

[54] **GAS DISCHARGE DISPLAY DEVICE**

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[58] Field of Search 340/324 M, 166 EL; 315/84.6, 168, 169 R, 169 TV; 313/220

[56]

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Primary Examiner—David L. Trafton

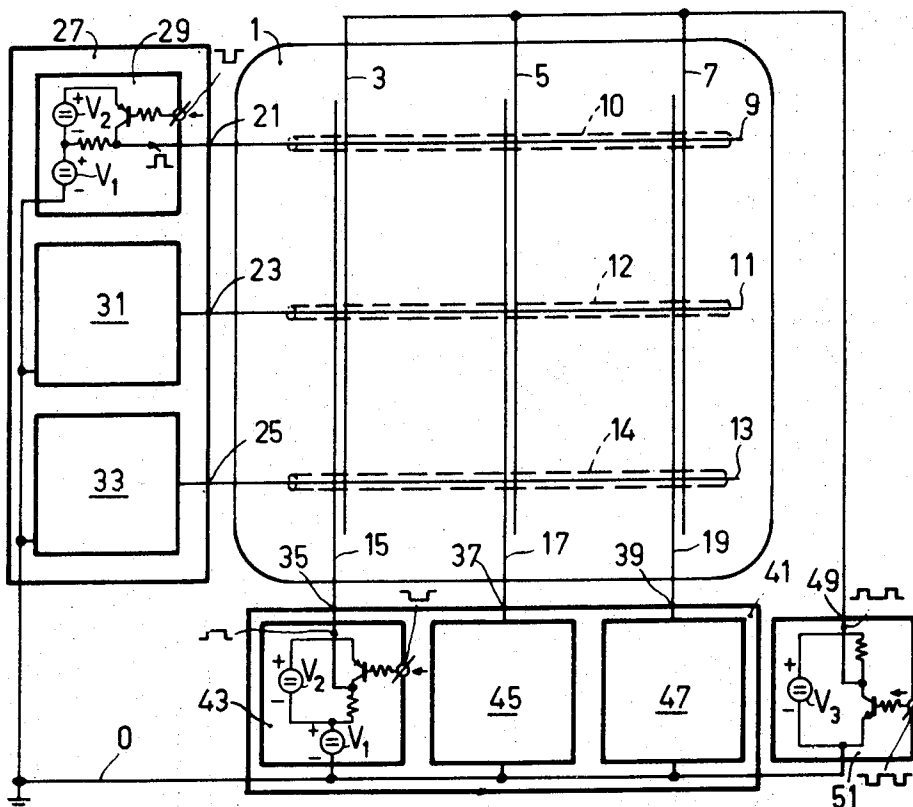
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ABSTRACT

Gas discharge display device of a cross-bar type which comprises a cathode system, an auxiliary anode system and an anode system and in which in order to permit the use of low-dissipation control circuits the electrodes of the auxiliary anode system are at right angles to those of the anode system.

3 Claims, 2 Drawing Figures



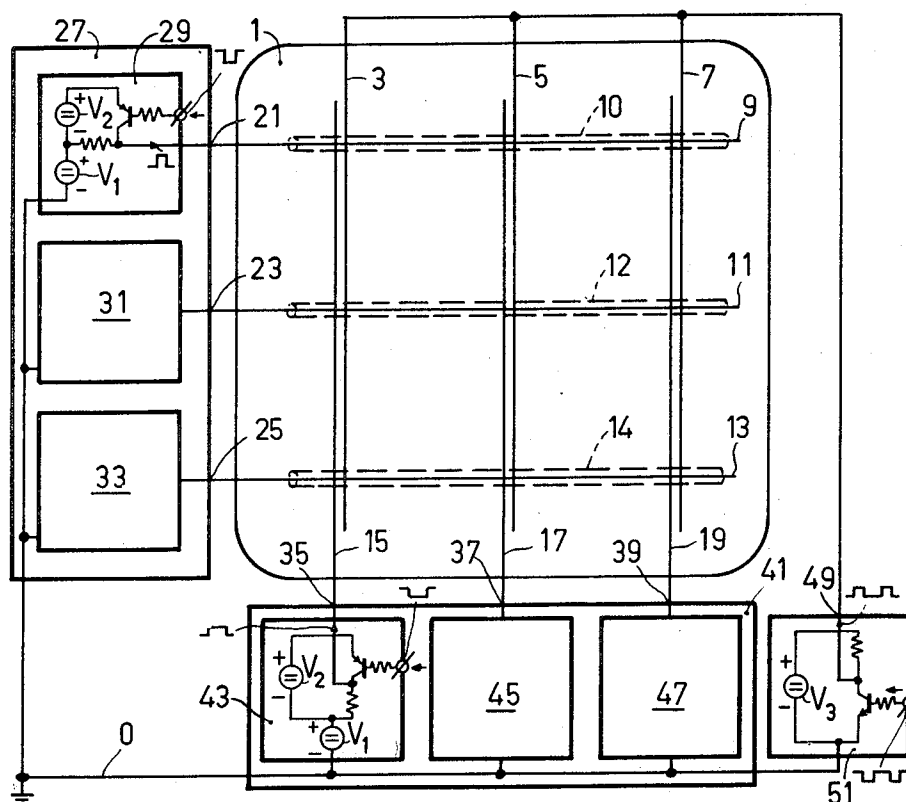


Fig. 1

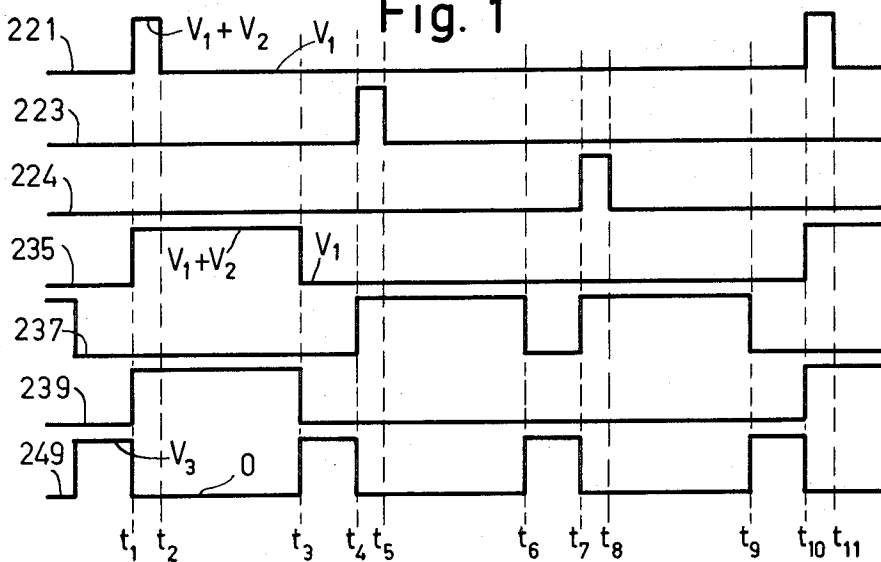


Fig. 2

GAS DISCHARGE DISPLAY DEVICE

The invention relates to a gas discharge display device which includes a system of cathodes and auxiliary anodes which belongs to an auxiliary discharge portion and a system of anodes which together with the system of cathodes belongs to a main discharge portion which serves for visual display, a first control circuit being coupled to the auxiliary discharge portion for obtaining linewise firing, along an electrode of the auxiliary discharge portion substantially at right angles to the electrodes of the anode system, of part of the auxiliary discharge portion whilst a second control circuit is coupled to the main discharge portion for firing, along a fired line of the auxiliary discharge portion, parts of the main discharge portion which are situated along electrodes of the anode system.

In "Electronics" of Mar. 2, 1970, pages 120-125 a gas discharge display device of the aforementioned type is described in which by means of the first control circuit the electrodes of the cathode system which are at right angles to those of the anode system are successively energized. The electrodes of the auxiliary anode system are at right angles to those of the cathode system and are connected via a limiting resistor to a fixed potential. The number of anodes of this display device is small.

It is an object of the invention to provide a display device which provides advantages when used for a large number of anodes in extensive display devices.

A gas discharge display device of the type mentioned at the beginning of this specification according to the invention is characterized in that the said electrode of the auxiliary discharge portion along which linewise firing takes place is an auxiliary anode of the auxiliary anode system, which auxiliary anode extends substantially at right angles to the electrodes of the anode system, the first control circuit being coupled to the electrodes of the auxiliary anode system.

In such a display device, for example, the cathodes may be at a fixed potential, so that the first control circuit controls only the auxiliary anodes which pass auxiliary discharge current and hence need to draw appreciably less current than the cathodes, which pass both the auxiliary discharge current and the main discharge current.

As an alternative, all the cathodes may commonly be driven by a third control circuit, in which case only a single stage is required which must be capable of passing a large current. The cathodes may be arranged at right angles to the anodes or at right angles to the auxiliary anodes.

In display devices comprising large numbers of electrodes, the arrangement according to the invention results in that the current to be supplied by the control circuits are reduced to a minimum, which is of importance for obtaining cheap transistor circuits.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying diagrammatic drawings, in which

FIG. 1 shows a simplified block diagram of a gas discharge display device according to the invention, and

FIG. 2 shows the waveforms of the control signals which are produced at the various electrodes of the display device shown in FIG. 1.

Referring now to FIG. 1, a gas discharge display panel 1 has a cathode system comprising cathodes 3, 5 and 7, an auxiliary anode system comprising auxiliary anodes 9, 11 and 13 each coated with a resistance layer 10, 12 and 14 respectively, and an anode system comprising anodes 15, 17 and 19.

The auxiliary anodes 9, 11 and 13 together with the cathodes 3, 5 and 7 form part of an auxiliary discharge portion, and the anodes 15, 17 and 19 together with the cathodes 3, 5 and 7 form part of a main discharge portion.

The auxiliary anodes 9, 11 and 13 extend at right angles to the anodes 15, 17 and 19 and are each connected to an output 21, 23 and 25 respectively of a first control circuit 27 which comprises control stages 29, 31 and 33 each coupled to one of the said outputs.

The anodes 15, 17 and 19 are connected to outputs 35, 37 and 39 respectively of a second control circuit 41 which comprises control stages 43, 45 and 47 which each are connected to one of these outputs.

The cathodes 3, 5 and 7 are connected to one another and to an output 49 of a third control circuit 51.

Voltage wave forms 221, 223, 225, 235, 237, 239 and 249 shown in FIG. 2 are produced at the outputs 21, 23, 25, 35, 37, 39 and 49 respectively. FIG. 2 further shows instants t_1 to t_{11} which are of importance for explaining the operation of the circuit arrangement. The voltage waveforms are idealized and not drawn to scale.

The operation of the circuit arrangement is as follows. At the instant t_1 , the voltage at the auxiliary anode 9 is made high and that at all the cathodes is made low. As a result, in the auxiliary discharge portion gas discharges are produced at the points at which the auxiliary anode 9 crosses the cathodes 3, 5 and 7, which discharges lie on a line along the auxiliary anode 9. The currents flowing through these gas discharges are restricted at each crossing by the resistance coating 10 on the auxiliary anode 9.

At the same instant t_1 the voltages at the anodes 35 and 39 are increased, so that in the main discharge portion main discharges are produced at the points at which the fired line of the auxiliary discharge portion along the auxiliary anode 9 crosses the said anodes 35 and 39, and these main discharges are used for visual display either directly or, for example, via conversion of light by means of phosphors. If desired, for example in order to reduce the dissipation in the circuit arrangement, after the main discharges have been struck the voltage set up at the auxiliary anode 9 may be removed by decreasing it at the instant t_2 .

At the instant t_3 the main discharges at the anodes 35 and 39 are extinguished in that the voltage at these anodes is decreased and simultaneously the voltage at the cathodes 3, 5 and 7 is increased.

At the instant t_4 a line of points at which the auxiliary anode 11 crosses the cathodes 3, 5 and 7 is fired in the auxiliary discharge portion in that the voltage at these cathodes is decreased and the voltage at the auxiliary anode 11 is increased.

Thus, the voltage at the anode 37 is increased, causing the crossing of this anode and the fired auxiliary discharge line to emit light.

At the instant t_5 the voltage at the auxiliary anode 11 is decreased and at the instant t_6 the voltage at the anode 37 is decreased and the voltage at the cathodes

3, 5 and 7 is increased. Thus all discharges are distinguished.

Similarly, at the instant t_8 a main discharge is produced at a crossing of the anode 37 and a line of auxiliary discharges fired along the auxiliary anode 13, and at the instant t_9 this discharge is extinguished again, after which at the instant t_{10} the cycle described can repeat.

The auxiliary discharge portion includes only one control circuit 51 which must be capable of supplying a large current. In many cases this circuit may even be dispensed with. In that case a fixed potential is applied to the cathodes.

Although in the embodiment shown the cathodes extend at right angles to the auxiliary anodes, they may obviously extend in the same direction as these auxiliary anodes.

The instants t_2 , t_5 and t_7 for interrupting the current to the auxiliary anodes may advantageously be selected in the manner mentioned hereinbefore so as to reduce the dissipation in the first control circuit 27 to a minimum, however, if desired they may be later. In selecting the instants t_2 and t_3 the deionisation time of the gas discharge must obviously be taken into account.

When self-scanning circuits are used in which the transfer of current from one auxiliary anode to the other is of importance, the instant t_2 , t_3 , t_5 , t_6 and t_8 , t_9 must be chosen so as to facilitate this scanning.

Although in the embodiment described the currents at the crossings in the auxiliary discharge portion are limited by coating the auxiliary anodes with a resistance layer, obviously other suitable methods of limitation may be used.

Furthermore, if desired, the currents in the main dis-

charge portion may be modulated in a suitable manner for obtaining a grey scale.

What is claimed is:

1. Gas discharge display device which includes a system of cathodes and auxiliary anodes which belongs to an auxiliary discharge portion and a system of anodes which together with the system of cathodes belongs to a main discharge portion which serves for visual display, a first control circuit being coupled to the auxiliary discharge portion for obtaining line-wise firing, along an electrode of the auxiliary discharge portion of substantially at right angles to electrodes of the anode system, of part of the auxiliary discharge portion whilst a second control circuit is coupled to the main discharge portion for firing, along a fired line of the auxiliary discharge portion, parts of the main discharge portion which are situated along electrodes of the anode system, characterized in that the said electrode of the auxiliary discharge portion along which line-wise firing takes place is an auxiliary anode (9, 11 or 13) of the auxiliary anode system, which auxiliary anode extends substantially at right angles to the electrodes (15, 17, 19) of the anode system, the first control circuit (27) being coupled to the electrodes of the auxiliary anode system.

2. Gas discharge display device as claimed in claim 1, characterized in that the electrodes (3, 5, 7) of the cathode system are connected to one another and to a third control circuit.

3. Gas discharge display device as claimed in claim 1, characterized in that the said auxiliary anode (9, 11 or 13) extends substantially at right angles to the electrodes (3, 5, 7) of the cathode system.

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