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Przybylek

[11] **3,821,588**

[45] **June 28, 1974**

[54] **DISPLAY PANEL HAVING FLAT SIDE EDGES TO PERMIT BUTTING TOGETHER PLURAL PANELS**

[75] Inventor: **George J. Przybylek,** Scotch Plains, N.J.

[73] Assignee: **Burroughs Corporation,** Detroit, Mich.

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[52] **U.S. Cl.** **313/220,** 313/109.5

[51] **Int. Cl.** **H01j 17/18**

[58] **Field of Search** ..... 313/220, 109.5; 315/169 TV; 340/166 EL, 324 R

[56] **References Cited**

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Primary Examiner—Herman Karl Saalbach
Assistant Examiner—Siegfried H. Grimm
Attorney, Agent, or Firm—Robert A. Green; Edward G. Fiorito; Paul W. Fish

[57] **ABSTRACT**

A display panel includes a base plate and a face plate to define a housing which is filled with gas and which contains any desired form of display device including, for example, segmented cathode glow electrodes or a matrix of dot-like cells, each having an anode and a cathode electrode. Assuming that a plurality of such panels are to be butted along adjacent side edges, then along these side edges of the base plate and face plate, the lower surface of the face plate and the top surface of the base plate are provided with aligned channels. Thus, each panel has two pairs of aligned channels. A rigid thin plate is inserted in each pair of channels, and the remainder of the channels, not taken up by the thin plates, and the space between the plates adjacent to the outer edges thereof are filled with a sealing material such as a glass frit which can be fused by the application of heat, and which cools to form a gas-tight seal. In this panel, the side edges are flat, and a plurality of such panels can be butted together to provide a combination large-area panel.

4 Claims, 5 Drawing Figures

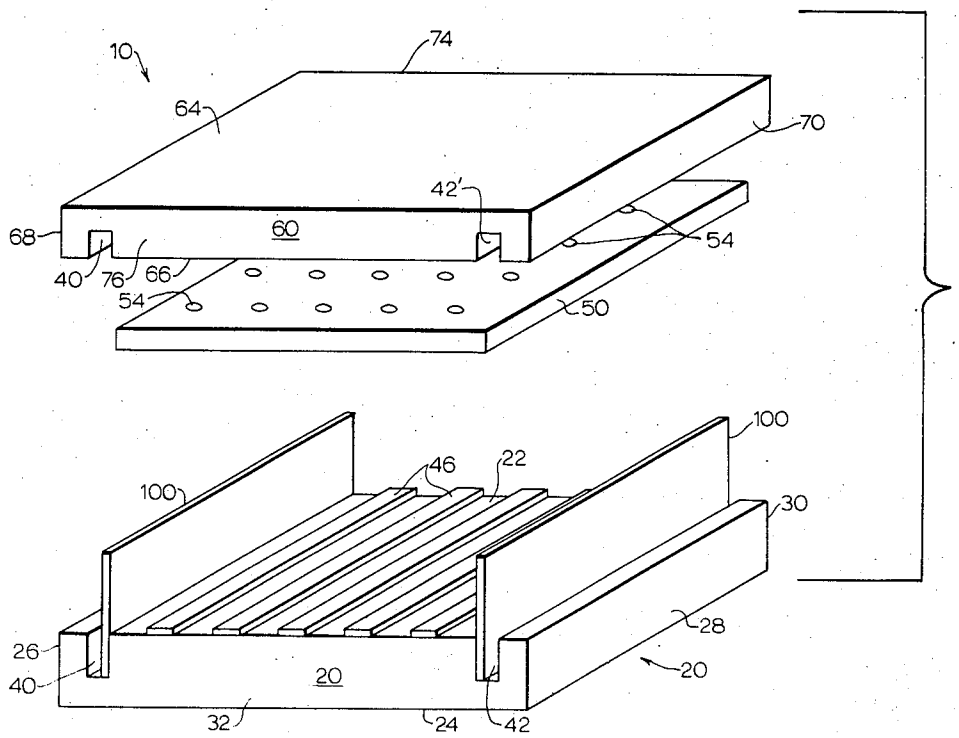


Fig. 1

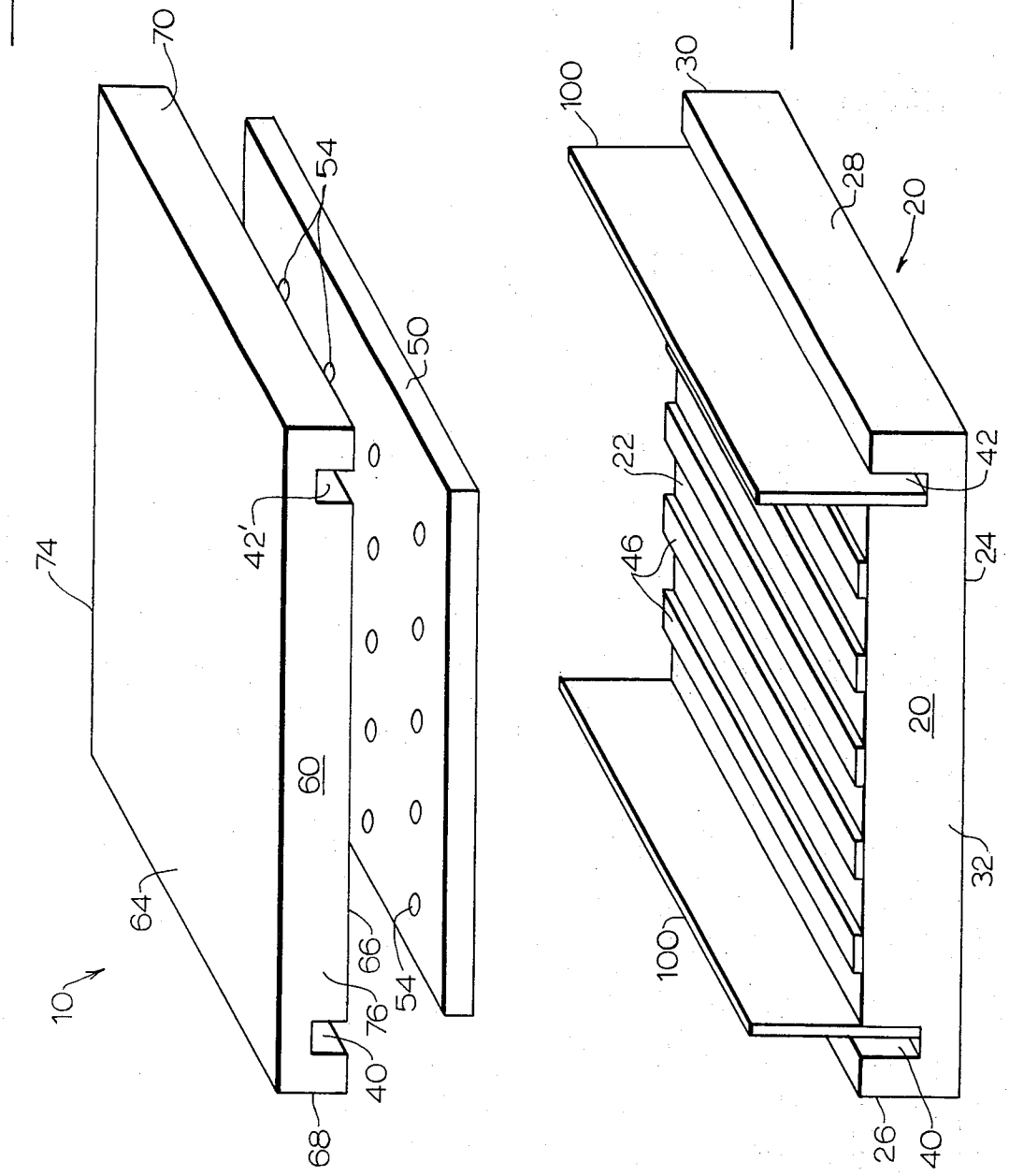

70
54
50
74
42'
60
64
66
76
54
10
40
68
100
30
28
20
22
42
46
24
20
32
100
26
40

Fig. 2

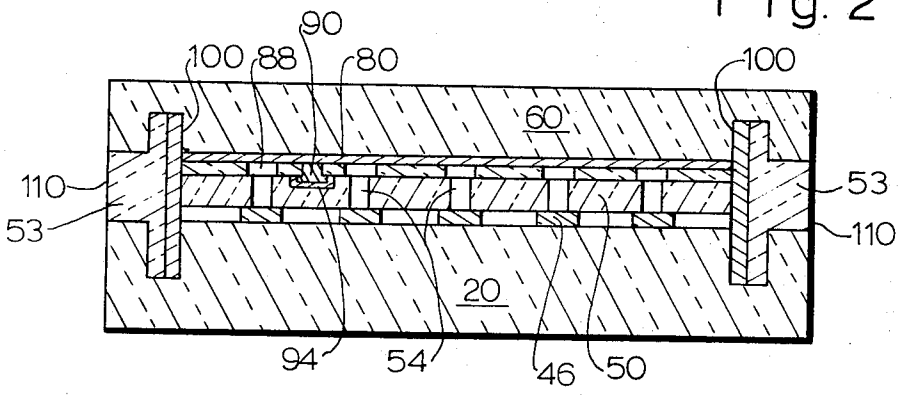
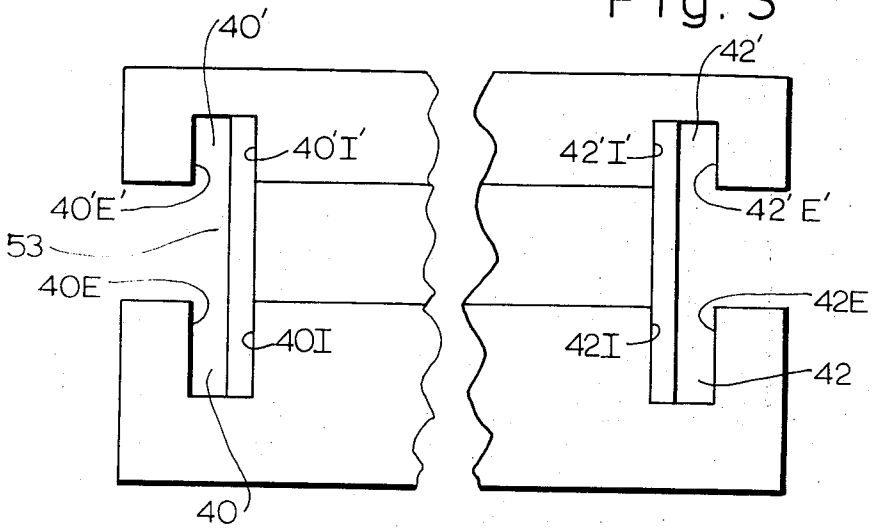


Fig. 3



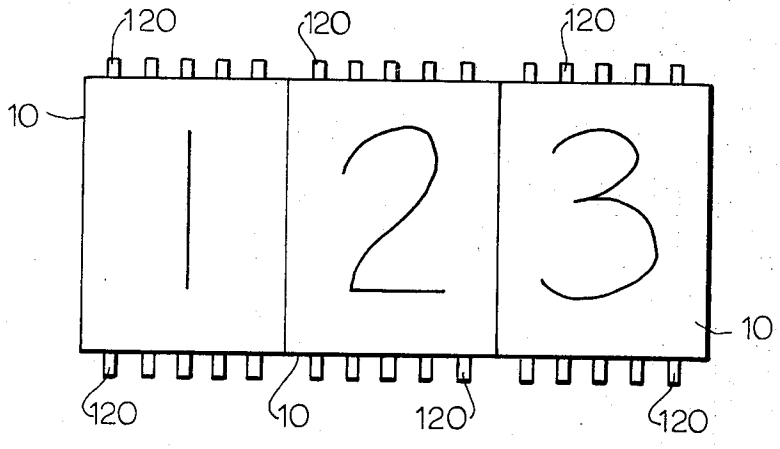


Fig. 5

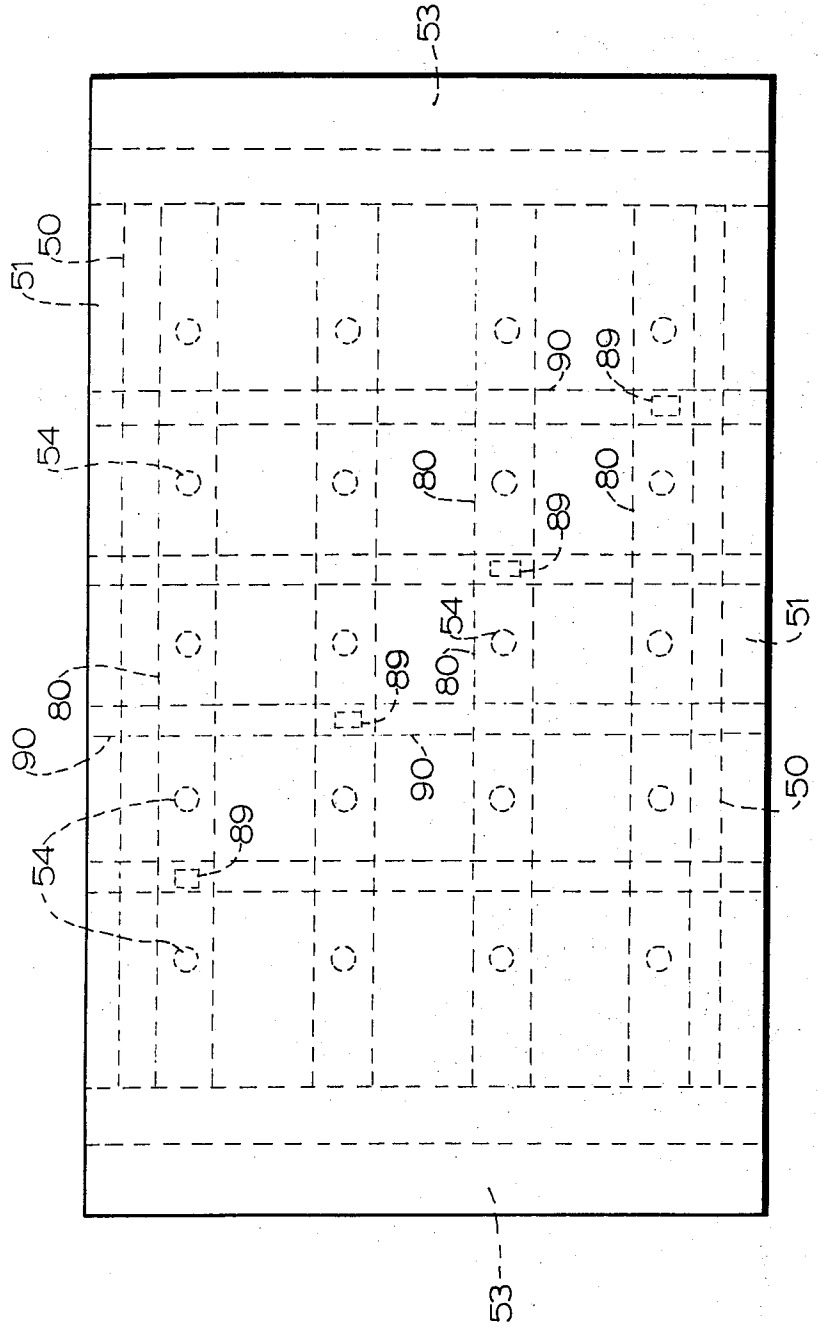


Fig. 4

DISPLAY PANEL HAVING FLAT SIDE EDGES TO PERMIT BUTTING TOGETHER PLURAL PANELS

BACKGROUND OF THE INVENTION

Display panels of various types have been known for many years, and there is an ever present need for larger and larger panels. In general, panels are made of glass plates, and the size of any panel is limited in general by the size of plate which can be obtained, and, for mass-produced panels to be sold at a reasonable price, only relatively small glass plates can be obtained. Thus, at the present time, if large panels are desired, it is necessary to couple together or butt together a plurality of smaller panels. Up to the present time, buttability was not readily achieved because it was difficult to form edges on panels which were flat and which could be butted together with ease.

SUMMARY OF THE INVENTION

Briefly, a buttable panel embodying the invention has flat opposed side edges, in which, in effect, the side walls are moved inwardly and the side seals are formed inwardly of the side edges whereby flat buttable edges can be formed on the panel.

DESCRIPTION OF THE DRAWINGS

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

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

FIG. **3** is an enlarged, side elevational view of a portion of the panel of FIG. **1**;

FIG. **4** is a plan view of the panel of FIG. **1** showing selected portions thereof; and

FIG. **5** is a plan view of a composite panel made up of a plurality of panels of the type shown in FIG. **1** butted together along their side edges.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The principles of the invention are applicable to substantially any type of display device or other structure which is made up of a plurality of flat plates and where it is desired to couple together or butt together a plurality of devices to form a device of substantially any desired size. For purposes of illustrating the principles of the invention, a gas-filled dot matrix display device is shown and described.

According to the invention, a dot matrix panel **10** includes a base plate **20** having a top surface **22** and a bottom surface **24** and having a left edge **26,** a right edge **28,** an upper edge **30,** and a lower edge **32.** The top surface **22** of the base plate **20** is provided with two channels or slots **40** and **42** which are spaced apart adjacent to, and parallel to, the left and right side edges of the base plate, respectively. The slots **40** and **42** extend across the width of the base plate between the upper and lower edges **30** and **32.**

An array of first electrodes **46,** which in the final panel are operated as anode electrodes or cathode electrodes, are seated on the top surface **22** of base plate **20.** The electrodes are preferably strip-like in form and are disposed parallel to each other extending between the upper and lower edges of the plate parallel to the slots **40** and **42.** The electrodes **46** may be silk-screened or evaporated onto the base plate, or they may be individual metal strips suitably coupled to the base plate.

An insulating center plate **50** of glass, ceramic, or the like having a plurality of apertures **54** arrayed in rows and columns is disposed on the top surface of the base plate and seated on the electrodes **46.** Each column of apertures or cells **54** is aligned with, and in operative relation with, one of the electrode strips.

In a preferred construction, plate **50** is of such length that it extends from slot **40** to slot **42,** but of such width that it does not extend fully from the upper edge **30** to the lower edge **32** of base plate **20.** Thus, spaces **51** are present between the adjacent upper edges of plates **50** and **20,** and the adjacent lower edges of these two plates, as illustrated in FIG. **4.**

The panel is completed by a cover or face plate **60** of glass, ceramic, or the like which is generally similar in structure and size to the base plate **20** and includes top surface **64** and bottom surface **66,** a left edge **68,** a right edge **70,** an upper edge **74,** and a lower edge **76.** A pair of channels or slots **40, 42'** are formed in the lower surface of the face plate close to and parallel to the left and right side edges **68** and **70,** respectively, and extending between the upper and lower edges of the face plate. The slots **40'** and **42'** are positioned so that, when the face plate **60** is placed over the center plate **50** and the base plate **20,** the slots **40** and **42'** are aligned with each other and the slots **42** and **42'** are aligned with each other.

Referring to the pairs of slots and to the enlarged showings thereof in FIG. **3,** slots **40** and **40'** have vertically aligned and coplanar walls **40E** and **40'E'** disposed adjacent to the outer edges of the panel, and inner aligned and coplanar edges **40I** and **40'I'** disposed adjacent to the interior of the panel. Slots **42** and **42'** have similar coplanar outer walls **42E** and **42'E'** and coplanar inner walls **42I** and **42'I'.**

The face plate **60** carries on its lower surface **66** a plurality of electrodes **80,** usable as anodes or cathodes, disposed parallel to each other and at right angles to the electrodes **46** on base plate **20.** Since light produced in the cells **54** must be seen through the face plate, the electrodes **80** are preferably transparent and comprise thin metallic films or a material such as NESA. The electrodes **80** are preferably in strip form, and each is aligned with, and in operative relation with, a row of cells **54** in the center plate **50.**

The lower surface **66** of face plate **60** and the electrodes **80** are provided with a coating **84** of an insulating material such as glass, the coating being provided with openings **88** which are aligned with the cells **54** in the center plate **50.** In addition, the coating **84** is provided with a plurality of other openings **89,** each overlaying and exposing one of the conductive strips **80.** A plurality of conductive terminal strips **90,** which may be screened, plated, or evaporated, are formed on the insulating layer, each in contact with one of the conductive strips **80** through an aperture **89** in the insulating layer. Each terminal strip **90** extends preferably between the upper and lower edges of the face plate and, if desired, is coated with a thin film or layer **94** of insulating material.

In assembling the panel **10,** the three plates **20, 50** and **60** are combined as a sandwich so that channels **40** and **40'** are aligned and channels **42** and **42'** are aligned. A thin rigid plate **100** of metal or plastic or the like is inserted in each pair of aligned channels and dis-

posed up against the inner edges **40I**, **40'I'** and **42I**, **42'I'**. The plates thus form the side walls of the panel and block the interior of the panel along the sides thereof. The plates **100** may be of any suitable thickness, but preferably they are considerably thinner than the channels are wide, for example of the order of one-fourth as wide, generally as illustrated. When the panel is assembled, the remaining portions of the channels between the plates **100** and the outer walls **40E**, **40E'** and **42E**, **42'E'** and the spaces **53** between the top and bottom plates **60** and **20**, respectively, adjacent to the outer edges thereof, are filled with a sealing material such as a glass frit or the like. Such a sealing material may be of the type known as Pyroceram. This sealing material is also disposed in the spaces **51** between and along the aligned top and bottom edges of the face plate and base plate. However, the sealing material does not fill these spaces so that access can be had to the electrodes **46** and **90** which have their ends located in these spaces.

When the panel is heated to a suitable temperature, the sealing material fuses, and, when it cools, it forms a gas-tight seal **110** around the periphery of the panel. After the seal has been made, the side edges of the panel are favorably flat, and panels having these edges can be readily coupled or butted together to form larger composite panels.

It is to be noted that the sealing material contracts slightly when it cools so that it is relatively easy to use an amount which provides a proper seal but which does not project beyond the side edges of the base plate and face plate. However, if some sealing material happens to project beyond these edges, it can be easily removed to provide the desired smooth, planar side edges on the panel.

The spaces **51** between the base plate and face plate formed along the upper and lower edges of the panel permit access to the ends of the electrodes **46** and to the ends of the terminal strips **90** so that electrical connection can be made thereto by means of contact members of the type described and claimed in copending application Ser. No. 201,655, filed Nov. 24, 1971 and now abandoned. In such an arrangement, spring-like metallic contacts **120** (not shown in detail) are inserted between the top and bottom plates in contact with electrodes **44** and **94** and projecting away from the panel, as illustrated generally in FIG. **5**, whereby external electrical contact may be made thereto.

The panel is processed in conventional fashion by procedures which include, among others, exhausting the panel through a suitable tubulation (not shown) and inserting the desired gas atmosphere. Such procedures are well known in the art and need not be described in detail.

Display panels **10** embodying the invention can be butted together, generally as illustrated in FIG. **5**, to provide a panel of such a size as cannot be made economically as a single unit at the present time. Thus, as illustrated, substantially any number of individual panels **10** can be coupled together and secured together, either mechanically or by means of a cement of some type disposed between the individual panels.

It is clear from the foregoing description that the principles of the invention may be employed with many different types of display devices including gas devices, electroluminescent devices, semiconductor devices, liquid crystal devices, and the like or even with other devices, not necessarily display devices, where it is desired to form composite large devices from smaller individual devices.

What is claimed is:

1. A display device comprising

a sandwich-type envelope including at least a base plate and a face plate sealed together along their aligned peripheries to form a display panel,

said base plate and face plate having aligned coplanar left edges and aligned coplanar right edges,

a first slot in the top surface of said base plate adjacent to said left side edge thereof and a similar aligned first slot in the bottom surface of said face plate, said first slots having aligned coplanar outer walls adjacent to the outer left side edge of said base plate and face plate and aligned coplanar inner walls adjacent to the inside of said panel, said first slots forming a first pair of slots,

a second slot in the top surface of said base plate adjacent to said right edge of said base plate and a similar aligned second slot in the bottom surface of said face plate, said second slots having aligned coplanar outer walls adjacent to the outer right side edges of said base plate and face plate and aligned coplanar walls adjacent to the inside of said panel, said second slots forming a second pair of slots,

a relatively rigid plate seated in each of said pairs of aligned slots,

a sealing material filling said pairs of aligned slots and sealing the portions thereof adjacent to said rigid plates and forming a gas-tight seal between said base plate and face plate along the left and right side edges thereof, said sealing material and said left and right side edges of said base plate and face plate forming flat left and right side edges of said panel to permit buttability of one panel with a similar panel.

2. The panel defined in claim **1** wherein said plates are seated in said pairs of aligned slots and bear against the aligned coplanar inner walls thereof, whereby, in effect, forming the side walls of the inner portion of said panel.

3. The panel defined in claim **1** wherein said plates are narrower than said slots and are positioned in said slots so that they bear against the inner walls thereof.

4. The panel defined in claim **1** wherein said panel includes upper and lower edges and including a plurality of gas-filled display devices within said panel,

at least two electrodes in operative relation with each of said display devices, said electrodes extending through the upper and lower edges of said panel.

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