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MULTIVIBRATOR

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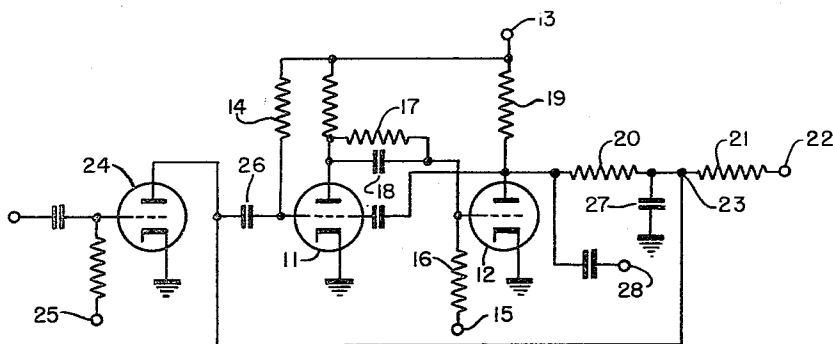


FIG. 1

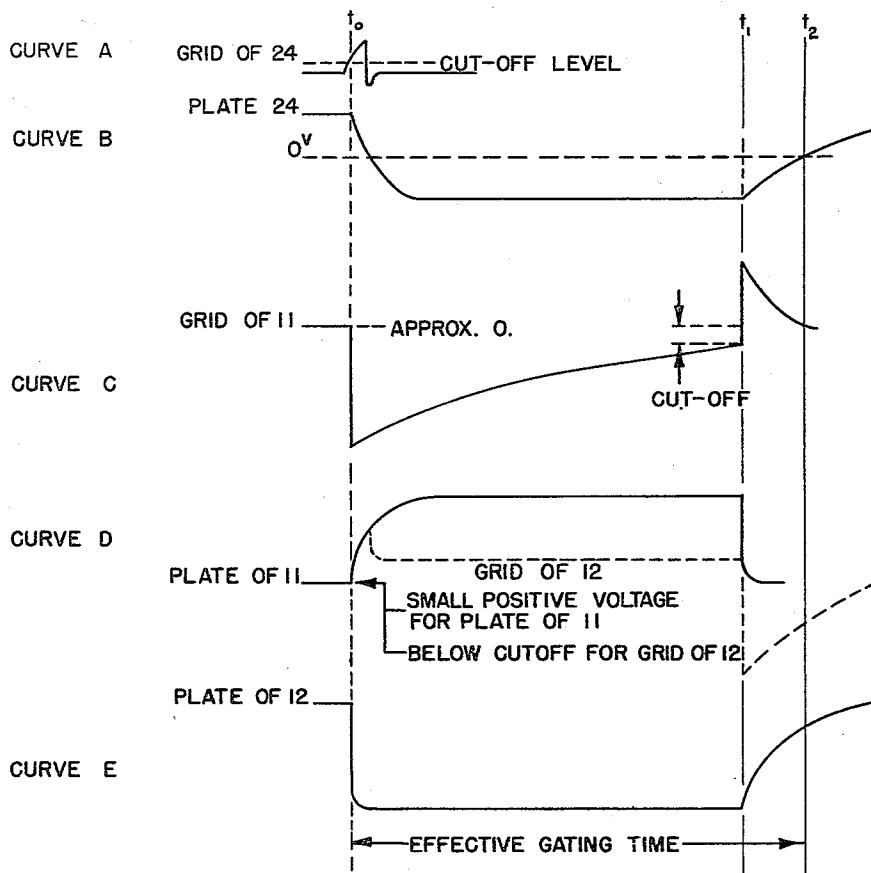


FIG. 2

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MULTIVIBRATOR

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6 Claims. (Cl. 250—27)

1 This invention relates to multivibrator circuits and more particularly to driven multivibrator circuits wherein the duration of the generated voltage gate is controlled by an electronic protective switch.

The conventional multivibrator circuit is most frequently employed to generate rectangular voltage gates of specified duration, having the leading edge of the gate synchronized with a driving trigger voltage, and to introduce a measured time delay between the driving trigger voltage and the operation of a second circuit. In the conventional "one-shot" multivibrator circuit, the plate of the normally conducting tube is connected to a source of positive voltage, and the grid of the normally cut-off tube is connected to a source of negative voltage, thereby causing the circuit to have a single stable equilibrium condition, which necessitates a driving trigger voltage to actuate each cycle of its operation. If the conventional one-shot multivibrator is fired by some source of trigger voltage immediately after completing its cycle, its next cycle will have a somewhat shorter period because of residual charges on the coupling condensers. This may result in allowing signals which the multivibrator gate was intended to exclude to pass on to other parts of the circuit, or introduce an incorrect time delay in the operation of a second circuit. To eliminate these inaccuracies in conventional circuits, D. C. restorers or similar devices involving the use of the very low impedance of vacuum tubes, are employed to control the discharges of the coupling condensers and hence the duration of the voltage gate.

The primary object of the present invention is to improve the conventional one-shot multivibrator circuit in its application to the production of voltage gates and time delays.

Another object of the present invention is to provide a method of very definitely controlling the duration of the voltage gates of a one-shot multivibrator.

A further object of the present invention is to provide an electronic protective switch to prevent the firing of a one-shot multivibrator circuit until complete equilibrium is reached after the previous cycle.

A still further object of the present invention is to provide a method of controlling the duration of the voltage gate of a one-shot multivibrator

2 using a single electron tube as an electronic protective switch.

The foregoing and other objects will be apparent from the following specification when taken with the accompanying drawings in which:

Figure 1 is a schematic diagram of the basic circuit; and

Figure 2 illustrates the basic waveforms which are generated by the circuit.

Referring to Fig. 1, triode electron tubes 11 and 12 are connected as a conventional one-shot multivibrator, tube 11 being normally conducting and tube 12 normally cut off. This is the only equilibrium condition possible because the grid of tube 11 is connected to a source of positive voltage applied at terminal 13 through resistor 14, and the grid of tube 12 is connected to a source of negative voltage applied at terminal 15 through resistor 16. The only departure from the conventional multivibrator is the use of the parallel combination of resistance 17 and capacitance 18 in the coupling between the plate of tube 11 and the grid of tube 12 to avoid the averaging effect of the coupling condenser 18, and the consequent change of bias on tube 12 due to different pulse repetition rates.

Resistors 19, 20 and 21 are of such value that the division of voltage between the positive voltage applied at terminal 13 and a negative voltage applied at terminal 22 results in a positive voltage at point 23 and also at the plate of tube 24 when the multivibrator is in its quiescent condition. Tube 24 is biased just beyond cut-off by a negative voltage applied at terminal 25, so that a positive signal input, sufficiently greater than noise voltage as shown in curve A of Fig. 2 will cause tube 24 to conduct. When tube 24 conducts, its plate voltage drops, and this negative signal coupled through condenser 26 produces a signal on the grid of tube 11 as shown in curve C, Fig. 2, which triggers the multivibrator. When this occurs the voltage on the plate of tube 12 drops to a low value as shown by curve E, Figure 2, and the voltage at point 23, and also at the plate of tube 24, actually becomes negative by the voltage divider action of resistors 20 and 21. This negative swing of voltage is shown on curve B, Figure 2. As a result, no signal on the grid of tube 24, however large, can influence the multivibrator. When the multivibrator completes its cycle at t_1 shown in

Fig. 2, the plate potential of tube 24 still requires the time between t_1 and t_2 for recovery to a positive value. Tube 24 thus prevents the multivibrator being triggered immediately after its cycle is complete, because the voltage on its plate remains negative until condenser 27 charges part way back to its quiescent value. The effective gating time of the multivibrator is thus increased by the time between t_1 and t_2 , allowing the coupling condensers of the multivibrator circuit sufficient time to return to the same quiescent condition after each cycle. The generated voltage gate, shown in curve E, Fig. 2, is taken from output terminal 28.

The invention described in the foregoing specification need not be limited to the details shown, which are considered illustrative of one form the invention may take.

What is claimed is:

1. In combination with a driven multivibrator including a normally conducting and a normally nonconducting electron tube each having a control grid, a cathode and an anode, a third electron tube having at least a control grid, a cathode and an anode, said anode of said third electron tube being capacitively coupled to the control grid of said normally conducting tube of said multivibrator, a source of negative voltage, a resistive voltage divider connected between the anode of said normally nonconducting tube and said source of negative voltage, the anode of said third electron tube being directly coupled to an intermediate point of said voltage divider normally having a positive potential with respect to ground, a condenser connected between said intermediate point of said voltage divider and ground, a source of input voltage pulses, and means to apply said voltage pulses to the control grid of said third electron tube, the resulting drop in anode potential of said third electron tube initiating a single cycle of operation of said multivibrator, the operation of said multivibrator acting to make said intermediate point of said voltage divider negative and hence apply a negative potential to the anode of said third electron tube for the duration of said multivibrator cycle, thereby isolating said multivibrator from said input pulses during the period of said multivibrator cycle plus the time of charging said condenser to a positive potential.

2. In a driven multivibrator circuit including a normally conducting and a normally nonconducting electron tube each having a control grid, a cathode and an anode, a protective switch comprising a third electron tube having at least a cathode and an anode, a source of negative potential, a resistive voltage divider connected between the anode of said normally nonconducting tube and said source of negative potential, the anode of said third electron tube being connected directly to an intermediate point on said voltage divider, the potential at said intermediate point being normally positive, a storage condenser connected between the said intermediate point on said voltage divider and ground, means to apply input trigger pulses to said multivibrator through said third electron tube to initiate single cycle oscillations of said multivibrator, the multivibrator action rendering said normally nonconducting electron tube conductive and reducing the anode potential thereof, thereby causing the potential at said intermediate point of said voltage divider to become negative making said third electron tube nonconductive to isolate said multivibrator from said input pulses, said isolation time exceeding the period of said multivibrator

oscillation for a time substantially determined by the time constant for charging said condenser.

3. In combination with a driven multivibrator responsive to a source of repetitive input voltage pulses to generate single cycle oscillations, a protective circuit comprising an electron tube coupled between said source and said multivibrator to apply pulses from said source to trigger said multivibrator input, means to bias said electron tube to be responsive to voltage input pulses having a predetermined amplitude, means to apply a portion of the output voltage wave of said multivibrator to said electron tube to render said electron tube inoperative for the time duration of said multivibrator output wave, and a storage capacitor connected to the output of said multivibrator whereby the charging time constant of said capacitor following the termination of said multivibrator cyclic operation causes said output voltage wave to extend the inoperative time of said electron tube.

4. In combination with a driven multivibrator responsive to a source of repetitive voltage pulses to generate single cycle oscillations, a protective circuit comprising an electron tube having at least a cathode, a control grid and an anode, means applying input voltage pulses from said source to said control grid, means biasing said electron tube to be responsive to pulses having a predetermined amplitude to produce an output pulse at the anode of said tube, a circuit coupling the anode of said electron tube to said multivibrator to initiate a single cycle operation of said multivibrator from each output pulse, a circuit for applying the oscillation voltage wave of said multivibrator to said anode of said electron tube to drive said anode negative for the time duration of said multivibrator operation, and a storage capacitor connected to the output of said multivibrator to hold the anode of said third tube at a negative potential for the time for charging said capacitor before returning the anode potential of said electron tube to a positive value.

5. In combination a multivibrator circuit including two electron tubes each subject to control through its input circuit and each having its input circuit coupled to the output circuit of the other for producing mutual interaction, means to hold the first of said tubes normally conducting and the second of said tubes normally nonconducting, a voltage divider resistance network in the output circuit of said second tube, a source of trigger pulses, a third electron tube having its input circuit connected to said source and its output circuit coupled to input of said first tube for feeding trigger pulses to said first tube thereby to block the same, a storage capacitor connected to said voltage divider network at a positive potential point thereon, means to energize said third electron tube from the potential of charge of said capacitor, and means to reverse the charge of said capacitor from the output circuit of said second tube to hold said third tube nonconducting for the period of said multivibrator cycle plus the time of charge of said capacitor to a positive potential through said voltage divider resistance network.

6. In combination, a multivibrator including two electron tubes each subject to control through its input circuit and each having its input circuit coupled to the output circuit of the other for producing mutual interaction, means to hold the first of said tubes normally conducting and the second of said tubes normally nonconducting, a source of negative potential, a voltage dividing resistance

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network connected between said second tube and said negative potential source such than an intermediate point thereon normally at a positive potential is driven negative upon conduction of said second tube, a storage capacitor connected between said intermediate point and ground, a source of trigger pulses, and a third electron tube energized by the potential at said intermediate point and having its input circuit connected to said source and its output circuit coupled to the input of said first electron tube for applying trigger pulses thereto to block the same and to drive said second tube to conduction, whereby

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said third electron tube is rendered nonconducting during the period of said multivibrator cycle plus the time of charging said storage capacitor to a positive potential.

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