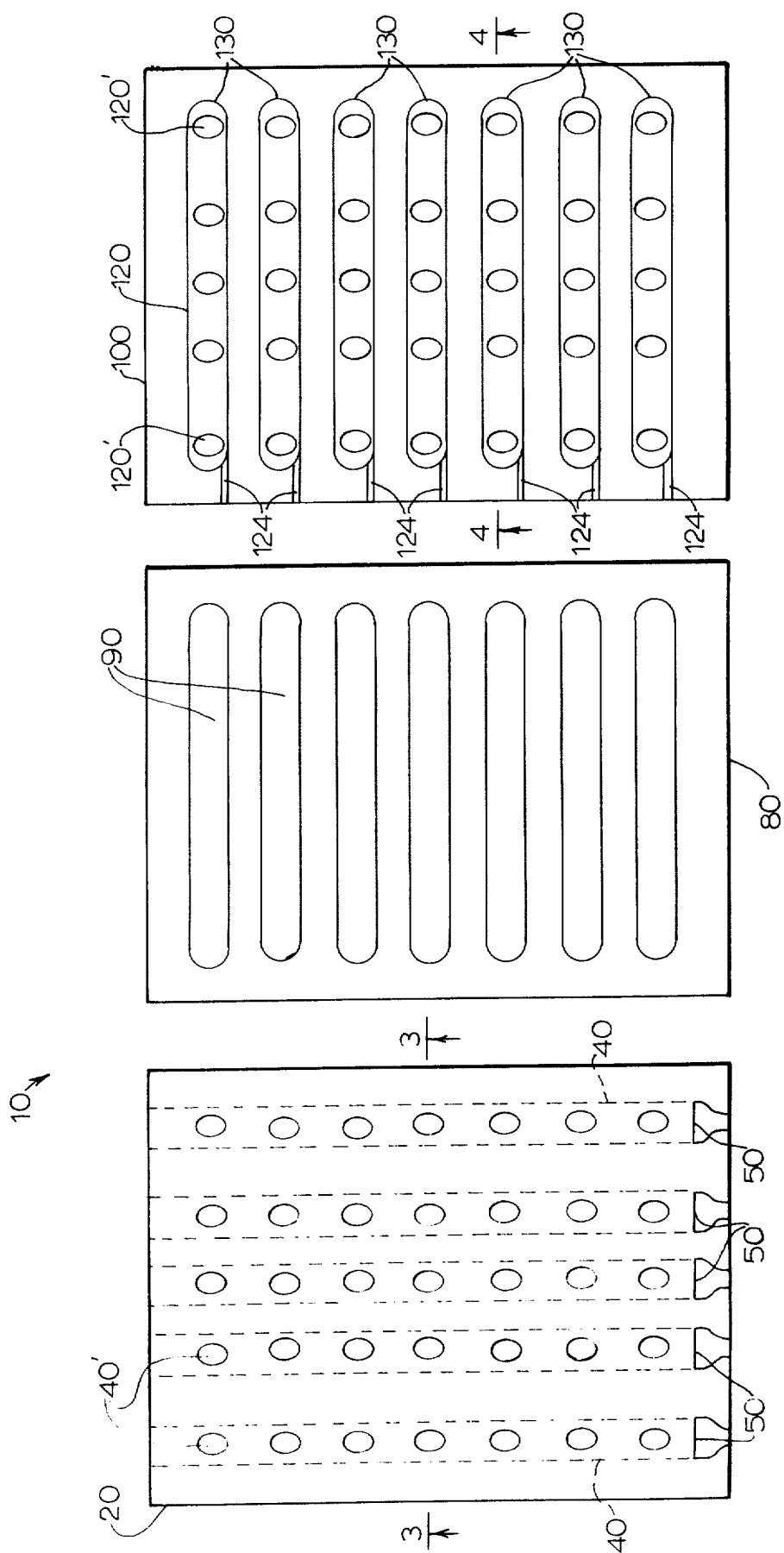


Fig. 1

Fig. 2

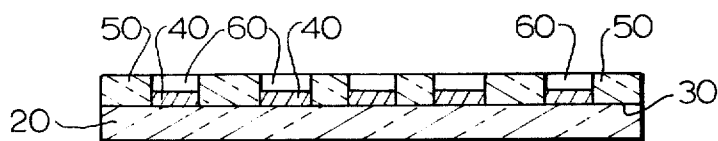
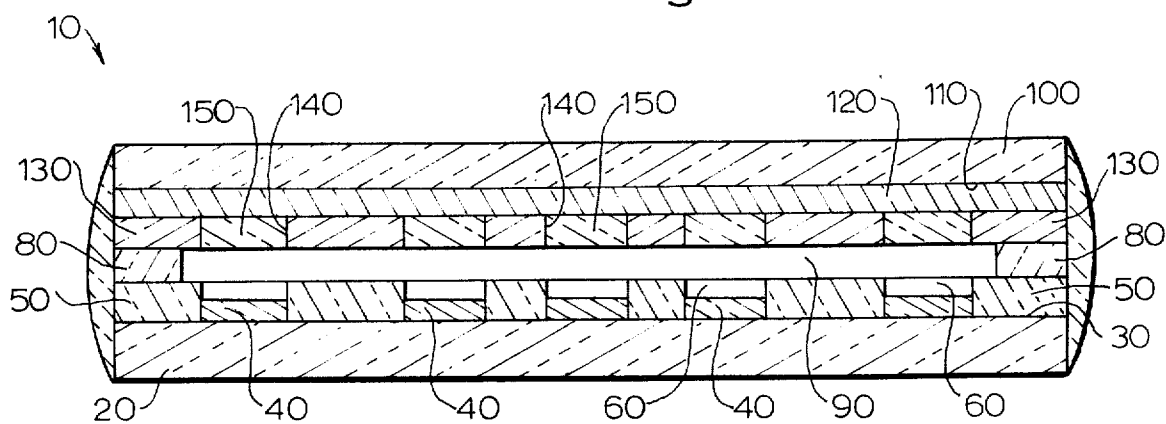


Fig. 3

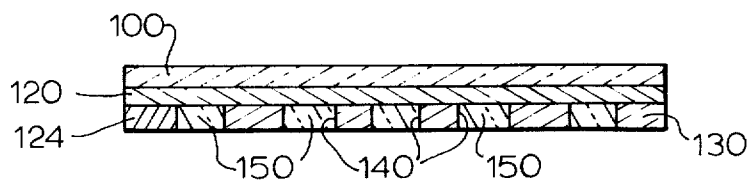


Fig. 4

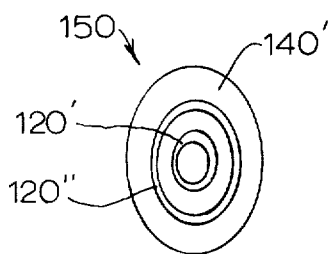


Fig. 5

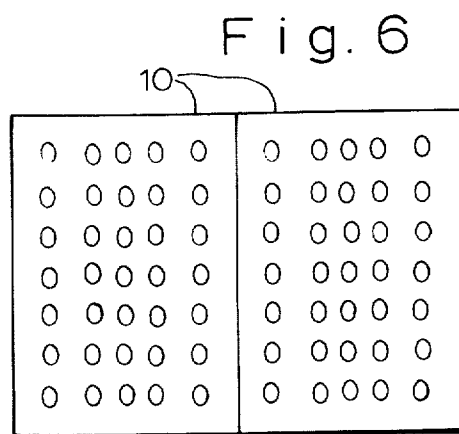


Fig. 6

Fig. 7

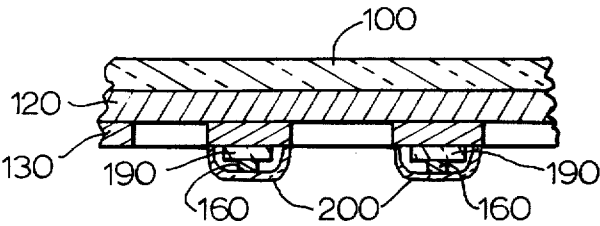
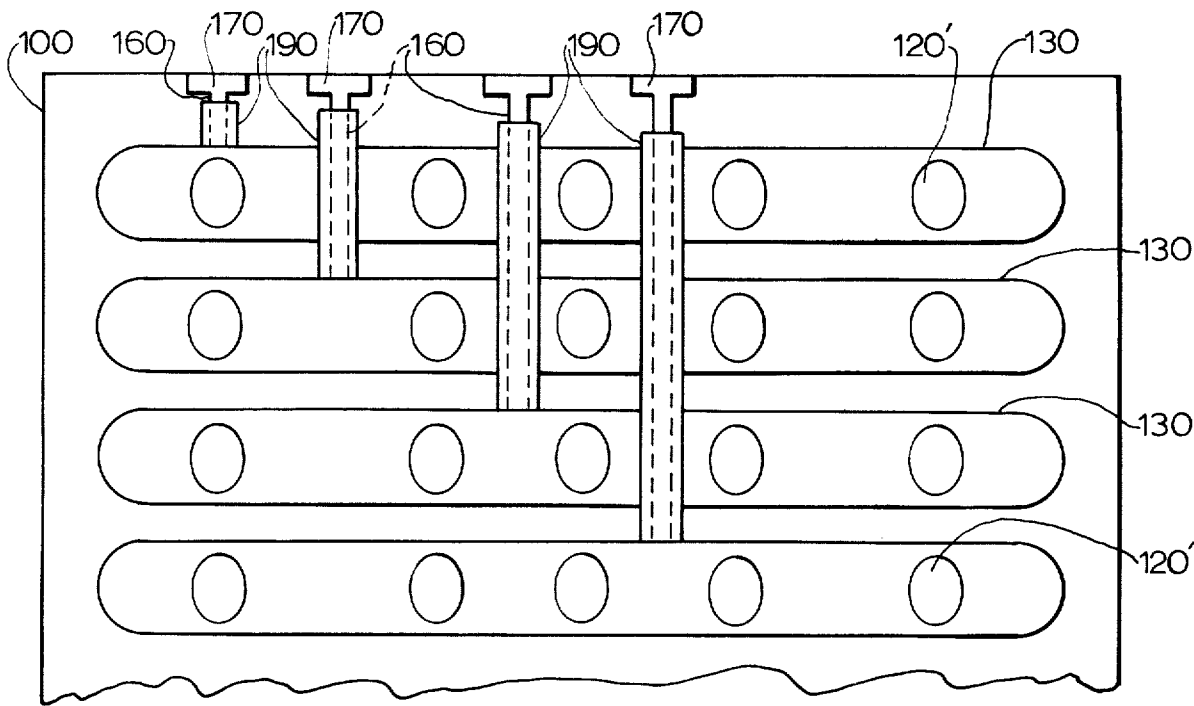


Fig. 8

BUTTABLE, GASEOUS DISCHARGE, DISPLAY PANEL INCLUDING ELECTRODES PROVIDING A DOT MATRIX DISPLAY

BACKGROUND OF THE INVENTION

Dot matrix display panels comprising dot-like cells arrayed in rows and columns are known in the art. However, there has been a need for dot matrix display panels comprising relatively large dots or cells and suitable for large-area or so-called wall-size or wallboard displays. Since it is relatively difficult to make a single panel of this desired type and size, the industry has needed panels which could be coupled together to provide the desired large wall panel. Such panels have not been known in the prior art in a form suitable for production.

SUMMARY OF THE INVENTION

The display panel comprises relatively large gas-filled cells arrayed in rows and columns and adapted to be energized in different combinations to display characters. The cells are formed by column cathode electrodes specially spaced and shaped, covered by an insulated plate having horizontal slots, each aligned with a row of cells. A face plate is seated on the insulated plate carrying horizontal anodes formed with active areas arrayed in rows and columns, each aligned with one of the cathode apertures and each carrying a phosphor material.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded view of a display panel embodying the invention;

FIG. 2 is a sectional view showing the panel of FIG. 1 assembled;

FIG. 3 is a sectional view along the lines 3—3 in FIG. 1;

FIG. 4 is a sectional view along the lines 4—4 in FIG. 1;

FIG. 5 is an enlarged view of a panel cell showing a phosphor layer in place;

FIG. 6 is a plan view showing, in schematic form, a plurality of panels butted together;

FIG. 7 is a plan view of a portion of FIG. 1 showing a modified connection scheme therefor; and

FIG. 8 is a sectional view of a portion of the apparatus of FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A dot matrix display panel 10 embodying the invention includes a base plate 20 of insulating material such as glass or ceramic having a top surface 30, on which is formed a plurality of parallel, vertical, conductive cathode strips 40. The base plate is coated with an insulating layer 50 having a series of apertures 60 formed along its length, each exposing a cathode dot 40'. In one suitable construction using a 5×7 dot matrix to form characters, five cathode strips are provided, and layer 50 has seven apertures exposing seven cathode dots 40'. The strips 40 extend to an upper or lower (as shown) edge of the base plate 20 so that electrical connection can be made thereto. The cathode strips 40 and layer 50 are preferably formed by a screen printing process.

In one embodiment of the invention wherein the width of the panel was limited but relatively large dots

were required, the desired results were achieved by placing the cathodes at the center of the panel, for example, the middle three cathodes, more closely together, by 10 mils or so, than the first and fifth are spaced from the second and fourth, respectively. With this arrangement, sufficient space was provided between all of the cathodes, and particularly between the first and fifth cathodes, and the edges of the panel to permit an hermetic seal to be formed. In addition, the cathodes areas or dots 40' were made generally oval in form. This permits a narrower cathode strip to be used than would be required with a circular cathode area having the same glow area. This embodiment of the invention is illustrated in FIG. 1.

The panel 10 includes an apertured center sheet 80 of insulating material disposed on the coated cathodes 40 and including horizontal slots 90, each of which is aligned with a row of cathode dots 40'. The sheet 80 may be a separate preformed sheet or plate, or it may be formed on the base plate by a screen printing process. The panel 10 also includes a face plate 100 of glass having a bottom surface 110 on which is formed, in order, a plurality of anode strips 120 of transparent conductive material such as tin oxide, each strip 120 being aligned with a row of cathode dots 40' and a plurality of layers 130 of opaque conductive material having a plurality of apertures 140, one layer 130 provided for and overlaying each of the anode strips 120 and each aperture 140 generally overlaying a cathode dot 40'. The apertures 140 may be circular or oval-shaped as desired. If desired, a mass or body 150 of phosphor material is provided in each of the apertures 140 in the opaque metal layers 130, with one suitable phosphor being zinc orthosilicate:Mn. Preferably, the phosphor bodies are formed as spaced rings 140', between which anode rings 120'' are exposed as shown in FIG. 5. The anode strips 120 are provided with tabs 124 at an edge of the face plate for connecting them to external circuitry.

The face plate 100, insulating center sheet 80, and base plate 20 are hermetically sealed together along their adjacent edges by any suitable material such as a glass frit, and the panel thus formed is filled with a suitable gas such as argon, neon, or the like at a pressure in the range of about 75 to about 300 Torr. Those skilled in the art understand the parameters which relate to gas pressure, and a suitable pressure can be readily determined.

The panel 10 is operated generally like other dot matrix dot matrix devices, with operating potential being applied to the cathode strips 40 sequentially and simultaneously applying operating potential to selected anode strips 120 to fire the cells at which these electrodes cross each other to cause the cathode dots 40' at these locations to exhibit cathode glow. The light, that is the ultraviolet light, generated at the cathode dots energizes the associated phosphor dots 150, and this fluorescent light combined with the normal cathode glow is seen by a viewer through face plate 100. It can be seen that the color of the light output from the panel can be varied, depending on the choice of phosphor and the gas selected, as is well known in the art. For example, a combination of neon gas and zinc orthosilicate phosphor provides a blend of red and blue-green light which produces a yellow-white output light.

One advantage of the panel of the invention is that a plurality of such panels may be coupled together at ad-

jacent side edges to provide a relatively large wall-type display as illustrated in FIG. 6. For this type of arrangement, a different anode connection scheme is desirable, and one such scheme is illustrated in FIGS. 7 and 8. In this arrangement, a narrow conductive run 160 extends from contact with each opaque strip 130 to a contact pad 170 at the upper or lower edge of the face plate 100. The runs 160 may be of the same material as the opaque layer. Where each run crosses one or more opaque strips, an insulating layer 190 is provided on such strips to insulate the run from the strips it crosses. In addition, all of the runs are coated with a layer 200 of insulating material. With this arrangement, contact pads for making external connection to the anodes are provided at an edge of the panel whereby, when panels are butted together, the anode pads are readily accessible. It is noted that the conductive runs 160 and the various insulating layers 190 and 200 may be formed by a screen printing process.

What is claimed is:

1. A display panel comprising
 - a gas-filled envelope including
 - a base plate and face plate hermetically sealed together,
 - a plurality of vertical conductive strips positioned on the top surface of said base plate,
 - a first layer of insulating material covering said conductive strips and including first apertures disposed in series along each of said conductive strips, each first aperture exposing a dot-like portion of the associated strip which is operable as a cathode electrode, said dot-like cathode electrodes being arrayed in rows and columns,

a second layer of insulated material on said first layer and having a plurality of horizontal slots, each aligned with a row of said cathode electrodes,
 a plurality of horizontal strips of transparent conductive material on the inner surface of said face plate, each such strip overlaying one of said horizontal slots in said second layer, and
 an opaque conductive layer on each of said horizontal strips and having a series of second apertures therein,
 each second aperture exposing a dot-like area of its horizontal strip which is operable as an anode electrode, each such anode electrode being vertically aligned with and in operative relation with one of said cathode electrodes.

2. The panel defined in claim 1 and including a phosphor material in each of said second apertures in contact with at least a portion of the anode electrode therein.

3. The panel defined in claim 2 wherein said phosphor material is provided as concentric rings between which the anode electrode is exposed.

4. The panel defined in claim 1 wherein said first apertures are generally oval in shape.

5. The panel defined in claim 1 wherein said vertical strips include a first, a last, and intermediate strips, the spacing between a plurality of said intermediate strips being smaller than the spacing between others of said strips whereby sufficient spacing may be provided between the first and last strip and the adjacent edges of said panel to form an hermetic seal.

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