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ELECTRONIC DEVICES

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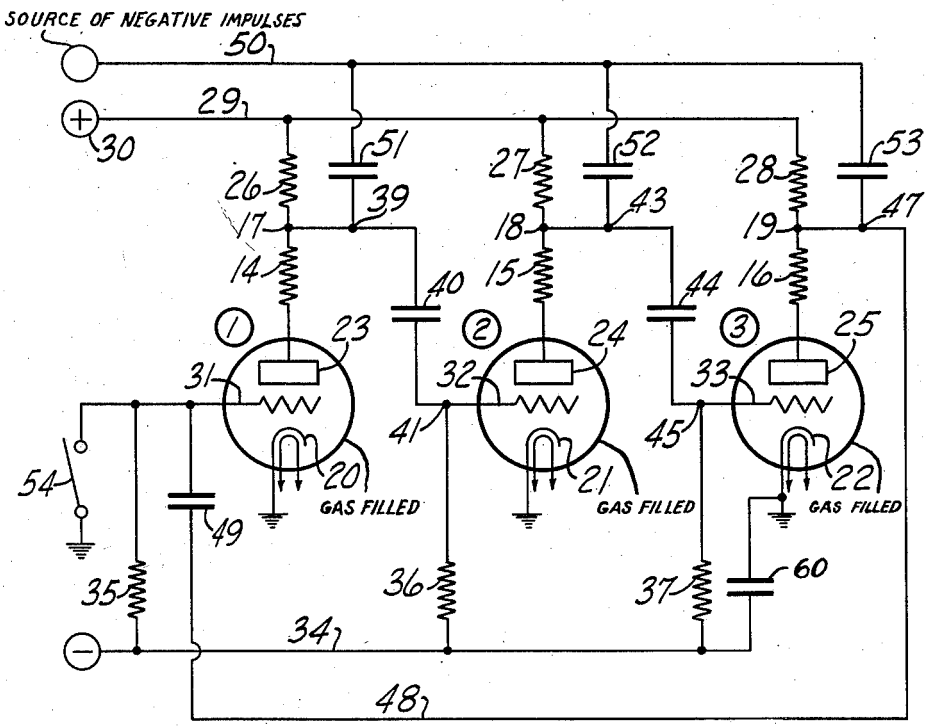

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ELECTRONIC DEVICES

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5 Claims. (Cl. 315—230)

This invention relates to an electron tube counting ring and more particularly relates to a gaseous discharge electron tube counting ring responsive step by step to each of a plurality of negative potential impulses.

Counting rings of electron gas discharge tubes heretofore known have operated in various ways, but the circuit elements of resistance and capacitance have been numerous and closely adjusted to obtain stable operation. This invention provides a stable counting ring having a small number of circuit elements. In the disclosed invention, each negative potential impulse impressed commonly upon the tubes results first in the extinguishment of any then conducting tube of the ring, which extinguishment causes, by means of a positive impulse created at the anode thereof, the firing and rendering conducting of the next tube of the ring. The last tube of the ring, when it is rendered non-conducting by a negative input impulse, causes conduction to commence in the first tube of the plurality, thus causing the tubes to be operated one at a time in endless chain sequence.

Therefore, it is the principal object of this invention to provide a counting ring composed of gaseous electron discharge tubes, wherein the tubes are rendered conducting one at a time in sequence to each of commonly received negative potential impulses.

Another object of the invention is to provide a counting ring of gaseous electron discharge tubes responsive to each of the negative impulses commonly impressed thereon, each of said impulses rendering any conducting tube non-conducting, which action of extinguishment gives rise to a positive potential impulse which is impressed on the next tube of a series, firing it and causing it to become conductive.

Another object of the invention is to provide an electronic counting ring including a plurality of electron gas discharge tubes arranged in a circuit wherein the tubes are caused to be operated step by step, each of said steps of operation being caused by negative potential impulses.

Another object of the invention is to combine a plurality of gaseous electron discharge tubes in a circuit whereby they are electrostatically coupled in an endless series anode to control grid and whereby the anodes are all coupled electrostatically in parallel to a common input conductor.

Another object of the invention is to provide a gaseous electron tube counting ring wherein the extinguishment of a tube causes the next tube in the ring to become conducting.

With these and incidental objects in view, the invention includes certain novel features of construction and combinations of parts, the essential elements of which are set forth in appended claims and a preferred form or embodiment of which is hereinafter described with reference to the drawing which accompanies and forms a part of this specification.

The drawing shows three gas electron discharge tubes connected in endless operative chain.

General description

Referring to the drawing, three gaseous electron discharge tubes "1," "2," and "3" are shown with their respective cathodes 20, 21, and 22 grounded. Each anode is connected to a supply conductor 29 through two resistors. Anode 23 is connected through resistor 14 of 5,000 ohms, point 17, and resistor 26 of 50,000 ohms to conductor 29; anode 24 is connected through resistor 15 of 5,000 ohms, point 18, and resistor 27 of 50,000 ohms to conductor 29; and anode 25 is connected through resistor 16 of 5,000 ohms, point 19, and resistor 28 of 50,000 ohms to conductor 29. Conductor 29 is supplied with 150 volts positive potential. The tubes selected for this embodiment of the invention are equivalent to the "884" type, and said potential supply between the anodes and the cathodes is more than sufficient to sustain conduction therebetween. The potential drop in a conducting tube is about 15 volts. Each of the tubes "1," "2," and "3" is supplied with control grids, said grids being numbered 31, 32, and 33, respectively, and each of said grids is connected to a 25-volt negative potential supply conductor 34 through a resistor, said resistors being of 250,000 ohms each and numbered 35, 36, and 37, respectively. Conductor 34 is grounded through capacitor 60 of 4 microfarads. Each anode is coupled to the control grid of the next tube of the ring through a capacitor of 100 micro-microfarads, anode 23 being connected through resistor 14, point 17, point 39, capacitor 40, and point 41 to the control grid 32 of tube "2"; anode 24 of the "2" tube is connected through resistor 15, point 18, point 43, capacitor 44, and point 45 to grid 33 of tube "3"; and anode 25 of the "3" tube is connected through resistor 16, point 19, point 47, conductor 48, and capacitor 49 to grid 31 of the "1" tube, completing the endless chain connection. Each of the anodes is connected to the input conductor 50 through a capacitor of 100 micro-microfarads. Anode 23, for instance, is connected through resistor 14, point 17, point 39, and capacitor 51 to said conductor 50; anode 24 is connected through resistor 15, point 18, point 43, and capacitor 52 to the conductor 50; and anode 25 is connected through resistor 16, point 19, point 47, and capacitor 53 to conductor 50.

By grounding any selected grid, the associated tube will become conducting, and, for the purposes of the disclosure, a key switch 54 has been provided to ground grid 31 of the "1" tube, which

causes said tube to fire and become conducting, and, upon that occurring, point 39 will drop in potential from 150 volts positive to 15 volts positive. Such drop in potential of anode 23 is impressed through resistor 14, point 17, point 39, and capacitor 40 onto the grid 32 of the "2" tube, rendering it more negative, causing no change in the non-conducting condition of the tube. If a negative potential impulse of 200 volts is impressed on the conductor 50, said impulse having a duration of, for example, one fifteen-thousandth of a second, said impulse will be impressed through capacitors 51, 52, and 53, causing a drop in potential of each of the anodes 23, 24, and 25. Inasmuch as the anode 23 is already at a potential of 15 volts positive, the input impulse, even though attenuated, causes the anode 23 to drop below the potential of the cathode, thus extinguishing the tube and allowing the grid 31 to regain control. Upon tube "1" being extinguished, anode 23 rises to 150 volts positive potential, which is the potential of the conductor 29. This rise in potential causes a sharp positive potential impulse to be impressed through resistor 14, point 17, point 39, capacitor 40, and point 41 onto the grid 32 of the "2" tube, causing said tube to fire and become conducting.

It is seen that a negative potential impulse impressed upon the input conductor results in the extinguishment of any conducting tube, which extinguishment gives rise to a positive potential impulse which fires the next tube in the series.

Resistors 14, 15, and 16 are included in the circuit as oscillation suppressors.

Because the tube "1" extinguishes and causes the positive potential impulse to be impressed on the grid 32 of the "2" tube, firing the "2" tube within one ten-thousandth of a second, it will be seen that the input impulse should not be of any greater duration. With different values of circuit elements, different time factors would result. It will be apparent that, if there were but two tubes in the ring, the circuit would be comparable to a trigger circuit in operation, wherein either one of the two tubes may be conducting and the other tube non-conducting at any given instant and wherein said tubes will maintain a certain mode of operation until caused to change by an outside electric stimulus. It will also be apparent that the number of tubes may be increased indefinitely, so that each of the tubes in the ring may represent a digit in a numerical denominational order; for instance, there may be ten tubes in the ring, corresponding to the number of digits in the decimal system of numerical notation. It is further pointed out that the tubes may represent any unit of data non-numerical in nature, such as the letters of the alphabet or symbols having any other connotation.

Although the tubes themselves, by the glow of their discharge, may visually indicate which of the tubes is conducting, points like points 17, 18, and 19, by their potential, may be electrically sensed to show whether the associated tube is conducting or not, and, by means well known in the art, these points may be scanned automatically so as to cause mechanical or electrical indication of the state of the tubes.

While the embodiment of the invention herein shown and described is admirably adapted to fulfill the objects primarily stated, it is to be understood that it is not intended to confine the invention to the one form or embodiment herein disclosed, for it is susceptible of embodiment in various forms all coming within the scope of the claims which follow.

What is claimed is:

1. In an electronic counter, a plurality of electron tubes each having an anode, a cathode, and a control element; a common anode potential supply conductor to which each anode is connected through a resistor; means coupling each anode electrostatically to the control element of another tube in an endless operative chain; and means coupling all the anodes electrostatically to a common conductor.

2. In an electronic counter, a plurality of gaseous electron tubes each having an anode, a cathode, and a control element; a common anode potential supply conductor to which each anode is connected through a resistor; means coupling each anode electrostatically to the control element of another tube in an endless operative chain; and means coupling all the anodes electrostatically to a common conductor.

3. A plurality of gaseous electron discharge tubes each having an anode, a cathode, and a control grid; means to supply cathode potential to said tubes; means to supply anode potential to said tubes, each anode being connected to the supply means through a resistor; means to supply controlling potential to the control grids; means connecting the tubes in an endless operative chain by electrostatically connecting each anode to the control grid of the next tube of the endless chain so that the rise in potential of an anode as conduction ceases in a tube will impress a positive electric potential impulse on the control grid of the next tube in the sequence to cause it to fire and become conductive; and means connecting the anodes electrostatically in parallel so that a negative electric potential impulse applied to said means will extinguish any conducting tube.

4. A plurality of gaseous electron discharge tubes each having an anode, a cathode, and a control grid; means to supply cathode potential to said tubes; means to supply anode potential to said tubes, each anode being connected to the supply means through a resistor; means to supply controlling potential to the control grids; means connecting the tubes in an endless operative chain by electrostatically connecting each anode to the control grid of the next tube of the endless chain so that the rise in potential of an anode as conduction ceases in a tube will impress a positive electric potential impulse on the control grid of the next tube in the sequence to cause it to fire and become conductive; means connecting the anodes electrostatically in parallel so that a negative electric potential impulse applied to said means will extinguish any conducting tube; and means to cause a selected tube to become conducting.

5. In an electronic counter, a plurality of two or more gaseous electron discharge tubes; means connecting the tubes in an endless operative chain series so that the extinguishment of one tube will cause the next tube of the series to fire and become conducting; and means common to the tubes and to which they are electrostatically coupled in parallel which when impressed with a negative potential impulse extinguishes any then conducting tube.

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