

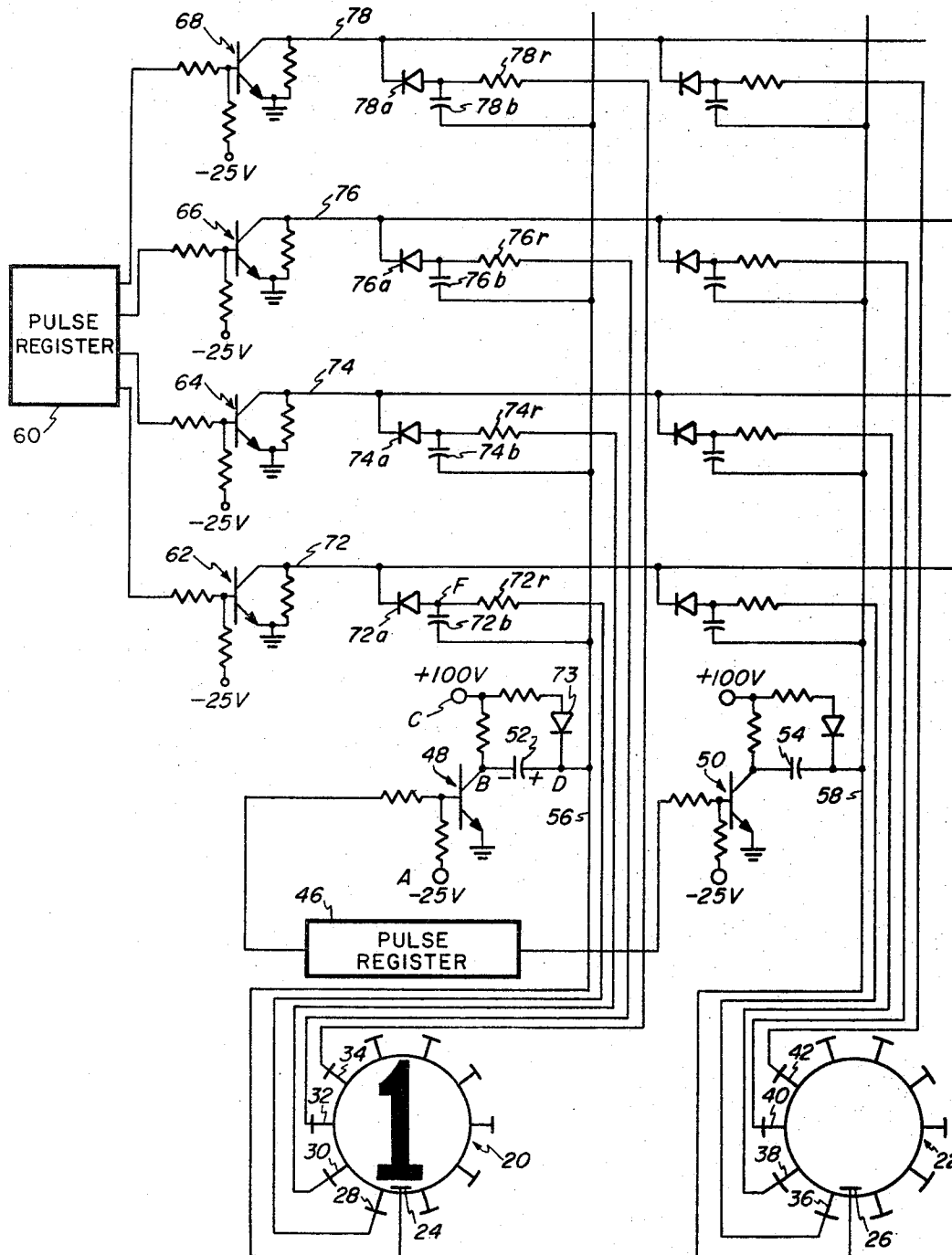
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APPARATUS FOR DRIVING A PLURALITY OF DISPLAY TUBES

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APPARATUS FOR DRIVING A PLURALITY
OF DISPLAY TUBES

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4 Claims. (Cl. 315-84.6)

This invention pertains to apparatus for driving a plurality of display tubes of the kind having an anode and a plurality of cathodes, with each cathode connected to a numeral, letter or other symbol configuration on the face of the tube and causing the respective numeral to be illuminated when the respective cathode is conducting with the anode of the tube. Such tubes are available from and manufactured by the Burroughs Corporation, Detroit, Michigan.

Much effort has been expended building drive apparatus for a plurality of such tubes that will select the tube and then select the particular numeral, letter, or other symbol in the tube to be illuminated. It is desirable to provide such a drive apparatus that will make the numeral selection on a particular tube and maintain the numeral illumination during the selection period by using only two pulse sources, one pulse source to select the tube and another source to select the digit in the tube. Circuits have been designed to provide a drive for this circumstance but they have been costly, cumbersome, and complex. This invention provides a simplified drive mechanism utilizing a minimum of components the majority of which are relatively inexpensive.

It is therefore an object of this invention to provide a matrix of grid wires which are capacitor and diode connected to each other to provide a drive for the above mentioned display tubes, which matrix can store a pulse input for a full selection period so that only two pulse sources provide the selection information for a plurality of display tubes, one pulse source for selecting a tube and a second pulse source for selecting the symbol to be displayed on said tube.

This and other objects of this invention will become more apparent when a preferred embodiment illustrated in the drawing is considered with the following description.

In the drawing are shown two display tubes 20, 22 each having an anode 24, 26 respectively and each having a plurality of cathode connections which for tube 20 are shown at 28, 30, 32 and 34 while for tube 22 are shown at 36, 38, 40 and 42. While only two tubes are shown having four cathode connections each, in normal practice there could be many more tubes and ten or more cathode connections for each tube. For the purpose of simplified explanation, however, a reduced number are shown.

Each cathode connection of the tubes is electrically connected to a numeral on the face of the tube and when a cathode is energized, the numeral corresponding to that cathode will become illuminated and will stay illuminated throughout the period of cathode energization. The numerals are superimposed and only the illuminated numeral is visible. The following description will indicate how this invention solves the problem of energizing these cathodes with a constant signal source from only two pulse sources.

A pulse register 46 supplies negative pulses to the bases of transistors 48, 50 and the emitters of transistors 48, 50 are grounded while their collectors are connected through capacitors 52, 54 respectively to grid column lines 56, 58 respectively, and to anodes 24 and 26 respectively. A bias voltage is applied to the base of each

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transistor, e.g., at point A for transistor 48, and the transistors are in conductive operation until they are pulsed negatively from register 46 at which time the transistors are turned off and point B goes from near ground potential to the potential applied at point C, which in this embodiment is about 100 volts, less the IR drop between C and B. This raises point D to about 170 volts, the ionization potential for firing tubes 20, 22, from the 100 volts it was at, and also raises grid column line 56 to 170 volts and also anode 24 to 170 volts. This prepares tube 20 to fire which it will if a positive pulse is simultaneously applied from a pulse register 60 which will cause a path to ground for the appropriate cathode and associated capacitor and hence establish an ionization voltage of about 170 volts between the anode and the cathode. The manner in which the cathode voltage becomes lowered will now be described.

Pulse register 60 is capable of supplying a positive pulse to the bases of transistors 62, 64, 66 or 68 causing the pulsed transistor to conduct resulting in the grounding of the collector of the pulsed transistor. The collectors of transistors 62, 64, 66 and 68 are connected respectively to grid row lines 72, 74, 76 and 78 with each grid row line connected through a diode 72a-78a and a capacitor 72b-78b to grid column line 56 and with each grid row line connected through similar diodes and capacitors to grid column line 58 and connected in a similar manner to any other grid column lines that may be added. The point F between the diode 72a and capacitor 72b is connected through a resistance 72r to cathode 28 of tube 20, and the corresponding points F between the diodes and capacitors connected to grid row line 56 are connected through a resistance to cathodes 30, 32, 34 of tube 20. Likewise, the cathodes 36-42 of tube 22 are connected to corresponding points between the diodes and capacitors connected to grid row line 58. When the collector of transistor 62 is grounded due to the base of transistor 62 being pulsed, grid row line 72, and all of the diodes connected thereto, will also become grounded and cathodes connected to grid row line 72 such as cathodes 28 and 36 will be lowered in voltage to near ground potential (there is a remanent charge across capacitor 72b). Since anode 24 is simultaneously being pulsed, tube 20 will have illuminated thereon the numeral connected to cathode 28. Tube 22 will not be illuminated since its anode is not being supplied with 170 volts. The pulse from point D causes a current flow through tube 20 which not only illuminates the selected numeral but also charges capacitor 72b.

The numeral on tube 20 will remain illuminated due to the RC time constant determined by the values of capacitor 72b and resistor 72r which are selected to keep the numeral illuminated until the next pulses are available from registers 46, 60. If it is desired to maintain the same numeral of tube 20 illuminated, anode 24 will continue to have the 170 volts applied from a pulse from register 46 while the base of transistor 62 will receive a second pulse to hold point F at ground potential. If the tube and/or numeral is desired to be changed, then the pulse will be applied respectively to a different grid column and/or grid row line. After capacitor 72b has discharged, and transistor 62 no longer conducts, then the point F will no longer be at ground potential and it will tend to follow the potential of anode 24 so that there will no longer be a potential difference between anode 24 and cathode 28, and the numeral on tube 20 will no longer be illuminated. The purpose of diode 72a is to isolate the charge on capacitor 72b from all the other capacitors which are diode connected to row line 72, and to prevent the charge from capacitor 72b from being dissipated. The purpose of diode 73 is to isolate the charge of capacitor 52 from point C.

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Although this invention has been disclosed and illustrated with reference to particular applications, the principles involved are susceptible of numerous other applications which will be apparent to persons skilled in the art. The invention is, therefore, to be limited only as indicated by the scope of the appended claims. 5

Having thus described our invention, we claim:

1. Apparatus for driving a plurality of display tubes comprising

an anode in each display tube and a given number of cathode symbol electrodes in each display tube, 10
a first pulse source,
a second pulse source,
a plurality of symbol lines with the number of symbol lines being equal to the number of symbol electrodes 15
in each of the tubes,
a plurality of anodes with anode lines with the number of anodes being equal to the number of tubes,
first switch means between said first pulse source and each of said plurality of symbol lines, 20
said first pulse source having means to apply pulses in any sequence to said symbol lines,
a second switch means between said second pulse source and each of the anode lines,
diode means and capacitor means being series connected 25
between each of said symbol lines to each of the anode lines,
a point between each of the series connected diode means and capacitor means being connected through a resistor to a symbol electrode, whereby a capacitor means and resistor are between each anode and each of the cathode symbol electrodes associated with that anode so that once said first and second pulse means have been operated a cathode symbol will remain illuminated until the capacitive means 35
has discharged through said resistance,
said first pulse source lowering the symbol electrode voltage to which it has been switched and the second pulse source raising the anode voltage to which it has been switched so that conduction occurs in each 40
tube only between the lowered cathode symbol voltage in that tube and the raised anode voltage in that tube.

2. The apparatus of claim 1 with

said first switch means comprising first transistors with 45
a first transistor being associated with each of said symbol lines,
each first transistor base being connected to the first pulse source, each first transistor emitter being grounded, each first transistor collector being connected to its respective symbol line, and the emitter and collector of each of the first transistors being resistance connected so that when the transistor is on, the collector and associated symbol lines are grounded, 55
the second switching means comprising second transistors with a second transistor being associated with each of the tube anode lines,
the second transistor bases being biased so that said second transistors are normally conducting, 60
the second transistor emitters being grounded,
an anode voltage source,
the second transistor collectors being connected to the anode voltage source through a resistor,
said second transistor bases being connected to the second pulse source so that a pulse from said second

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pulse source will turn said second transistors off raising the pulsed second transistor collector voltage from ground potential to the voltage source potential thereby raising the anode voltage to cause the tube to conduct with that cathode symbol electrode voltage lowered to ground potential,

circuit anode voltage means for connecting each of the second transistor collectors to said anode voltage source and to a tube anode,

said circuit means for applying a multiple of the anode voltage source to an anode when said base of the second transistors associated with the anode is pulsed.

3. The apparatus of claim 2 with

said circuit means comprising a second diode means with one side of the second diode means being connected between anode voltage source and an anode of a tube,

second capacitor means,

said second capacitor means being between the other side of said second diode means and the collector of a second transistor thereby raising the voltage of the other side of said second diode means when the second transistor is turned off to a value substantially greater than the anode voltage source value.

4. Apparatus for driving a plurality of display tubes comprising;

an anode in each display tube and a given number of cathode symbol electrodes in each display tube,
a plurality of symbol lines with the number of symbol lines being equal to the number of symbol electrodes in each of the tubes,

a plurality of anode lines respectively connected to said anodes,

a plurality of first switch means respectively connected between said symbol lines and a reference potential, a first pulse source being operably associated with said plurality of first switch means for operating said first switch means in any sequence,

a plurality of second switch means respectively connected to said anode lines for changing the potential of said anode lines to a preselected potential in any sequence which potential differs from said reference potential by at least the discharge potential of said tube,

a second pulse source operably associated with said plurality of second switch means for operating said second switches in any sequence,

diode means and capacitor means being series connected between each of said symbol lines to each of the anode lines, and

a point between each of said series connected diode means and capacitor means being connected through a resistor to a symbol electrode.

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