

Jan. 10, 1956

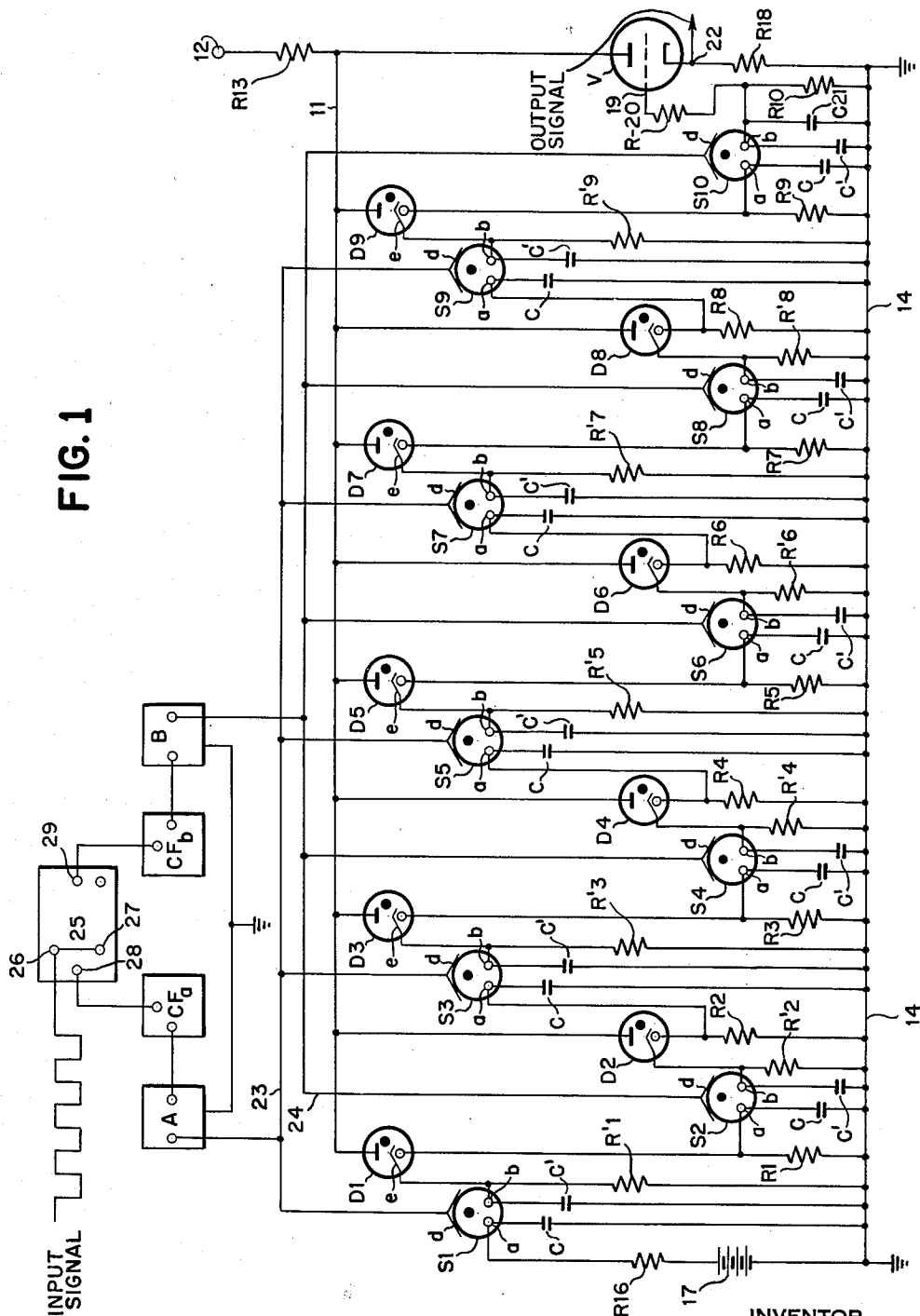
H. J. GEISLER
GAS TUBE COUNTER

2,730,655

Filed March 12, 1953

4 Sheets-Sheet 1

FIG. 1



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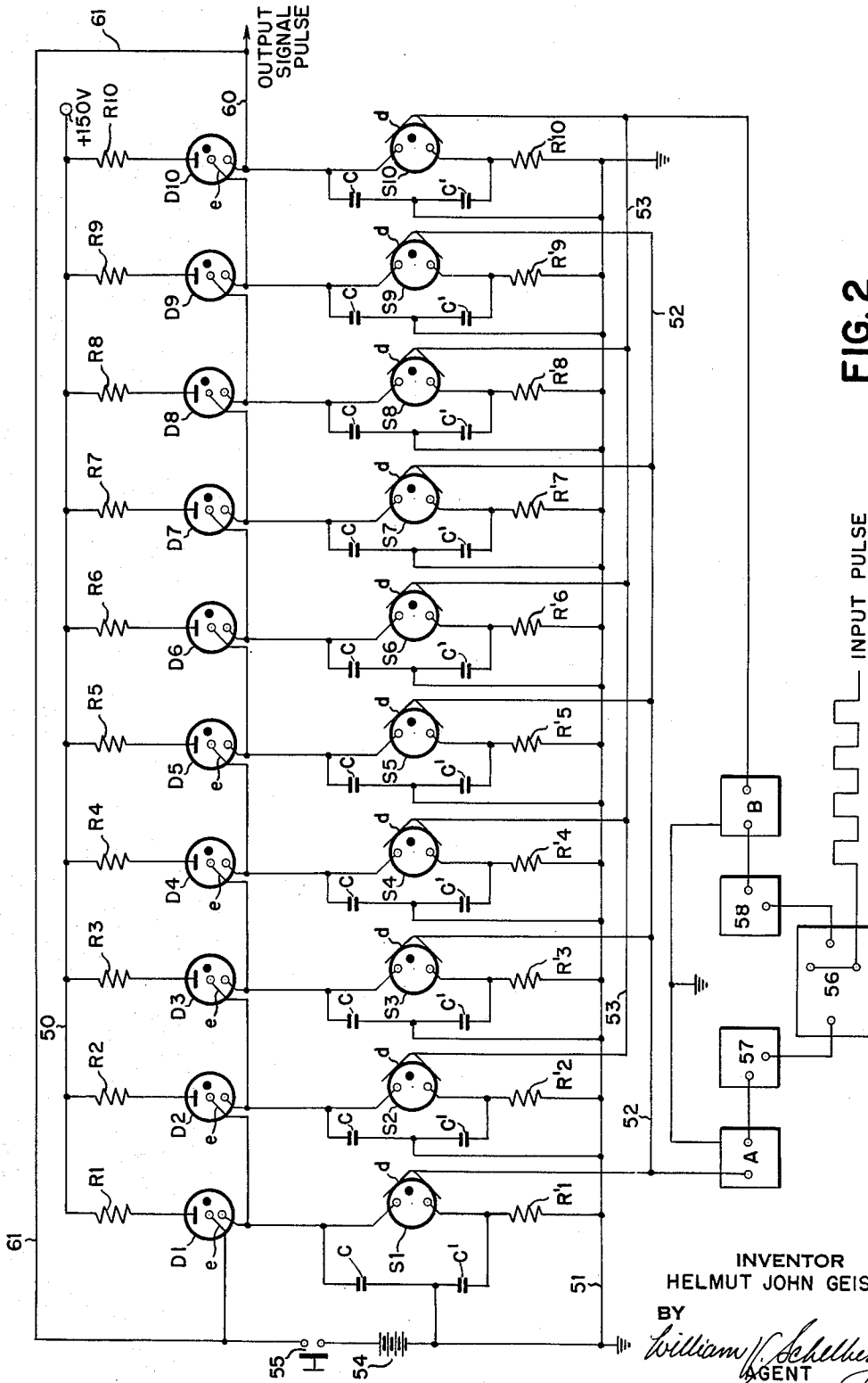
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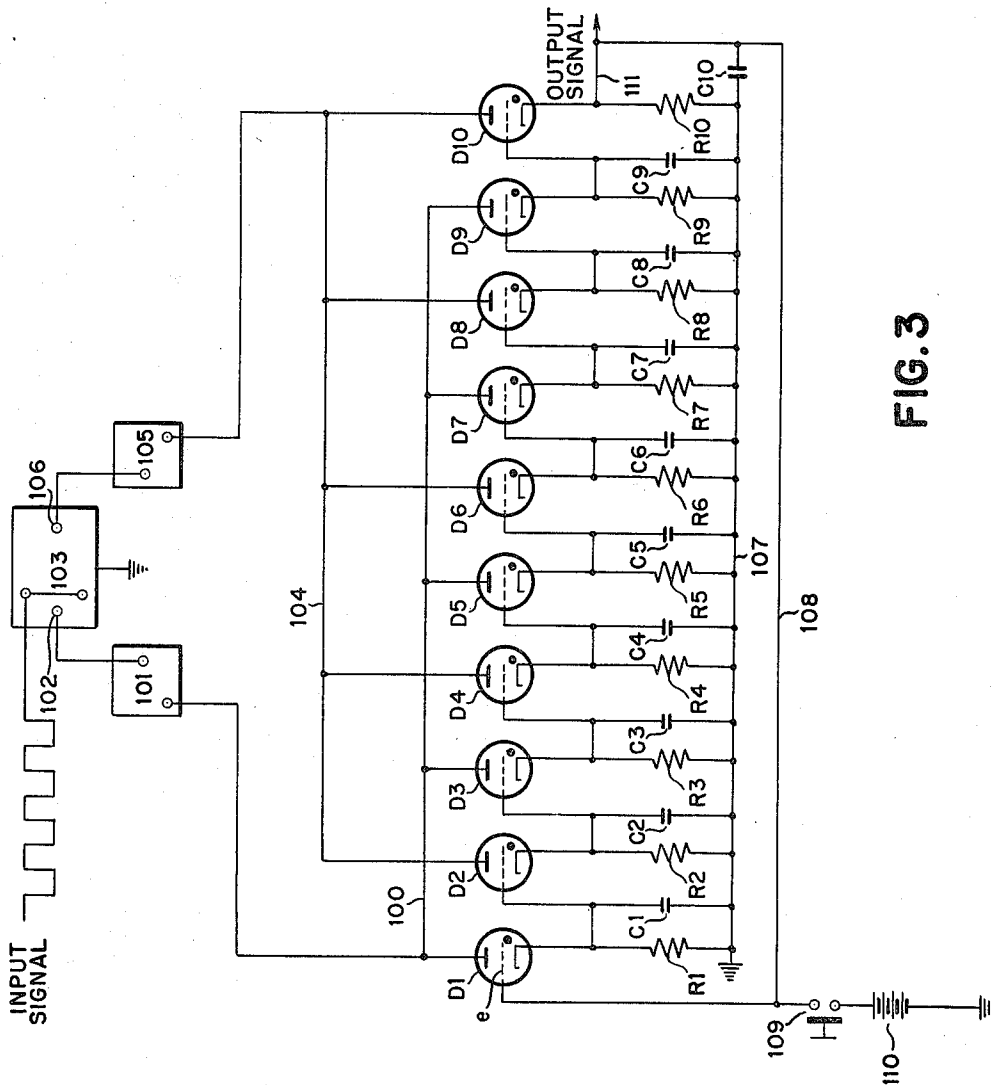


FIG. 3

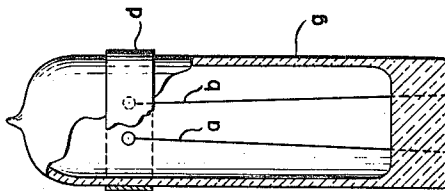


FIG. 4

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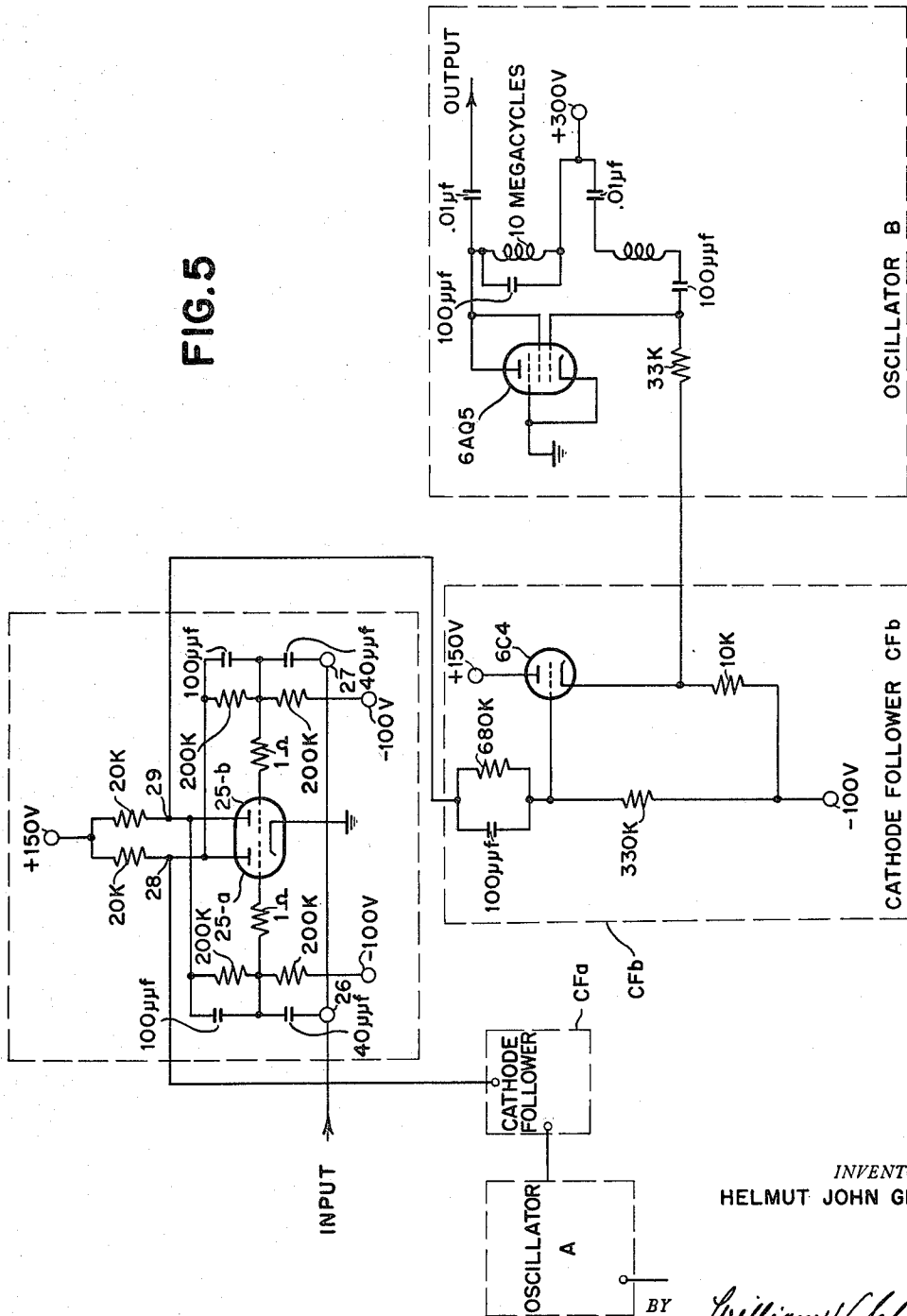
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2,730,655

GAS TUBE COUNTER

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Application March 12, 1953, Serial No. 341,989

10 Claims. (Cl. 315—84.5)

This invention relates to an electronic counting circuit and is particularly directed to a counting circuit of the chain or ring type using gas filled tubes for counting a series of discrete voltage impulses.

The counter tubes in such systems are arranged in tandem and conduct in sequence in the same order as a series of applied impulses, so that the number of impulses received is indicated by the location of the tubes which are rendered conductive. This operation requires the next logical digit representing counter tube to be conditioned or "primed" by conduction of the tube preceding it so that it may be rendered conductive by a stepping signal initiated by a succeeding input pulse. These systems in known forms develop a common difficulty that a single stepping pulse simultaneously applied to all the tubes may produce a chain reaction causing a complete count in all digit representing tubes of the ring.

In the systems to be described, stepping pulses are applied alternately to groups comprising alternate ones of the digit position tubes in a novel manner with positive assurance that a single applied pulse will not produce such a chain reaction.

Accordingly, the principal object of the invention is to provide an electronic counter embodying improved reliability of performance through alternate pulsing of groups of odd and even digit representing tubes.

Another object is to provide a novel gas tube counter system employing radio frequency actuated switching tubes as a means for applying the stepping signals to the odd and even groups of counter tubes.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose by way of example, the principle of the invention and the best modes which have been contemplated, of applying the principle.

In the drawings:

Fig. 1 is a circuit diagram of one form of an improved counter employing radio frequency actuated switch tubes for controlling the stepping impulses.

Fig. 2 is a circuit diagram of a modified form of gas tube counter also employing radio frequency actuated switch tubes.

Fig. 3 is a circuit diagram of a further modification of the gas tube counter.

Fig. 4 is a diagram of a preferred form of radio frequency actuated gas tube switch employed in the gas tube counter systems illustrated in Figures 1 and 2.

Fig. 5 is a wiring diagram of a typical trigger, cathode follower and oscillator circuit such as are shown in block form in Figures 1-3.

The particular radio frequency actuated gas switch tube employed in several forms of the present invention is illustrated in Figure 4. This tube provides a simple fast acting switch device combining the desirable features of economy, good life and insensitivity to temperature change. As shown in this figure, two electrodes *a* and *b* are provided within the envelope *g*, and a third electrode *d*, comprising a conductive metal band, encircles the ex-

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terior body of the tube adjacent the ends of the electrodes. The electrodes *a* and *b* are made of aluminum and provide a highly conductive surface with low sputter rate. These electrodes are immersed in a gas filling of 2% argon and 98% neon at approximately 60 mm. Hg pressure. The exterior electrode *d* consists of a band of silver reduced from a mixture of silver oxide and lead borate in the sealing process.

Application of radio frequency energy between the external band electrode *d* and both of the internal electrodes *a* and *b* produces an auxiliary radio frequency discharge through the gas filling which will allow flow of low voltage direct current between the electrodes *a* and *b* due to immersion of these electrodes in the field of the radio frequency discharge.

Typical operating characteristics of the switch tube are given in the following table:

R. F. fire-----	75-100 peak volts at 10 megacycles.
R. F. extinction-----	35-50 peak volts.
D. C. fire-----	115-150 volts.
D. C. extinction-----	90-115 volts.
Ignition time-----	Less than 1 microsecond.
Resistance with 200 volts peak R. F.-----	5000 ohms.
Resistance 10 microsec. after removal of R. F.-----	200,000 ohms.

The particular tube characteristics as well as the electrode composition, gas filling and the like may be varied considerably without departing from the principles to be explained, and are given here for purposes of illustration only and are not intended to be limiting as to the type of radio frequency switch tube employed in the electrical systems hereinafter described.

In the system chosen for illustration in Fig. 1, nine digit representing tubes *D* and an output tube *V* are employed in the counter for use in a decimal system, however, the number of tubes may be varied as desired to adapt the arrangement for use with duo-decimal, quinary or other counting systems.

The digit representing tubes *D* comprise three element cold cathode gas tubes having a starter gap formed by the adjacent spacing of a starter or auxiliary anode electrode *e* and the tube cathode. With proper anode potential, application of a positive voltage to the starter electrode will cause ignition in the starter gap and conduction will then transfer to the main anode cathode gap in well known manner.

Each digit representing position of the counter comprises a relay tube *D*, and R. F. switch tube *S* and resistors *R* and *R'*. In the figure, these principal components are given similar subscript labels corresponding with the digit position with which they are associated. The anodes of the nine digit representing relay tubes *D*₁ to *D*₉ are connected to a common plate potential supply conductor *11* which is maintained at a positive potential of from 120 to 150 volts as applied from terminal *12* through a resistor *R*₁₃ by a voltage source not shown. The cathodes of each of the tubes *D* are connected to a grounded conductor *14* through resistor *R* and the starter electrodes *e* are connected to the internal electrode *b* of an associated R. F. switch tube *S*. A resistor *R'* provided at each digit position also connects the starter electrode *e* to the grounded conductor *14*. A connection is provided between the cathode of each digit tube *D* and the internal electrode *a* of the R. F. switch tube *S* associated with the next higher digit position. The electrode *a* of the first digit position switch tube *S*₁ is connected through resistor *R*₁₆ to the positive terminal of a battery *17* or other equivalent potential source of approximately 80 volts. The bank of digit position tube

circuits is connected in parallel with a series connected triode vacuum tube V and a resistor R18. A switch tube S10 is provided for control of the tube V with electrode *b* of the tube S10 connected to grid 19 through a resistor R20 and to the grounded conductor 14 through a circuit comprising a resistor R19 and a capacitor C21 connected in parallel. An output signal lead 22 is coupled to the cathode of tube V.

The external electrodes *d* of the odd numbered switch tubes S1, S3, S5, S7 and S9 are connected through a conductor 23 to the output terminals of an oscillator A, while the electrodes *d* of the even numbered switch tubes S2, S4, S6, S8 and S10 are connected through a conductor 24 to the output terminal of a second oscillator B. The oscillators A and B are similar and may be of any well-known type having an output of from 75 to 150 peak volts at a frequency of from 10 to 20 megacycles. The structure of such an oscillator is illustrated in detail in Figure 5, and will be described hereafter. A pair of condensers labeled C and C' are provided for each switch tube S, and are connected respectively between the electrodes *a* and *b* and the grounded conductor 14. These capacitors serve to complete a circuit path for radio frequency energy applied to the external electrode *d* while blocking flow of direct current energy which may be applied to the internal electrodes.

The oscillators A and B are alternately turned on and off by means of a conventional trigger circuit 25 operating through associated cathode follower circuits CFa and CFb. In general, the conventional trigger circuit includes two discharge tubes so interconnected that when either tube is conductive, the other is cut off. The trigger circuit will remain in either of these two stable states until a control pulse is applied to reverse the conducting status of the tubes. Voltage values at points in the trigger circuit will differ according to whether the tubes are in one relative conductive status or the other, and such voltage variation may be used for circuit controlling purposes as is well-known.

The conventional trigger, cathode follower and oscillator circuits shown in Figure 1 in block form are illustrated in detail in Figure 5. The two discharge tubes 25a and 25b of the trigger are shown in this figure as contained within a single envelope, however, separate tubes may be employed as desired. The negative input pulse to be counted is applied to terminals 26 and 27 of the trigger and is directed to the grid circuits of both the trigger tubes 25a and 25b. Assuming the tube 25b to be initially conducting, its grid is driven sufficiently negative by the input pulse to render it non-conductive while tube 25a is unaffected since it is already cut off. As tube 25b cuts off, its plate potential rises to approach the plus 150 volt plate supply voltage. This voltage increase is applied to the control grid of tube 25a through a parallel connected 100 mmf. condenser and 200 k. resistor. As a result, the grid of tube 25a is made sufficiently positive to cause this tube to fire and its plate potential then decreases. The decrease in potential at the plate of tube 25a is applied to the grid of tube 25b through a second parallel connected 100 mmf. condenser and 200 k. resistor associated with tube 25b and now maintains this unit non-conductive. The first pulse has now turned tube 25b off and tube 25a on. In a similar manner, the next input pulse turns tube 25a off and tube 25b on. The output terminals 28 and 29 of the trigger are thus subjected to a negative shift in voltage of approximately 100 volts as a result of the conductive and non-conductive states of the tubes connected to these terminals. Inasmuch as the trigger is primarily a voltage device, it cannot be loaded, and a follower tube must be employed. The output terminal 29 is shown controlling a conventionally coupled cathode follower circuit CFb, and the output of the latter controls the oscillator B by pulsing the control grid of the oscillator tube in conventional manner in response to the change in potential at terminal

29. A similar cathode follower circuit CFa is controlled from output terminal 28 and drives oscillator A.

Referring to Figure 1, trigger 25 is initially maintained in a first stable state with tube 25b conducting and oscillator B turned on with its output applied through lead 24 to the external electrodes *d* of the even numbered switching tubes S2, S4 . . . S10. Since the electrodes *a* and *b* of these tubes do not have a D. C. potential applied to them, no conduction takes place and the counter stands at zero.

Upon application of a first input pulse to trigger 25, the oscillator B is turned off and oscillator A turned on with the output of the latter applied through lead 23 to the odd numbered switching tubes S1, S3, S5 . . . S9, each of which is then energized. A circuit path is now completed from the positive terminal of the battery 17 across the internal electrodes *a* to *b* of switch tube S-1 and through resistor R'1 to the grounded side of the battery via conductor 14. The voltage drop developed across resistor R'1 raises the potential of starter electrode *e* of the first digit representing tube D-1. The anode of tube D-1 being at a positive potential and the cathode at ground potential, this tube fires with the conducting path traced from terminal 12 through resistor R13, tube D-1, resistor R-1 and to the grounded side of the plate supply source through conductor 14.

The drop developed across resistor R-1 raises the potential of electrode *a* of the second switch tube S-2, however, this tube does not conduct as oscillator B is now turned off. Application of a second pulse to trigger 25 again reverses operation of the oscillators so that B is turned on and A off. Switch tube S-2 now fires, and the potential developed across resistor R'2 raises the potential of the starter electrode *e* of digit position tube D2 to a positive value and both tubes D-1 and D-2 conduct with a positive potential developed across resistor R2 now applied to electrode *a* of switch S-3. Continued application of pulses to the trigger will cause it to flip, alternately turning the oscillators off and on so that the counter will advance step by step in the manner described until each digit position tube D is rendered conductive. On application of the 9th input pulse, tube D9 fires and a potential is developed across resistor R9, applying a positive voltage to electrode *a* of switch tube S10. Application of the 10th input pulse causes switch tube S10 to fire, and a voltage is developed across resistor R10, raising the potential of grid 19 of the vacuum tube V. Tube V is thereby rendered conductive and a positive output pulse is obtained from the tube side of resistor R18 at terminal 22. At the same time, the bank of counter tubes is shorted through the tube V and resistor R18 in series and the voltage applied across the bank of counter tubes D is reduced to a value less than that required to sustain conduction (65-85 v.) by virtue of R13. All the counter tubes D are thereby extinguished and the counter is reset to zero. Tube V is maintained in a conducting state for a sufficiently long period as determined by the values of resistor R19 and capacitor C21 until all the digit tubes D are deionized whereupon the vacuum tube V returns to a normal, non-conducting condition and the voltage applied at terminal 12 is again available on conductor 11 and the anodes of the counter tubes.

The gas tube counter illustrated in Figure 2 in modified form employs a radio frequency actuated switching tube S in series with each digit representing tube D to complete a circuit from the cathode of the tube D to ground. In this arrangement, a digit representing tube D will become conductive only when its starter electrode *e* is energized coincidentally with energization of the associated series connected switch tube S. Isolation of successive digit position tubes is obtained by alternate stepping energization of the switch tubes pertaining to groups of odd and even number relay tubes in a manner similar to the previously described arrangement.

As shown in this figure, the anodes of digit position tubes D-1 to D-10 are connected through individual

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resistances R1 to R10 to a common source of D. C. potential of approximately 150 volts maintained on a conductor 50. The cathodes of the storage tubes D are connected to a grounded conductor 51 through correspondingly labeled R. F. switch tubes S and series resistances R'. A pair of condensers C and C' are connected in series across the internal electrodes *a* and *b* of each switch tube S with their common terminal connected to the grounded conductor 51. These condensers provide a path for the radio frequency energy applied to the external electrodes *d* from a pair of oscillators A and B through conductors 52 and 53 to which the odd and even number switch tubes respectively are connected. The condensers C in addition serve to prime the next digit representing tube as will be more fully explained. The starter electrode *e* of each digit representing tube D is connected to the cathode of the preceding digit tube with the starter electrode of tube D-1 being connected to the cathode of the last position tube D10. A battery 54 or other source of unidirectional potential is also coupled to the starter electrode *e* of tube D-1 through reset switch 55 which is closed to initially condition this tube for conduction prior to making an entry into the counter. The oscillators A and B are turned on and off by a conventional trigger circuit 56, and cathode followers 57 and 58, which, as before mentioned, may be of any well-known type and employed, for example, in an arrangement such as that shown in Figure 5.

In operation, trigger 56 is initially set in a first stable state so that oscillator B is turned on and A off. Since none of the digit tubes D are now primed, conduction will not take place. Closure of reset switch 55 primes tube D-1 by raising the voltage of its starter electrode *e* to the potential of source 54, however, the tube D1 does not fire as switch tube S-1 is not supplied with an actuating radio frequency signal and the cathode of tube D-1 remains effectively disconnected from ground.

Upon application of a first input pulse, trigger 56 flips turning oscillator B off and A on. The resistance between the internal electrodes *a* and *b* of tube S-1 then drops to a relatively low value connecting the cathode of tube D-1 to ground through resistor R'1. Digit tube D-1 now fires and as a consequence capacitor C associated with switch tube S-1 is charged. Upon application of a second input pulse to be counted, trigger 56 again flips and oscillator A is turned off and B on. Turning off oscillator A extinguishes switch tube S-1 and necessarily the series connected digit tube D-1. Turning on oscillator B fires the digit position tube D-2 as its starter electrode *e* is connected to the positively charged capacitor C of switch tube S1 and is thus maintained at a potential sufficient to initiate conduction. The counter is advanced step by step in a similar manner each time the trigger 56 is flipped by an incoming pulse. On firing the last counter tube D10, an output pulse is obtained on a conductor 60 connected to the cathode of the tube D10. This positive output pulse is also applied to the starter electrode *e* of the first digit tube D-1 through a lead 61, and this tube is now conditioned independently of the reset switch 55 and battery 54 by the condenser C associated with switch tube S10.

The gas tube counter of Figure 3 employs an arrangement for alternately applying stepping pulses to odd and even numbered digit position tubes D without requiring the radio frequency actuated switches and oscillators. All the anodes of the odd numbered tubes D1, D3 . . . D9 are connected to a lead 100 for common energization through a cathode follower 101 controlled from an output terminal 102 of trigger circuit 103, and all the anodes of the even numbered tubes D2, D4 . . . D10 are connected to a lead 104 for common energization through a cathode follower 105 controlled from output terminal 106 of the trigger. The cathodes of each of the tubes D1 to D10 are connected to a grounded line 107

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through individual resistances R1 to R10, each of which is connected in parallel with a correspondingly labeled condenser C1 to C10. The ungrounded terminal of each condenser C is connected with the control electrode *e* of the next succeeding digit position tube. The connection from condenser C10 associated with the last tube D-10 being made to the starter electrode *e* of the first tube D1 by a lead 108 with condenser C10 connected in parallel with a reset switch 109 and a battery 110 or other potential source of approximately 80 volts.

Trigger 103 and cathode followers 101 and 105 operate in the same manner as described in connection with the foregoing counter circuits and as discussed in connection with the elements shown in Fig. 5. The trigger is initially set so that line 100 connecting the anodes of the odd numbered counter tubes is at a potential below the extinction value and line 104 connecting the even numbered counter tubes is at a potential above the tube strike voltage. Before an entry is made into the counter, reset switch 109 is closed to apply voltage from the battery 110 to the starter electrode *e* of tube D-1 thereby "priming" the tube. A first input pulse causes trigger 103 to flip, raising the potential of terminal 102, and the cathode follower 101 connected thereto conducts to thereby apply high potential to line 100 and cause tube D-1 to fire. Conduction through resistance R1 develops a charge on the associated condenser C1 and results in the application of a positive potential to the starter electrode *e* of the next digit tube D-2. On receipt of a second pulse, trigger 103 again flips and line 100 swings below the sustaining voltage and tube D-1 is extinguished. At the same time, line 104 swings sufficiently positive to fire tube D2. The R1C1 constants are so proportioned that condenser C1 retains its charge for a time period greater than the extinction time of tube D-1 and thus maintains the starter electrode *e* of tube D2 at a positive potential during the interval that the trigger flips or until D2 fires.

The counter is advanced in like manner each time the trigger flips and, on the tenth input pulse, the tube D-10 conducts and applies a positive potential pulse to the line 108 connected to the starter electrode *e* of the first digit representing tube D-1, thus conditioning this tube for further operation independently of the battery 110 and reset switch 109. An output lead 111 is coupled to the cathode of tube D10, and is subjected to a positive swing in voltage as tube D10 is rendered conductive.

In each form of the invention described and illustrated, three element cold cathode counter tubes have been employed, however, it is contemplated that thyratrons may be used as counter tube elements with proper alteration of the values of the circuit components and applied potentials.

It will be further appreciated that only the arrangement of a single denominational order of an accumulator has been illustrated and described and that the counters may be employed as the units order of a counter having a plurality of orders. In such case, the ten count output may be directed to the input of a second gas tube counter unit so that on every tenth input pulse the second counter will be advanced one unit. Similarly, the output of a tens order counter may be utilized to operate a hundreds order counter etc., as in conventional accumulator counter arrangements. Read-out may be effected from the counter in the well-known manner by advancing the counter until an output pulse is obtained at a differential time in the read-out cycle in accordance with the number standing in the counter.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the

intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. In a gas tube counter, a first plurality of digit position gas tubes, a second plurality of digit position gas tubes interspersed between the tubes of said first plurality, said tubes having an anode, cathode and control electrode and being adapted to be rendered conductive in succession in response to the application of a series of input pulses to be counted, circuit means connecting the anode and cathode electrodes of said tubes for energization, switch means connecting the anode-cathode circuit of each said tube to the control electrode of the next adjacent tube so that conduction in one tube renders the next adjacent tube conductive on operation of said switch means, and stepping means operable in response to said input pulses to alternately operate the switch means connecting the control electrodes of the tubes of said first plurality and the switch means connecting the control electrodes of the tubes of said second plurality so that the last tube rendered conductive indicates the number of input pulses applied.

2. In a gas tube counter, a first plurality of digit position gas tubes, a second plurality of digit position gas tubes interspersed between the tubes of said first plurality, said tubes being adapted to be rendered conductive in succession in response to the application of a series of input pulses to be counted, means for energizing said digit position tubes including switch means coupled to each tube and means responsive to the conductive state of each tube for conditioning the next adjacent tube for operation, and stepping means operable in response to said input pulses to alternately operate the switch means coupled with the tubes said first plurality and the switch means associated with the tubes of said second plurality so that the last digit position tube rendered conductive indicates the number of input pulses applied.

3. In a gas tube counter, a first and second plurality of serially arranged three electrode gas tubes, the tubes of said first and second plurality being alternately interspersed and adapted to be rendered conductive in sequence on application of a series of input pulses to said counter, means for energizing and controlling the firing of said tubes including switch means coupled to one of the electrodes of each said tube, trigger means operable in response to the application of successive ones of said input pulses for controlling the operation of said switch means and applying a firing potential alternately to said first plurality of tubes and second plurality of tubes.

4. In a gas tube counter comprising a first and second plurality of interspersed serially arranged digit position tubes, said tubes having an anode, cathode and control electrode, means for rendering said tubes conductive in a predetermined sequence corresponding with the sequence of application of a series of input pulses to be counted, said means including trigger means operable in a first stable state to apply an operating potential to the anode-cathode circuit of said first plurality of digit position tubes and in a second stable state to apply an operating potential to the anode-cathode circuit of said second plurality of digit position tubes, said trigger means reversing its stable state on receipt of each input pulse, and means responsive to conductivity of each digit position tube for conditioning the next succeeding tube for operation comprising circuit means coupling the cathode of each tube to the control electrode of said next succeeding tube so that application of operating potential to the anode-cathode circuit causes only the tube succeeding a conductive tube to fire.

5. A gas tube counter comprising a first and second plurality of interspersed serially arranged three element gas tubes, said elements comprising anode, cathode and control electrodes, trigger means operable in a first stable state to apply an operating potential to the anode-cathode circuit of said first plurality of gas tubes of said series

and in a second stable state to apply an operating potential to the anode-cathode circuit of said second plurality of gas tubes of said series, a resistance series connected in the anode-cathode circuit of each of said tubes, a capacitor connected in shunt with said resistance, said capacitor being connected with the control electrode of the next succeeding gas tube with the capacitor associated with the last tube of the series being connected with the control electrode of the first tube.

6. In a counter system, a first and second plurality of interspersed serially arranged three element gas tubes, said elements comprising anode, cathode and control electrodes, trigger means operable to apply a first potential to the anode-cathode circuit of the gas tubes of said first plurality and a second potential to the anode-cathode circuit of the gas tubes of said second plurality of said series when in a first stable state and to reverse the potentials applied to said tubes of said first and second pluralities in a second stable state, only one of said applied potentials being within the operating range of said gas tubes, capacitor means connected to the cathode electrode of each of said gas tubes and adapted to be charged upon conduction thereof, circuit means connecting the control electrode of said tubes to one terminal of the capacitor associated with the preceding tube with the control electrode of the first tube being connected with the capacitor associated with the last tube in said series, and output signal means associated with said last tube.

7. In a gas tube counter, a first and second plurality of interspersed parallel connected three element digit position gas tubes, said elements comprising anode, cathode and control electrodes, means including first and second radio frequency oscillators for rendering said gas tubes conductive in a predetermined sequence corresponding with the sequence of application of a series of input pulses, trigger means operable to turn said first oscillator on and said second oscillator off in a first stable switching state and to reverse the operation of the oscillators in a second stable switching state, said trigger means reversing its stable state on receipt of each input pulse, a plurality of radio frequency controlled switching tubes, one associated with each digit tube, means connecting the control electrode of each digit position tube to the cathode of the preceding digit position tube through the associated switching tube, circuit means connecting the output of said first oscillator for controlling the switching tubes associated with the digit tubes of said first plurality, and circuit means connecting the output of said second oscillator for controlling the switching tubes associated with the digit tubes of said second plurality, a normally non-conducting triode vacuum tube connected in parallel with said digit position tubes, means including an additional radio frequency actuated switch tube controlled by said second oscillator and coupled with said last digit position tube, said means completing a circuit to the control grid of said vacuum tube causing conduction therein and thereby shorting the paralleled digit position tubes and causing them to be extinguished, and means for obtaining an output signal on firing of said vacuum tube.

8. In a gas tube counter system, a first and second plurality of serially arranged three electrode digit position gas tubes, means for rendering said gas tubes conductive in a predetermined sequence corresponding with the sequence of application of a series of input pulses so that the digit position tube last rendered conductive is indicative of the number of input pulses applied, said means including a plurality of radio frequency actuated switching tubes, one connected to an electrode of each digit position tube and adapted to control application of firing potential to said digit position tubes of said first and second plurality alternately in response to successive ones of said input pulses.

9. In the counter system of claim 8, said means including a pair of radio frequency oscillators, trigger means responsive to said series of input pulses for controlling

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the operation of said oscillators, and means coupling the outputs of said oscillators to said radio frequency actuated switching means.

10. In a counter as set forth in claim 8, said radio frequency actuated switching tubes being connected in series with said digit position tubes across a source of potential, a pair of radio frequency oscillators, means including a trigger circuit for alternately turning said first oscillator on and said second oscillator off and for turning said first oscillator off and said second oscillator on, circuit means coupling said first oscillator with a first group of said radio frequency actuated switch tubes connected with the digit position tubes of said first plurality and circuit means coupling said second oscillator with a second group of radio frequency actuated switching tubes

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connected with the digit position tubes of said second plurality, and means activated in response to conduction of each digit position tube for conditioning the next succeeding digit tube for firing on completion of its circuit.

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