

United States Patent

Glaser

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[54] **DISPLAY PANEL HAVING GAS-FILLED CELLS UTILIZING PHOSPHOR MATERIALS**

[72] Inventor: **David Glaser**, Green Brook, N.J.

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

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[51] Int. Cl. **H01j 1/62**

[58] Field of Search **313/108 A, 108 B, 109.5; 315/169, 169 TV**

2,933,648 4/1960 Bentley 315/169 R
2,972,707 2/1961 Wood 315/169 R X
2,922,076 1/1960 Sack et al. 315/169 R X

Primary Examiner—Roy Lake

Assistant Examiner—James B. Mullins

Attorney—Kenneth L. Miller, Robert A. Green, George L. Kensinger and Charles S. Hall

[57] ABSTRACT

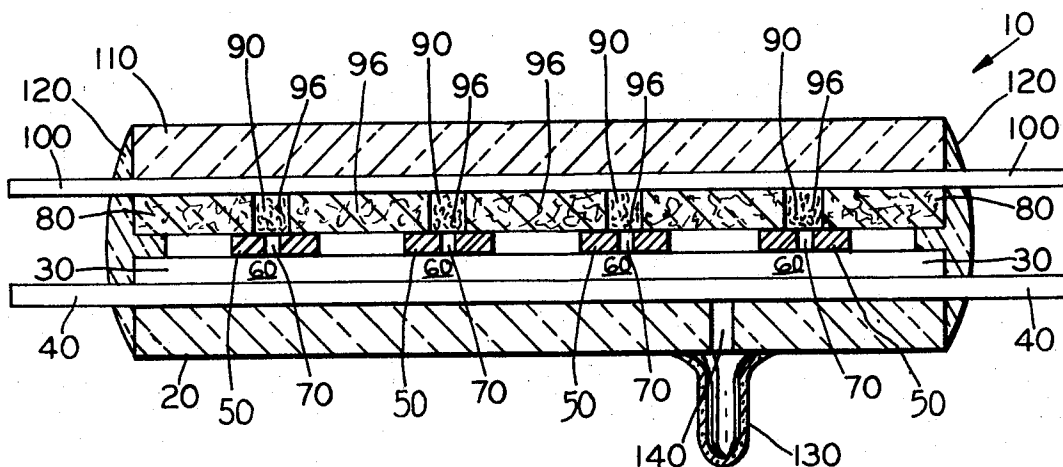
The display panel includes a plurality of gas-filled cells and electrodes therefor, with some of the cells being formed by apertures in an insulating plate. The panel includes a selected phosphor material which is integral with said insulating plate and is exposed in the apertures therein.

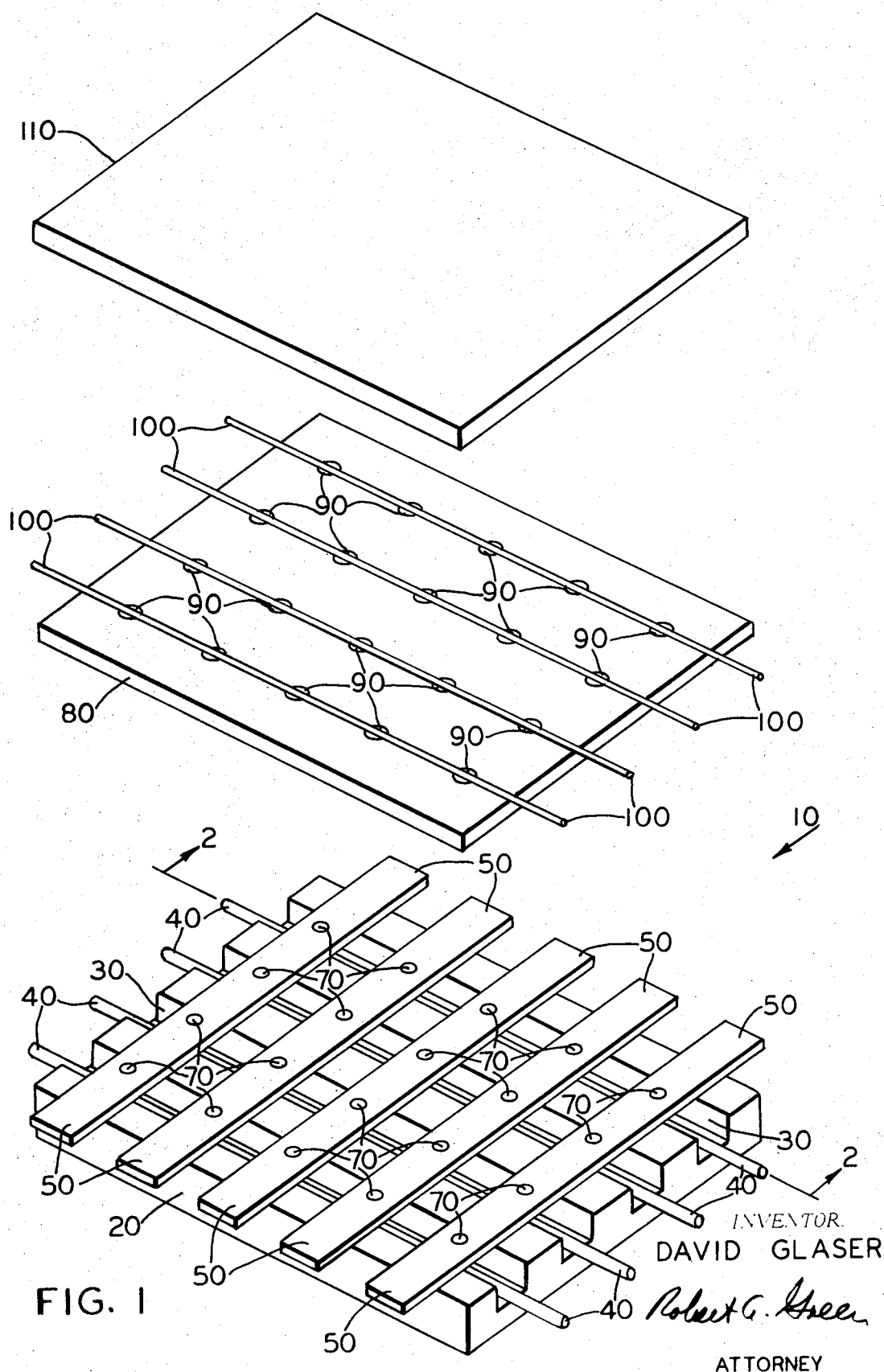
[56] References Cited

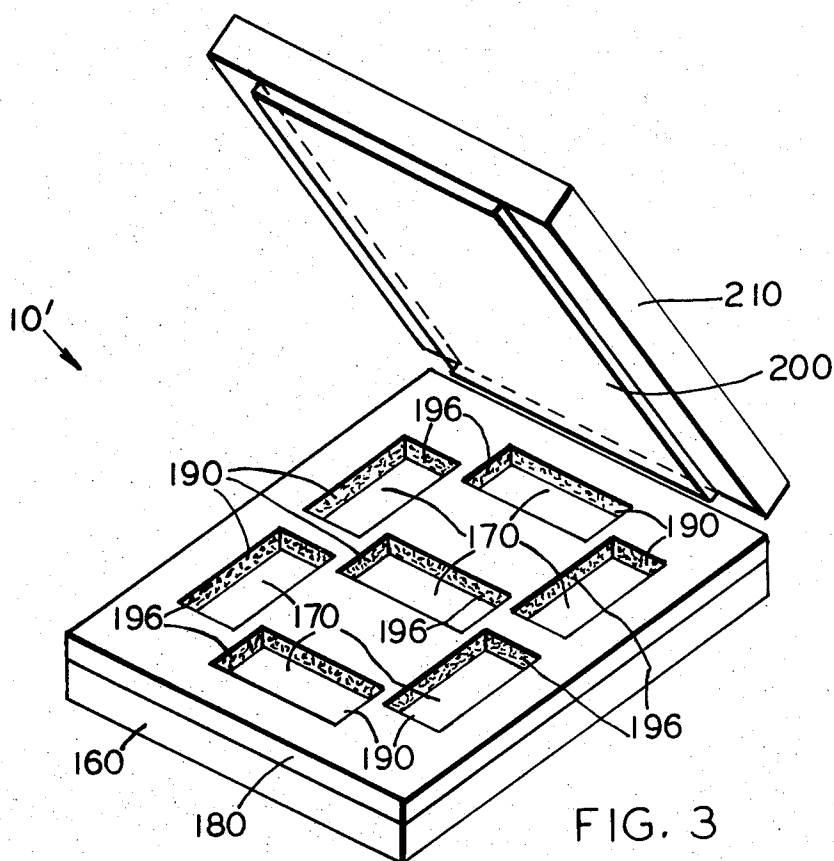
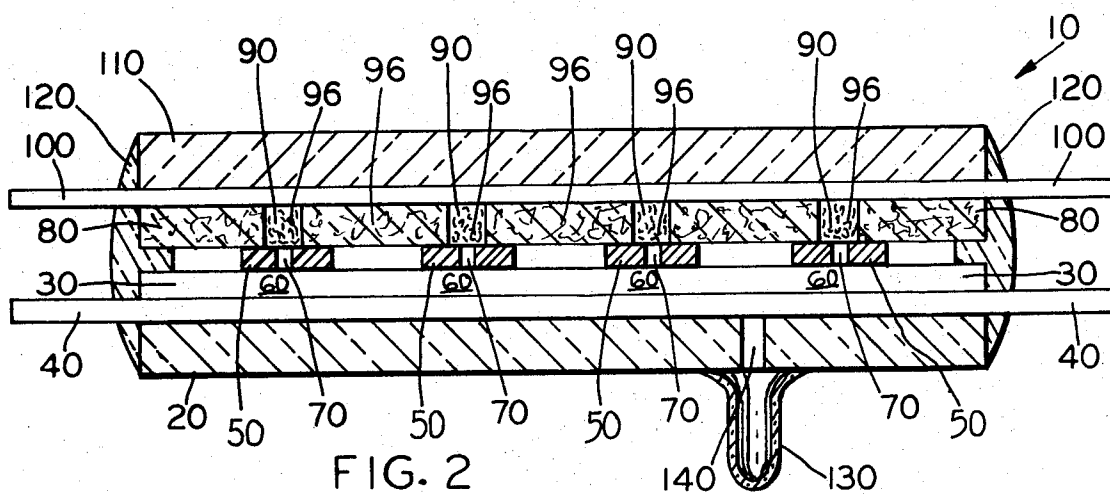
UNITED STATES PATENTS

3,559,190 1/1971 Bitzer et al. 315/169 R UX

11 Claims, 3 Drawing Figures







INVENTOR.

DAVID GLASER

BY

Robert C. Green

ATTORNEY

DISPLAY PANEL HAVING GAS-FILLED CELLS UTILIZING PHOSPHOR MATERIALS

BACKGROUND OF THE INVENTION

Gas-filled display panels have become commercially available, and there are at least two types which are offered for sale. One type includes rows and columns of small gas-filled cells which are selectively energized to represent characters. The other type includes segment-shaped glow elements which are energized in groups to represent characters. Generally, the light produced when such devices are operated has a characteristic color determined by the gas content, but it is desirable to be able to vary or select colors other than those provided by the known gases, and one arrangement uses phosphor materials for this purpose. However, the prior art provides no completely satisfactory method of introducing phosphor material into panel display devices.

SUMMARY OF THE INVENTION

Briefly, the invention comprises including a phosphor material in the body of an insulating plate which carries a plurality of apertures which comprise the display cells of a panel, with the phosphor material being exposed and accessible in said apertures.

DESCRIPTION OF THE DRAWINGS

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

FIG. 2 is a sectional view, along the lines 2—2 in FIG. 1, showing the panel assembled; and

FIG. 3 is a perspective exploded view of another type of display device which can utilize the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

One form of display panel 10 which may be utilized in practicing the invention is known as a SELF-SCAN panel and includes a base plate 20 of glass, ceramic, or the like having a top surface in which a plurality of parallel, horizontal slots 30 are formed. An electrode 40, preferably a wire operated as a scanning anode, is seated in each of the slots 30; and an array of electrodes 50, preferably flat strip electrodes operated as scanning cathodes, are seated on the top surface of the base plate 20. The cathode electrodes 50 are oriented at 90° to the anode electrodes 40 so that each cathode crosses each anode and each crossing defines a scanning gas cell 60. The cathodes carry tiny apertures 70, each of which is located at a scanning cell, and the scanning cells are arrayed in rows and columns.

An apertured insulating plate 80 is seated on the cathode electrodes, and, if desired, the cathodes may be seated in depressions in either the top surface of the base plate or the bottom surface of the apertured plate. The apertured plate includes apertures 90 which function as display cells, here being one display cell 90 for each scanning cell 60 so that the plate includes rows and columns of display cells.

According to the invention, a phosphor material 96 is provided in operative relation with each display cell 90, and, in one suitable arrangement, the phosphor is dispersed through the body of plate 80 and is exposed in the walls of the plate which define the apertures 90.

The plate 80 may be made of glass, or it may be made of a material known as Forsterite, and the desired phosphor material may be mixed with the starting material from which the plate 80 is formed by a molding process or by any other process. If the apertures 80 are formed directly in the manufacturing process, then particles of phosphor material 96 will be exposed in the walls of the cells, and similarly, if the holes are formed by a drilling process after the plate 80 is manufactured, then the phosphor material will be similarly exposed in the cells.

Phosphor materials which may be used in gas devices are well known, and some of these include zinc orthosilicates, zinc sulfides, lead sulfides, and the like.

An array of electrodes 100, preferably wires operated as display anodes, is seated on the top surface of the apertured plate 80, with each electrode being aligned with a row of display cells 90. The panel is completed by a top glass cover or viewing plate 110.

All of the insulating plates and electrodes are secured together by a seal 120 which may be formed of a glass frit or the like, and the panel is filled with the desired gas through a tubulation 130 secured to plate 20 and communicating with the interior of the panel through a hole 140 in plate 20. The gas used in panel 10 may be 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. The gas pressure may be selected from a relatively wide range, for example from about 50 to about 250 torr at room temperature, with about 175 torr being normally used.

The operation of a panel such as panel 10 is described in detail in copending application Ser. No. 850,984, and the intimate details of the operation will not be set forth herein. It is sufficient to say that the scanning cells and the display cells are operated in conjunction with each other, with information control signals being utilized to cause the cells 90 to glow and to display a message or character. When the cells 90 glow, the phosphor in the walls of the cells is energized to produce the desired color of glow in the cells and in the message displayed.

The principles of the invention may also be employed in a segment-type display device, one form of which is shown schematically in FIG. 3. The device 10' includes an insulating base plate 160 which carries a plurality of cathode segments 170, each of which has a conductive lead (not shown), and an apertured insulating plate 180 is seated on the insulating base plate, with each aperture 190 therein surrounding and enclosing one of the cathode segments. The panel 10' also includes an anode electrode 200, which may be a screen which is positioned over the group of cathode electrodes, or the anode may comprise a transparent conductive film as shown, formed on the cover plate 210 of the panel.

In the panel 10', the apertured insulating plate 180 includes embedded phosphor material 196 which is exposed in each of the apertures 190, generally in the manner described above.

It is clear that the invention may also be practiced with display panels having groups of cathode segments, each of which can display a character so that a plurality of characters can be displayed at the same time. Panels

of this type are described and claimed in copending application Ser. No. 61,642, filed Aug. 6, 1970.

What is claimed is:

1. A gas-filled display device comprising an envelope containing an insulating body having apertures defining gas-filled glow cells, and an anode and cathode electrode associated with each said cell, said insulating body having phosphor material dispersed through its body and exposed in said apertures. 5
2. The device defined in claim 1 wherein said apertures comprise small dot-like volumes which are arrayed in rows and columns and can be selectively energized to display characters. 10
3. The device defined in claim 1 wherein said insulating body has an array of elongated rectangular apertures, said apertures being energizable in different groups to represent characters. 15
4. The device defined in claim 1 wherein each cathode electrode is disposed within an aperture and each anode electrode is spaced therefrom. 20
5. A gas-filled display device comprising an envelope containing an insulating plate having apertures defining gas-filled glow cells and having top and bottom surfaces, an anode and cathode electrode associated with each said cell, said cathode being positioned adjacent to said bottom surface of said plate and said anode electrode being positioned adjacent to said top surface of said plate, said insulating plate having phosphor material dispersed through its body and exposed in said apertures. 25
6. A gas-filled display device comprising an envelope containing a first array of first gas-filled cells and having an anode electrode and a cathode electrode means associated with each of said cells, an insulating plate having a second array of second gas-filled cells in operative relation with said first array of cells with an anode and said cathode electrode means associated with each said second cell, said insulating plate having phosphor material dispersed through its body and exposed in said second cells. 30
7. A gas-filled display device comprising an envelope containing a first array of first gas-filled cells and having an anode electrode and a cathode electrode associated with each of said cells, and an insulating plate having a second array of second gas-filled cells in operative relation with said first array of cells with an anode and said cathode electrode associated with each said second cell, said second array of gas-filled cells being disposed adjacent to and above said first array of gas-filled 35

- cells, with each second gas-filled cell being in gas communication with one of said first gas-filled cells, said insulating plate having phosphor material exposed in said second cells. 40
8. A gas-filled display device comprising an envelope, a first insulating plate in said envelope, a plurality of cathode electrodes on said plate, a second insulating plate supported on said first plate and having a plurality of apertures, each of which surrounds and encloses one of said cathode segments, and an anode electrode spaced from said cathode electrodes, said second insulating plate having phosphor material exposed in said apertures. 45
9. A gas-filled display device comprising an envelope, a first insulating plate in said envelope, a plurality of cathode electrodes on said plate, a second insulating plate supported on said first plate and having a plurality of apertures, each of which surrounds and encloses one of said cathode segments, and an anode electrode spaced from said cathode electrodes, said second insulating plate having phosphor material dispersed through its body and exposed in said apertures. 50
10. Method of making a display panel comprising the steps of preparing a mixture of an insulating material and a phosphor material and forming a plate therewith having apertures in which particles of said phosphor material are exposed, assembling said plate with an anode electrode and a cathode electrode for each aperture in an envelope, introducing an ionizable gas into said envelope, and sealing said envelope. 55
11. A display device comprising a gas-filled envelope containing an insulating plate having apertures defining gas-filled glow cells, said cells being spaced apart, with solid portions of said plate disposed between them, and an anode and cathode electrode associated with each said cell, said insulating plate having particles of phosphor material dispersed throughout its volume and within the solid portions thereof disposed between said cells, said phosphor particles being exposed in the walls of said plate defining each of said apertures and in contact with the gas therein. 60

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