Dec. 5, 1967 P. K. DANO 3,356,898

XY GLOW LAMP DISPLAY WITH SWITCH FROM IGNITING TO HOLDING VOLTAGE

Filed Nov. 19, 1964

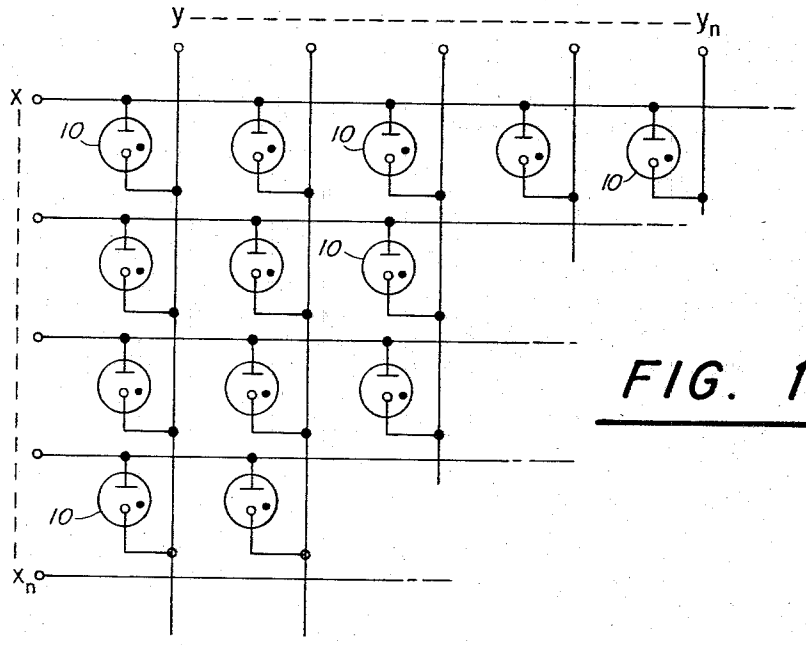

FIG. 1

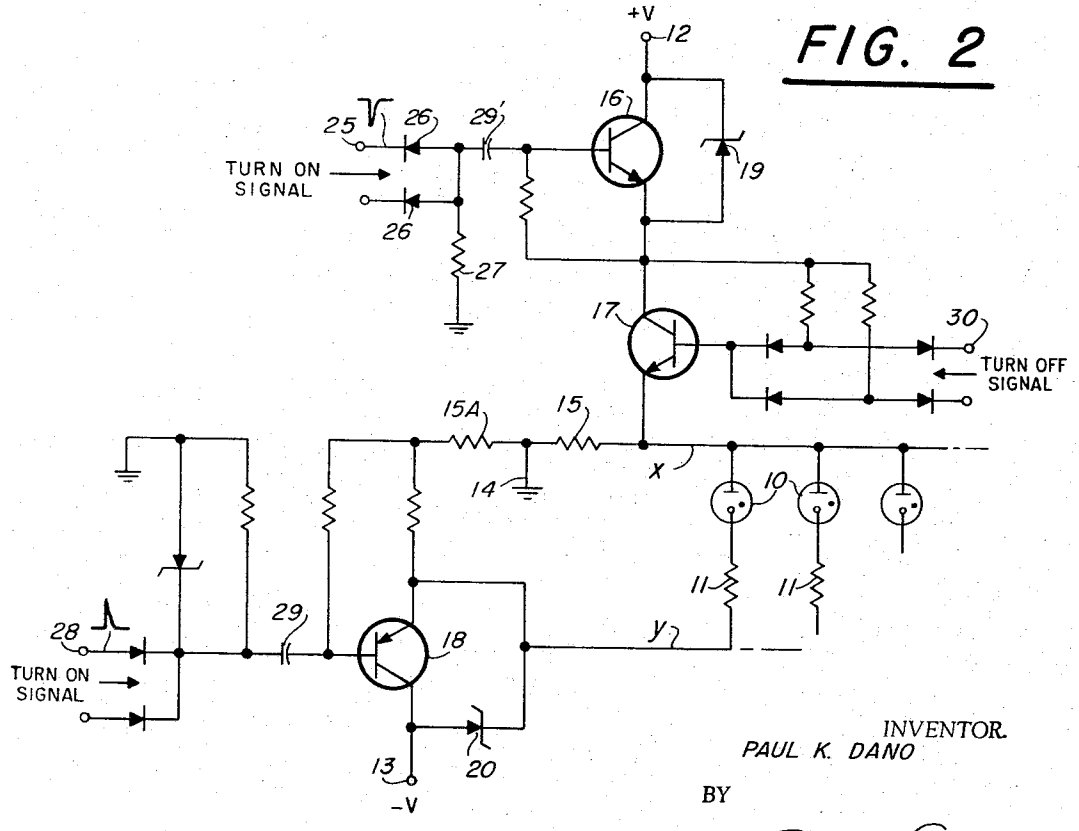

FIG. 2

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United States Patent Office 3,356,898 Patented Dec. 5, 1967

3,356,898

XY GLOW LAMP DISPLAY WITH SWITCH FROM IGNITING TO HOLDING VOLTAGE

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Filed Nov. 19, 1964, Ser. No. 412,577
2 Claims. (Cl. 315—297)

ABSTRACT OF THE DISCLOSURE

Neon glow lamps on a rectangular grid are selectively illuminated to show pictures. To conserve power when large numbers of lamps are on, the transistor switches for applying ignition potential, are each paralleled with a zener diode for applying the lower glow potential.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates to displays and is particularly directed to circuits for selectively illuminating the glow lamps of a rectangularly disposed grid of lamps.

By arranging small lamps which can be lighted in vertical and horizontal rows, much information can be pictorially displayed on a large screen. At each cross-over point of the vertical and horizontal, or X and Y, bus bars is connected one lamp so that by appropriate energization of selected X and Y bars any one lamp or group of lamps can be lighted. It is clear that the current drain can become quite large when hundreds or thousands of lamps are used, so that voltages at lamp terminals can become marginal.

It is an object of this invention to provide improved coupling and switch means between the power source and the X and Y bus bars of a lamp display.

The object of this invention is attained by connecting a glow lamp across each junction of the X and Y bus bars of a rectangular grid and then connecting between the voltage source and one end of each bar a novel transistor switch arrangement for applying to each bar any one of three voltages. The three voltages are, respectively, equal to the (1) the ignition voltage of the glow lamp, (2) the relatively lower glow maintaining voltage and (3) the lamp extinguishing voltage.

Other objects and features of this invention will become apparent to those skilled in the art by referring to the specific embodiment described in the following specification and shown in the accompanying drawing in which:

FIG. 1 is a circuit schematic of the type of XY grid contemplated in this invention; and

FIG. 2 is a schematic circuit diagram of one switch arrangement of this invention.

The glow lamp contemplated here is of the small pilot-light or spot-light type comprising an envelope filled with a low pressure inert gas and containing two lead-in wires and two electrodes which, when energized with the proper voltage, will ionize the gas and produce what is called a glow or gaseous discharge. The ignition voltage of the discharge is usually measurably higher than the voltage required to maintain the glow. The voltage to extinguish the discharge is lower than the maintenance voltage. One commercial glow lamp suitable for the system of this invention is of General Electric manufacture, type NE–76, and is called a neon glow lamp. The initial or ignition breakdown voltage of this particular lamp is between 68 and 76 volts while the voltage required to maintain a glow is between 50 and 60 volts. The steady current at

this voltage is about 0.4 milliampere, and the dark resistance between terminals is of the order of 100 megohms.

The grid or matrix of glow lamps shown in FIG. 1 may comprise any desired number of horizontal bus bars X to X_n and any number of vertical bus bars Y to Y_n. A glow lamp **10** is connected at each cross-over point so that when the appropriate positive and negative voltages are applied, respectively, to the X and Y bars a gaseous discharge is ignited. Not shown is logic circuitry for so programming the X and Y voltages as to produce a desired pattern of lights on the grid.

In FIG. 2 is shown one glow lamp and switch means for the particular X and Y bus bars connected to that lamp. Lamp **10** is connected in series with the current limiting resistor **11**. The voltage source, not shown, is connected to terminals **12** and **13** with the voltage polarization as shown, and is center-tapped and grounded. A circuit comprising the coupling resistor **15** and the emitter-collector circuits of NPN transistors **16** and **17** are connected in series between the positive terminal **12** of the voltage source and ground **14**. The emitter-collector of PNP transistor **18** is connected in series with coupling resistor **15A** between the negative terminal **13** and ground **14**. With the polarities shown transistors **16** and **17** are of the NPN type, while transistor **18** is of the PNP type. The constant voltage zener diode **19** is connected across transistor **16** and the constant voltage zener diode **20** is connected across transistor **18**. Zener diodes commercially identified as 1N756 have a constant voltage drop of 8 volts when reverse biased beyond avalanche.

Transistor **16** is driven between cut-off and saturation by the signal applied to input terminal **25**. The voltage at **25** and bias should be sufficient for distinct off-on switching action. The diodes **26** and resistor **27** are connected in AND gate configuration to permit control voltages at the signal input. In the embodiment shown, pulses applied to terminal **25** are coupled through the AND gate and coupling condenser **29'** to the base of the transistor **16** to drive the normally cut-off transistor to saturation. A control pulse applied to terminal **28** is likewise coupled through coupling condenser **29** to the base of switch transistor **18**.

In the quiescent state transistor **16** is cut off, as stated, and transistor **17** is turned on to saturation, and the resistance thereacross is negligible. The quiescent current path, then, is from the positive terminal **12** through zener diode **19**, through transistor **17** and hence through the coupling resistor **15** to ground. Where transistor **16** and **17** are of the commercial type 2N697, the coupling resistor **15** should be of the order of 20,000 ohms. If the power terminal **12** is at 38 volts, the voltage on bus bar X will be about 30 volts. That is, 38 volts minus 8 volts equals 30 volts. If now a signal is applied to terminal **25** and is capacitively coupled to the base of transistor **16**, transistor **16** is turned on, to saturation. The near-zero resistance of the transistor **16** short-circuits zener diode **19** so that essentially all of the +V voltage of terminal **12** is applied across the coupling resistor **15**. The bus bar X now rises to +38 volts.

The Y switch arrangement including transistor **18** operates in all essential respects the same as the X switch **16**. When transistor **18** is cut-off the voltage drop of say 8 volts is established across zener diode **20**, applying to Y bus bar the negative voltage of terminal **13** minus the drop across the diode. When transistor **18** conducts however, the diode is short circuited and the full —V volts, say —38 volts, is applied to bus bar Y. If then, both "on" signals at **25** and **28** are simultaneously applied, a full 76 volts (38+38) is applied across the glow lamp **10**, to reliably initiate the gaseous discharge. Momentary application only of the high voltage is required, and when the transistors **16** and **18** are returned to cut off the volt-

age difference between bars X and Y reduces to 60 volts for continuous operation. It is necessary to open circuit one side only of the power supply to extinguish the glow lamp **10**. By applying the proper voltage to the turn-off terminal **30** the base of transistor **17** can be driven to cut-off to open-circuit the series circuit. This effectively removes all voltage from bus bar X, and extinguishes the lamp.

Many modifications may be made in the specific circuitry of FIG. 2 without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. A display system comprising;

a two-dimensional array of glow lamps orderly arrayed in parallel rows and columns, each lamp having a first and a second terminal, having a predetermined ignition voltage 2V, between said terminals, and having a lower hold voltage,

a voltage source with one terminal of positive voltage, +V, and a second terminal of negative voltage, −V.

a first group of bus bars, each bar of said first group being connected with said first terminal of each of the glow lamps in one row of said array of lamps,

a second group of bus bars, each bar of said second group being connected with said second terminal of each of the glow lamps in one column of said array of lamps,

one group of switches connected between one terminal of said source and, respectively, each of the bus bars of said first group,

a second group of switches connected between the other terminal of said source and, respectively, each of the bus bars of said second group,

means for simultaneously closing the circuits of any two switches in different switch groups to apply said 2V ignition voltage to a selected one of said lamps, and

a constant voltage device connected across the switches of one group for establishing said lower hold voltage when the associated switch is open circuited.

2. The system defined in claim **1** further comprising a transistor with a controlled current path connected in series between each bus bar of one of set groups of bus bars and the associated switch for interrupting the voltage applied to said bus bar to extinguish said discharge device.

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