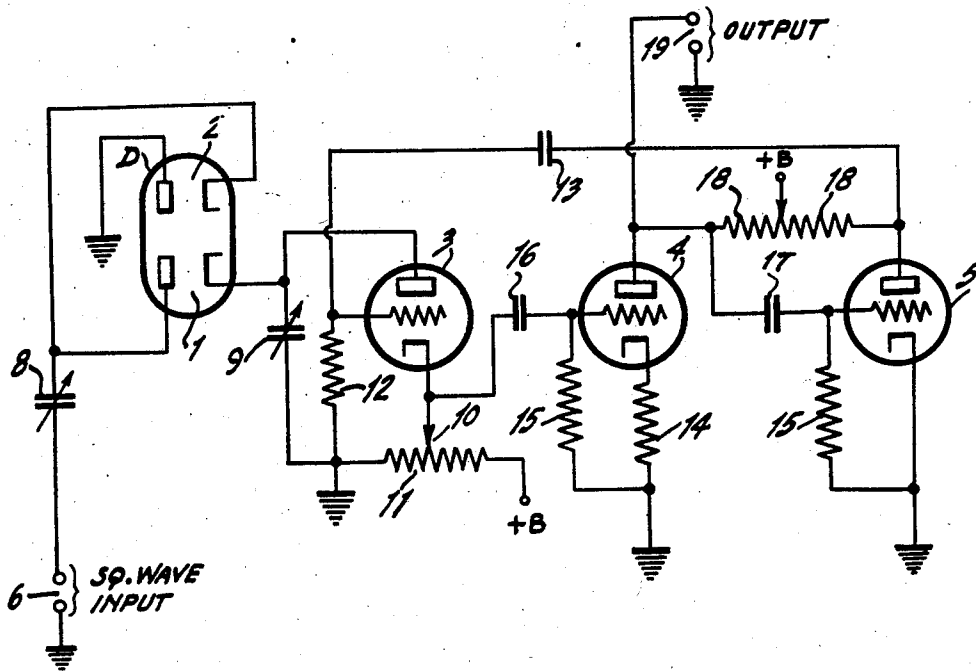


May 3, 1949.

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ELECTRONIC COUNTER CIRCUIT
Filed Sept. 6, 1945

2,469,031



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2,469,031

ELECTRONIC COUNTER CIRCUIT

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Application September 6, 1945, Serial No. 614,789

1 Claim. (Cl. 250—27)

1

This invention relates to counter circuits and has for its object to provide means for counting pulses through the operation of an electronic circuit arrangement which possesses no transformers and no negative potential supply source such as have been commonly required in counter circuits of the prior art.

Briefly, my invention comprises a twin diode rectifier tube and three vacuum tube triodes so concatenated as to provide for a step-wise build-up of charging potentials on one of two condensers which, generally, but not necessarily, has a greater capacity than the other. Input pulses of one polarity traverse a first condenser and produce successive increments of charge on a second condenser up to the predetermined number of pulses to be counted. The second condenser is then discharged through the first stage of the triode tubes by coupling a pulse to the grid circuit of the latter, this pulse being derived from the output of the final stage triode.

My invention will now be described in more detail reference being made to the accompanying drawing the sole figure of which represents diagrammatically a preferred circuit arrangement for carrying out the invention.

Referring to the drawing, I show a twin diode discharge tube D having two electronic paths 1 and 2 for blocking purposes. Three triode discharge tubes 3, 4 and 5 are shown arranged in concatenated stages for a purpose presently to be explained. The input terminals 6 are fed with pulses of a square wave or rectangular wave wherein only the positive peaks can be counted. The pulses are applied through a circuit including capacitor 8 and the two unilateral discharge paths 1 and 2 of the diode tube D. Traversing the discharge path 1 each positive pulse is applied to the build-up of charge on capacitor 9 which is connected between ground and the cathode of the discharge path 1. Negative pulses traversing the capacitor 8 are dissipated to ground through the discharge path 2 in the diode D.

The vacuum tube triode 3 is cut-off by having its cathode connected to a tap 10 on a potentiometer 11. This potentiometer is connected across the terminals of a suitable D. C. power supply. The anode of tube 3 is connected to capacitor 9 on the same side as its connection to the cathode of discharge path 1. The control grid in tube 3 is connected to ground through a resistor 12. This grid is also connected through a capacitor 13 to the anode in tube 5. Tube 4 has its cathode connected to ground through a cathode resistor 14. Tubes 4 and 5 possess in-

2

put circuits which include grid resistors 15. The anodes in tubes 4 and 5 are supplied through resistors 18 with positive D. C. potential (indicated as +B) which may be derived from the aforementioned power supply.

The cathode in tube 3 is coupled across capacitor 16 to the grid in tube 4. The anode in tube 4 is coupled across capacitor 17 to the grid in tube 5.

In the operation of my improved counter circuit it will be observed that the capacitance of the condenser 9 is so chosen with respect to that of condenser 8 that a desired number of pulses will be counted by accumulating their charges in a step-wise manner on the condenser 9. These charges, therefore, result in a gradual build-up of anode potential in the tube 3. The negative portion of the input voltage cycle is dissipated through discharge path 2. When the increments of charge reach a critical value on the condenser 9, tube 3 becomes conductive. This critical value is established by the cathode bias potential which is derived from the setting of the potentiometer tap 10.

The purpose of the triode tube stages 4 and 5 is to accelerate the discharge of the condenser 9 when it reaches its critical accumulation of charging pulses. The action is explained as follows:

A more positive cathode in tube 3 resulting from the conductive state of this tube is reflected in a control of tube 4 so as to render the latter tube more conductive. The anode in tube 4 is now driven to a more negative value and this causes tube 5 to be biased closer to cut-off. Previously tube 5 was in a conductive state.

As a result of biasing tube 5 closer to cut-off, its anode potential rises to a value which is reflected in a voltage surge across capacitor 13 and through resistor 12 to ground. This voltage surge drives the grid in tube 3 more positive and reduces the tube impedance to a value which quickly dissipates the charge on condenser 9. This condenser is thus prepared to immediately begin a new counting cycle.

Stated otherwise, the cathode of tube 3 couples a positive pulse into the grid of tube 4 which amplifies and inverts the pulse. The resulting negative pulse from the anode of tube 4 is coupled to the grid of tube 5 which again amplifies and inverts the pulse. The resulting pulse, now positive and amplified is coupled to the grid of tube 3 so that this last tube will continue to conduct and rapidly discharge the storage condenser 9.

A useful derivative from the operation of the

3

counter circuit may be obtained from the anode in tube 4 by connecting the same to output terminals 19. Optionally, however, the output may be taken from the anode of tube 5 or even from one of the cathodes in tubes 4 and 5, depending upon the wanted polarity of the output pulses representing successive groups of input pulses.

While it is possible to vary the count over a considerable range by an adjustment of the tap 10 on the potentiometer 11, it has been found in practice that, with other adjustments of the circuit selected for an optimum degree of stability, a train of pulses up to ten may be reliably counted irrespective of the pulse frequency through a range of several octaves.

It will be understood, of course, by those skilled in the art that modifications may be made without departing from the spirit of the invention. The circuit arrangement as shown and described is, therefore, to be considered as merely illustrative.

What is claimed is:

A counter circuit comprising a storage condenser, a charging condenser, a unilaterally conducting device connected between one plate of each of said condensers for admitting current from said charging condenser to said storage condenser, a second unilaterally conducting device connected between the junction of the charging condenser and the first-mentioned conducting device and the other plate of said charging condenser for discharging said charging condenser, means for impressing a pulsating current between the other plate of the storage condenser and the other plate of the charging condenser, first, second and third vacuum tubes, each having a cathode, an anode and a grid, a direct con-

4

nection from said one plate of said storage condenser to the anode of the first tube whereby the anode of said first tube receives its polarizing potential solely from said charging condenser, individual resistors between the grids and cathodes of said respective tubes, adjustable biasing means connected to the cathode of said first tube for normally biasing said first tube to cut-off, a connection from the cathode of said first tube to the grid of said second tube, a connection from the anode of said second tube to the grid of said third tube, a feedback connection from the anode of said third tube to the grid of said first tube, said second and third tubes comprising normally conductive amplifiers, whereby a positive charge on said storage condenser of a value sufficient to overcome the cut-off bias on said first tube causes a positive pulse to be applied to the grid of said second tube, as a result of which a negative pulse is applied to the grid of the third tube and an inverted pulse of positive polarity is fed back to the grid of said first tube, to thereby hasten the flow of current through said first tube and discharge said storage condenser.

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