

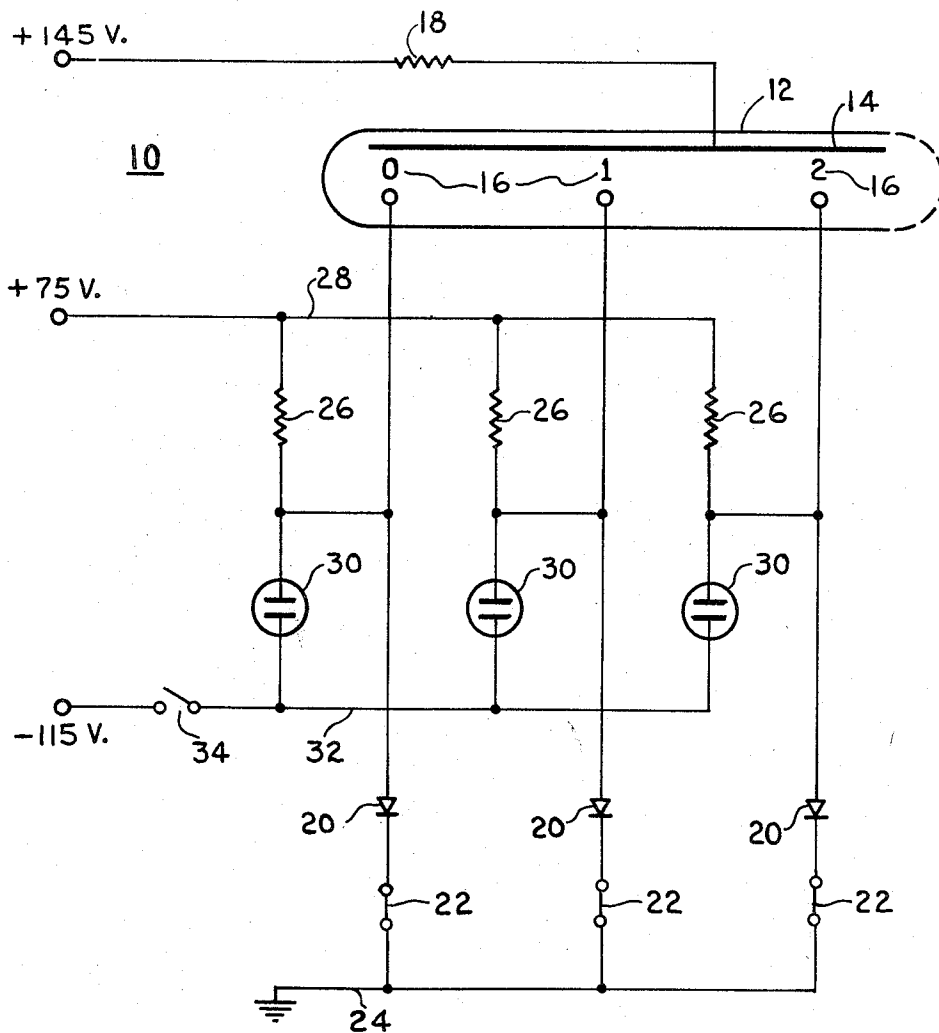
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GLOW TUBE STORAGE CIRCUITS

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GLOW TUBE STORAGE CIRCUITS

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6 Claims. (Cl. 315—84.6)

This invention relates to cold cathode gaseous glow tubes and particularly to circuits for storing cathode glow in such a tube.

One type of cold cathode glow tube comprises a gas-filled envelope which contains an anode electrode and a plurality of cathode indicator electrodes in the form of numerals, letters, or the like, which are adapted to glow when appropriate electrical potentials are applied thereto. Ordinarily, a voltage is applied between the anode and the selected cathode to be viewed, and the cathode glows as long as the voltage is applied. Up to the present time, it has not been possible to efficiently store a signal and maintain cathode glow in such tubes after the energizing voltage has been removed.

Accordingly, one object of the present invention is to provide an improved circuit for use with cold cathode gaseous glow tubes.

Another object of the invention is to provide an improved circuit for causing cathode glow and achieving storage of cathode glow in a cold cathode gaseous glow tube.

In brief, the principles and objects of the invention are achieved in a circuit including a cold cathode gaseous glow tube which comprises a gas-filled envelope containing an anode and one or more cathode indicator electrodes adapted to glow and to be viewed. The circuit arrangement is such that, in effect, bistable operation is achieved with operating voltages applied to the glow tube electrodes at all times. In one state of operation, the relationship between the voltages is such that a cathode cannot glow. In the other operating state, the voltage levels are altered sufficiently to cause a selected cathode to glow and these voltage levels are automatically maintained and cathode glow is maintained until positive action taken by a portion of the circuit re-establishes the first operating voltage levels, at which time cathode glow is discontinued. The circuit includes a second cold cathode gas tube which is characterized by a comparatively large difference between its firing voltage and its glow-maintaining voltage. This latter tube is connected in such a way that, when not ignited, insufficient voltage is applied across the cold cathode gaseous glow tube to cause a cathode to glow. When the second glow tube is ignited, the voltage levels change so that the voltage across the first-mentioned cathode glow tube is sufficient to achieve cathode glow. The second glow tube remains ignited until positive action is taken to extinguish it, for example, by removing its operating voltage, and the cathode indicator element continues to glow for the same period of time.

The invention is described in greater detail by reference to the single sheet of drawings which shows a schematic representation of a gaseous glow tube and a circuit in which it may be operated for initiating and storing cathode glow.

Referring to the drawing, a circuit 10 embodying the principles of the invention includes a cold cathode gaseous glow tube 12 such as the 6844 numerical indicator tube. This type of tube 12 comprises a gas-filled envelope

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which contains an anode electrode 14 and one or more cathode glow indicator electrodes 16 which may be in the form of letters, numerals, or the like. The tube 12 is shown schematically in Fig. 1 and the cathodes are shown as numerals. In actual construction in the type 6844 tube, the cathode indicator electrodes are aligned parallel to each other in a stack which also includes the anode electrode which may be in the form of a disk or screen or the like. However, the form of construction of the cathode indicator glow tube is not critical for the purposes of the present invention.

In the circuit of Fig. 1, the anode 14 of the cathode glow tube 12 is connected through a suitable bias resistor 18 to a positive voltage supply of about 145 volts. Each cathode electrode 16, three of which are shown, is connected through a unidirectional current flow device such as a diode 20 and a switch 22 to a common cathode buss 24 which is connected, in turn, to a source of reference potential such as ground. Each diode 20 is oriented with its anode connected to the tube cathode 16 and its cathode connected to the switch 22. Each indicator cathode 16 of tube 12 is also connected through a bias resistor 26 to a second buss 28 which is connected in turn to a source of positive supply voltage of about 75 volts. Each cathode 16 is also connected through a gaseous glow tube 30, for example, a neon tube or the like, to a third buss 32 which is connected through a switch 34 to a source of negative supply voltage of about -115 volts. The glow tube 30, preferably, has a wide range between its igniting voltage and its glow-sustaining voltage. A General Electric NE-96 neon tube is suitable. Such a tube has a voltage range, as described above, of about 60 volts.

In operation of the circuit of Fig. 1, ordinarily each of the switches 22 and switch 34 are closed, and, as a result, each of the cathode indicator electrodes is connected to ground. Thus, insufficient voltage appears across the cathode glow tube 12 to cause any of the cathodes to glow. The junction of each resistor 26 and each neon tube 30 is thus also effectively at ground potential. With this connection, 115 volts appear across each neon tube, and, since the neon tubes require a higher voltage, about 135 volts, for ignition, none of them is ignited. If it is desired to ignite one of the cathodes 16 of the cathode glow tube 12 and store the glow of this cathode, the switch 22 connected to the desired cathode is opened. When the switch 22 is opened, the voltage across the neon tube 30, coupled thereto through the appropriate diode 20, becomes 190 volts (115+75). This voltage is sufficient to fire the neon tube 30, which thereafter remains ignited, with about 75 volts appearing across its terminals. At this time, the desired cathode 16 of the tube 12 is at -40 volts (-115+75). With the selected cathode at -40 volts, the voltage between this cathode and the anode 14 is now about 185 volts, which is sufficient to cause the selected cathode 16 to glow. The cathode glow will now be maintained until the neon tube 30 is extinguished, and this may be accomplished by opening the switch 34 in the buss 32.

It is clear, of course, that this last operation of extinguishing the neon tube 30 may be performed by the application of a suitable positive pulse to the buss 32. In addition, each of the switches 22 may be replaced by a source of suitable positive pulses.

Those skilled in the art will appreciate that the specific supply voltages described above are not the only voltages which may be employed in practicing the invention and that the desired results may be achieved with other properly related voltages.

The invention thus comprises a comparatively simple and economical circuit for causing a cathode in a gaseous

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indicator tube to glow and for sustaining the glow after the initial energizing force has been removed.

What is claimed is:

1. A storage circuit for an indicator device including a first gaseous glow discharge tube containing an anode and a glow cathode, a first electrical path including a unidirectional current flow device connecting said cathode to ground and a second electrical path including a second gaseous glow tube connecting said cathode to a fixed negative potential, and means for applying a positive bias voltage to said anode, the combination of said positive voltage and the potential across said second gaseous glow tube when ignited being sufficient in magnitude to cause said first glow tube to glow.

2. A storage circuit for an indicator device including a first gaseous glow discharge tube containing an anode and an indicator glow cathode, a first electrical path including a unidirectional current flow device connecting said indicator cathode to ground and a second electrical path including a second glow tube connecting said indicator cathode to a fixed negative potential, and means for applying a positive bias voltage to said anode, the combination of said positive voltage on said indicator cathode and said negative voltage being sufficient in magnitude to ignite said second glow tube, the combination of said positive voltage on said anode and the potential drop across said second glow tube when ignited being sufficient to cause said first glow tube to glow.

3. A storage circuit for an indicator device including a gaseous glow discharge tube containing an anode and an indicator glow cathode, means for coupling a first positive voltage source to said anode, means for coupling a second smaller positive voltage to said indicator cathode, the voltage difference between said anode and said indicator cathode being insufficient to cause said indicator cathode to glow, a first electrical path connecting said cathode to the anode of a diode the cathode of which is connected to a source of reference potential, and a second electrical path coupling said indicator cathode through a second gaseous glow tube to a source of negative voltage, the combination of said smaller positive voltage and said negative voltage applied across said second glow tube being of sufficient magnitude to ignite said second tube, the combination of the positive voltage applied to said anode and the voltage applied to said indicator cathode by said ignited second glow tube being of sufficient magnitude to cause said indicator cathode to glow.

4. A storage circuit for an indicator device including a gaseous glow discharge tube containing an anode and an indicator glow cathode, a first positive voltage source coupled to said anode, a second smaller positive voltage coupled to said indicator cathode, the voltage difference between said anode and said indicator cathode being insufficient to cause said indicator cathode to glow, a first electrical path including a switch and connecting said cathode to the anode of a diode the cathode of which is

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connected to a source of reference potential, and a second electrical path including a switch and coupling said indicator cathode through a second gaseous glow tube to a source of negative voltage, said second glow tube having a comparatively wide range between its ignition voltage and its sustaining voltage, the combination of said smaller positive voltage and said negative voltage applied across said second glow tube being of sufficient magnitude to ignite said second tube, the combination of the positive voltage applied to said anode and the voltage applied to said indicator cathode by said ignited second glow tube being of sufficient magnitude to cause said indicator cathode to glow.

5. A storage circuit for an indicator device including a first gaseous glow discharge tube containing an anode and a glow cathode, a first current flow path from said glow cathode through a diode to a source of reference potential, the anode of the diode being connected to the glow cathode and the cathode of the diode being coupled to the source of reference potential, a second current flow path from said glow cathode through a second gaseous glow tube to a source of negative potential, a third current flow path from said glow cathode to a source of positive potential, and means for applying a positive bias voltage to said anode, the combination of said positive potential on said glow cathode and said negative potential being sufficient in magnitude to ignite said second glow tube, said ignited glow tube applying a voltage to said glow cathode such that said glow cathode is caused to glow.

6. A storage circuit for an indicator device including a first gaseous glow discharge tube containing an anode and a plurality of indicator glow cathodes, a first current flow path from each glow cathode through a diode and a switch to a source of reference potential, the anode of the diode being connected to the glow cathode and the cathode of the diode being coupled to the source of reference potential, a second current flow path from each glow cathode through a second gaseous glow tube and a switch to a source of negative potential, a third current flow path from each glow cathode to a source of positive potential, and means for applying a positive bias voltage to said anode, the combination of said positive potential on said glow cathode and said negative potential being sufficient in magnitude to ignite a selected one of said second glow tubes, each glow cathode being biased at a voltage by its ignited second glow tube such that it is caused to glow.

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