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ELECTRONIC COUNTING RING

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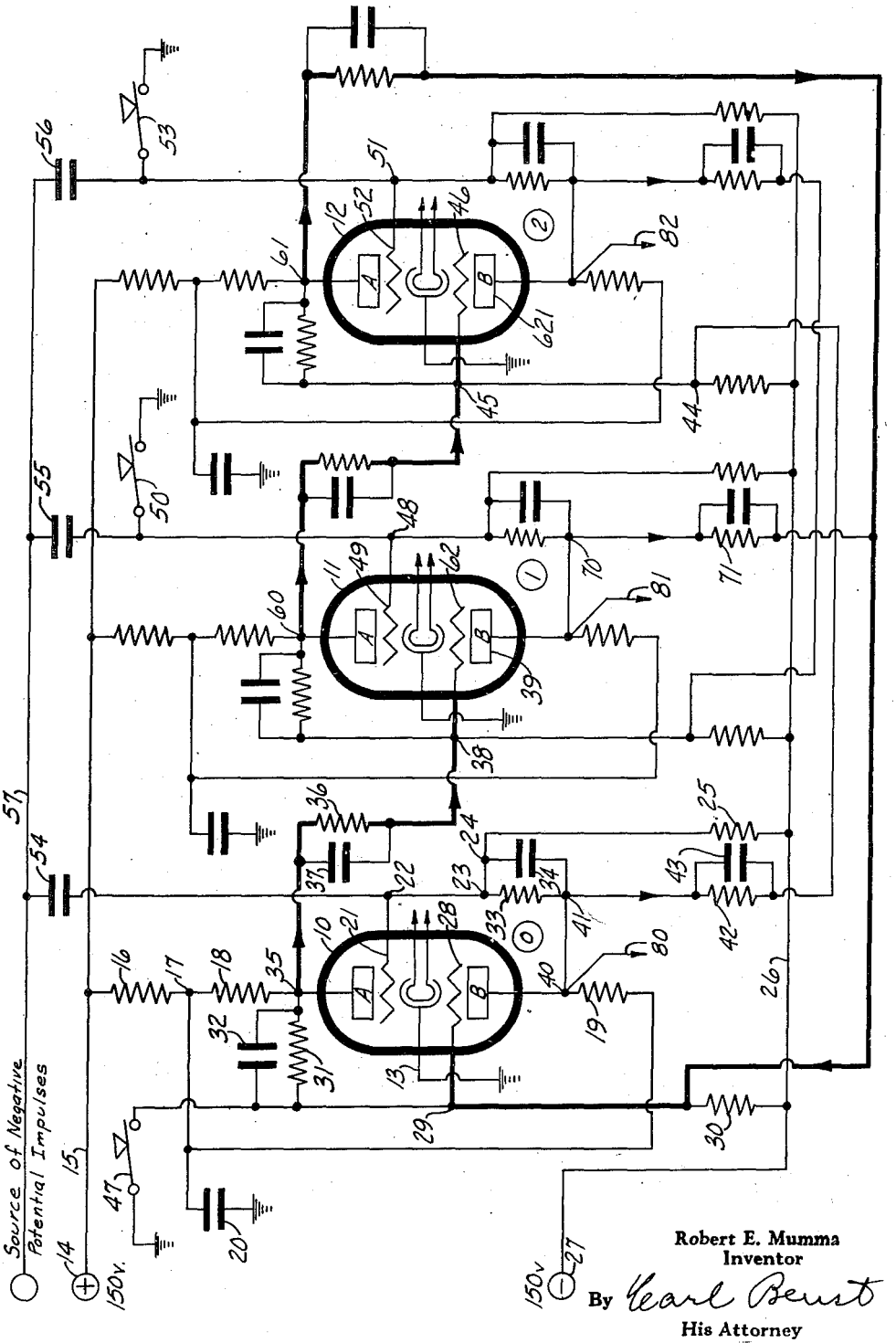

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ELECTRONIC COUNTING RING

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2 Claims. (Cl. 250—27)

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This invention relates to electron tube counting rings and more particularly pertains to such counting rings utilizing high-vacuum electron tubes.

The disclosed counting ring has a pair of high-vacuum electron tubes, in this disclosure represented as one duo-triode vacuum tube, which may be of the 7N7 type, for each digit place. Each of such duo-triodes is incorporated in a trigger circuit whereby each anode is connected to the control grid associated with the other anode of the same tube, so that only one anode receives electron current at any given instant. The duo-triodes, each constituting a trigger pair, are connected in an endless operative chain, so that, upon the receipt of potential impulses through a common source, the mode of operation of a determined duo-triode changes.

The mode of operation of a duo-triode is considered as not registering data when one of its anodes, which shall be termed the "A" anode, receives electron current, and is considered as registering data when the other anode, which shall be termed the "B" anode, receives electron current. Each duo-triode of the endless chain represents a value digit or zero. For registering zero, all the tubes except the "0" tube are first placed in the non-data-registering mode of operation. The "1" tube is, by reason of its adjacence in the chain to the "0" tube, through certain connections to be shown, rendered more susceptible to an input data-entering impulse commonly impressed on all the duo-triodes than any of the other tubes, and is the only one of the duo-triodes which is caused to change its mode of operation when an impulse within the susceptible range of the said "1" tube is received. The other tubes are not affected by such impulse.

The change in mode of operation of the "1" tube causes, by means of certain connections to be described, the resumption of the non-registering mode of operation of the "0" tube. In a similar manner, the condition of registration of data in the "1" tube causes the next impulse to effect a change in mode of operation of the "2" tube and to restore the "1" tube to a non-registering condition. The highest digit tube is connected to the "0" tube to complete the endless operative chain.

Therefore the principal object of the invention is to provide an electron tube counting ring having a trigger-connected duo-triode vacuum electron tube for each digit place of the ring.

Another object of the invention is to provide an electronic counting ring for counting electric

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impulses, wherein the digit elements consist of two anode-cathode pairs in a vacuum connected in a trigger circuit and having means whereby a digit-representing pair preceding in the endless chain conditions the digit element succeeding in the chain to be responsive to the next commonly received electric impulse.

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 is a circuit diagram of a three-place counting ring.

General description

The disclosure in the drawing is of a three-digit counting ring, but the counting ring may be made to have as many digits as desired, as it will be evident that the principles of the invention admit of an indefinite expansion of the ring.

Duo-triodes 10, 11, and 12, which, as stated, may be of the 7N7 type and to which type of tube the circuit elements as particularly given have been adjusted, represent, respectively, the digits "0," "1," and "2." It is to be understood that the designation of the tubes is a matter of choice, as they may represent any kind of symbol or character the use demands.

Each duo-triode has two anodes, a control grid for each anode, and a common grounded thermionic cathode. One of the anodes of each duo-triode will be considered the non-data-register anode; that is, when such an anode is receiving electron current, that condition signifies that no digit of that value is registered. Such anodes are marked "A" on the drawing. The other anodes of each duo-triode are marked "B," and, when such receive electron current, it signifies that such digit place as is represented by the duo-triode is registering data.

In the consideration of the potential supply for the duo-triodes 10, 11, and 12, tube 10 will be taken as an example. The cathode is grounded through conductor 13. An anode supply terminal 14 supplies conductor 15 with a positive potential of 150 volts. The anodes of tube 10 are connected to conductor 15 through resistor 16 of 250 ohms and point 17. Anode A of duo-triode 10 is connected to point 17 through resistor 18 of 25,000 ohms, and anode B of duo-triode 10 is connected to point 17 through resistor 19 of

25,000 ohms. Point 17 is electrostatically grounded through capacitor 20 of .1 microfarad to ground. Control grid 21, associated with the A anode, is connected through points 22, 23, and 24 and resistor 25 of 300,000 ohms to negative 150-volt conductor 26, connected to supply terminal 27. In a similar manner, control grid 28 is connected through point 29 and resistor 30 of 300,000 ohms to the negative 150-volt conductor 26. Anode A of duo-triode 10 is coupled to the grid 28 by resistor 31 of 150,000 ohms in parallel with capacitor 32 of 50 micro-microfarads through point 29. Anode B of duo-triode 10 is coupled to grid 21 by resistor 33 of 150,000 ohms in parallel with capacitor 34 of 50 micro-microfarads through point 22. Each A anode is coupled to the grid controlling the B anode electron current in the next succeeding tube in the chain. Thus, from point 35, the A anode of duo-triode 10 is coupled by means of resistor 36 of 500,000 ohms in parallel with capacitor 37 of 10 micro-microfarads and point 38 to the control grid 62 associated with anode 39 of the "1"-representing duo-triode 11.

Each B anode is coupled to the B anode control grid of the next preceding tube in the chain to cause it to resume a non-data-registering mode of operation. Thus, anode B of duo-triode 10 is connected through points 40 and 41, resistor 42 of 1,000,000 ohms in parallel with capacitor 43 of 5 micro-microfarads, and points 44 and 45, to grid 46 of the "2"-representing duo-triode 12.

Point 29, connected to grid 28 of duo-triode 10, may be grounded by the closing of key 47. Point 48, connected to grid 49 controlling electron current flow to the A anode of duo-triode 11, may be grounded by the closing of switch 50. Point 51, connected to grid 52 controlling electron current flow to the A anode of duo-triode 11, may be grounded by the closing of switch 53. Each of the grids 21, 49, and 52 is connected through an individual capacitor of 10 micro-microfarads, numbered, respectively, 54, 55, and 56, to input conductor 57, on which is impressed the negative electric potential impulses to be counted.

Operation

Upon the application of electrode potential through terminals 14 and 27, the duo-triodes will assume a mode of operation determined by the inequalities in their trigger pair connections. To zeroize the ring, it is necessary to have the B anode of the "0" duo-triode receiving electron current and to have the A anodes of the rest of the duo-triodes receiving electron current. This is accomplished by closing switches 47, 50, and 53, together, temporarily.

Point 35 is higher in potential than are points 60 and 61 as current is flowing through said points 60 and 61, causing a drop in potential by reason of the 25,250-ohm resistances in their respective potential supply connections. Thus, of the grids 62 and 46 controlling the B anode electron current of the "1" and "2" duo-triodes, respectively, the grid 62 is the more positive, by reason of its connecting to the non-conducting A anode of the "0" tube.

Therefore, when a negative impulse is impressed on conductor 57, the effect is to increase the internal resistance of the A sections of the duo-triodes, which results in making the potential at points 60 and 61 more positive, which rise in potential is reflected at the B section grids. The grid 62 of the "1" tube, however, has a cumulative rise in potential due to the effect of the non-conduction of the A section of duo-triode 10 plus the input impulse. This cumulative rise is sufficient to trigger duo-triode 11 to the exclusion of the other tubes of the ring if the negative input impulses are within the range between 21 and 36 volts for the values of current elements given as an example.

Provision has been made for returning the preceding digit-representing duo-triode of the chain to a non-registering mode of operation when its successor duo-triode in the chain is caused to assume a digit-registering mode of operation. For example, consider what occurs if the "0" tube is made to have its B anode receive electron current due to an input impulse, it having theretofore been rendered susceptible by the condition of the "2" tube representing the accumulation of data. When anode B of the "0"-representing duo-triode 10 commences to receive electron current, point 41 drops in potential. This potential drop is impressed through resistor 42 and capacitor 43 so as to be impressed through points 44 and 45 onto the grid of the B section of the "2"-representing duo-triode 12, causing it to stop electron conduction to the B anode and resulting in the tube triggering, so that the A anode commences to receive electron current.

Similar connections are made between each two of the duo-triodes of the ring. The ones described were chosen to disclose particularly the way in which the chain is closed into a ring. It is evident that a long chain of tubes will operate from one end to the other in the same manner.

The duo-triodes will respond one at a time to the received impulses, and only one B anode will be registering data at a given instant.

Points like points 80, 81, and 82, or any points receiving a potential change when an associated duo-triode changes from one mode of operation to another, may be used to sense the condition of the ring to control an indicating or read-out device.

It is evident that two triode vacuum tubes may be used to take the place of the duo-triode in a single envelope. It is also evident that the values of circuit elements may be changed to accommodate different vacuum tube characteristics, different potentials, and different input impulses.

While the form of mechanism 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 combination, a plurality of pairs of electron tubes, each tube having at least an anode, a cathode, and a control grid, one of the tubes of a pair being designated as the non-registering tube and the other tube of a pair being designated as the data-registering tube; means coupling the tubes of a pair for trigger operation in response to electric signals; a potential supply source for the cathodes, the grids, and the anodes, each of the anodes having a resistance connection to its supply source; connections between the anode of the non-registering tube of a pair and the grid of the data-registering tube of another pair creating an endless operative chain; electric signal means common to all the pairs of tubes whereby the pairs may be triggered one after another in response to commonly received impulses; and means connecting the anode of a data-register-

ing tube of one pair to the grid of the next adjacent data-registering tube in the endless chain in a direction reverse to the direction of sequential operation.

2. A plurality of pairs of vacuum electron tubes, each tube having at least an anode, a cathode, and a control grid; conductors supplying anode-cathode potential to each of said tubes, including an individual resistance in each anode supply conductor; means supplying controlling potential to the grids of all the tubes; means conductively and electrostatically connecting the anode of each tube of a pair to the grid of the other tube of the pair, said grid supply potential and anode-cathode supply potential being balanced to cause the tubes of a pair to have one or another mode of operation wherein there is conduction in one of the tubes but in only one or the other of such tubes at a given instant; means

coupling one tube of each pair to a source of electric signals for reception thereof, each of which signals tends to change the mode of operation of a pair of tubes if it is in a certain one of its two modes of operation; and means connecting the pairs in a sequential operative chain, said means including connecting the anode of each signal-receiving tube to the control grid of the non-signal-receiving tube of the next pair in the sequential chain, whereby if a pair of tubes is in a mode of operation which does not tend to change in response to a signal such chain connections affect the next pair of tubes in the sequential chain so as to be responsive to a signal tending to change its mode of operation if the said next pair is in the signal-receptive mode of operation.

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