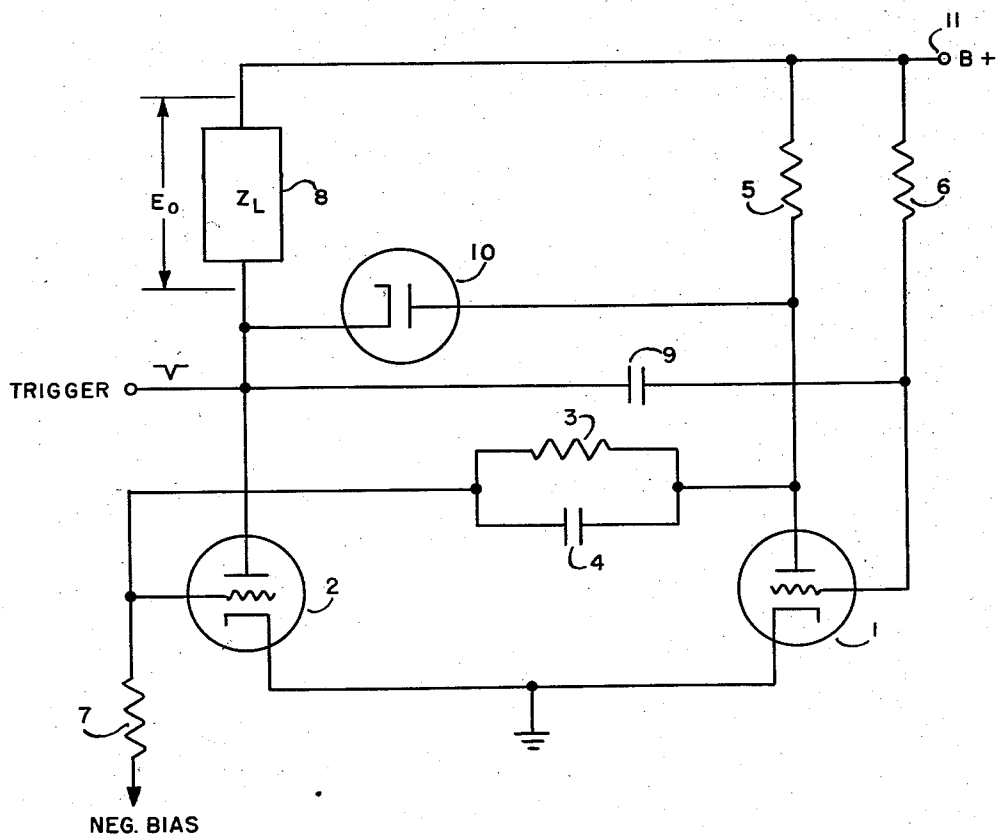


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MONOSTABLE MULTIVIBRATOR CIRCUIT FOR
VARIABLE LOAD IMPEDANCES
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MONOSTABLE MULTIVIBRATOR CIRCUIT FOR VARIABLE LOAD IMPEDANCES

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The present invention relates generally to electronic trigger circuits and, more particularly, to an improved monostable multivibrator whose output wave form has highly stabilized characteristics which are relatively independent of variations in load impedance.

In a wide variety of electronic control systems that require rectangular trigger pulses, such as, for example, delay circuits, coincidence gates and blanking circuits, the customary practice has been to employ a multivibrator circuit as the pulse generating means. Although conventional multivibrators provide fairly stabilized trigger pulses, the utilization of these circuits is somewhat restricted by the fact that their output wave forms are appreciably influenced by variations in load impedance. These variations in impedance introduce irregularities in the characteristics of the trigger pulses which may show up as distortions in the wave form or variations in the pulse duration or amplitude.

It is, accordingly, a primary object of the present invention to provide a monostable multivibrator whose stability of output wave form is greater than that of conventional circuits.

A second object of the present invention is to provide an improved multivibrator trigger circuit whose output wave form is substantially independent of variations in load impedance.

A further object of the present invention is to provide an improved multivibrator trigger circuit having an output wave form whose duration and amplitude is relatively constant for wide variations in load impedance.

A still further object of the present invention is to provide a monostable multivibrator having a self-regulatory feature for compensating for variations in load impedance during the operational cycle whereby highly stabilized output wave forms are produced.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawing, the single figure of which is a schematic diagram of a preferred embodiment of the invention.

Briefly, the present invention obtains improved wave form stability by incorporating a regulatory feature in the multivibrator circuit whereby variations in the output voltage caused by changes in the magnitude of the load impedance are compensated for by suitable corrections in the amplitude of the load current. This compensation is achieved by simply connecting a diode between the plates of the electron discharge tubes of the multivibrator. This diode is adapted to be rendered conductive whenever the multivibrator is activated and it completes a feedback path between the plate and grid of the output tube of the multivibrator which supplies the above plate current regulation.

Referring now to the figure, electron tubes 1 and 2, together with the RC circuit formed by resistor 3 and capacitor 4, and load resistors 5 and 8, constitute a

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conventional monostable multivibrator of the plate-coupled type. Because the control grid of triode 1 is returned to a positive source of potential via resistor 6 and the control grid of triode 2 is connected through resistor 7 to a suitable negative biasing potential, triode 1 is normally conducting and triode 2 is normally cut off. As is well-known, the multivibrator cycle can be instituted by coupling a negative trigger pulse via capacitor 9 to the control grid of triode 1. Whenever this happens, the plate potential of this triode rises towards the value of plate supply source 11 and the resultant positive pulse appearing at the anode of this tube is fed by means of RC circuit 3, 4 to the control grid of triode 2. The blocking bias on this tube is thereby removed and conduction is instituted therein. Once triode 2 begins to draw current, the regenerative switching process transfers triode 2 to a conductive status and triode 1 to a nonconductive status. The plate potential of triode 2 thus falls to a value normally determined by the magnitude of its load impedance, Z_L , identified by reference character 8, and the characteristics of this tube for approximately zero grid bias.

Up to this point in the discussion, the operation and function of the diode 10, connected between the plates of triodes 2 and 1, with its cathode coupled to the former and its anode to the latter, has been neglected; and, consequently, the description set forth has been the same as that of the conventional one-cycle multivibrator. Without the presence of diode 10, it will be recognized that the magnitude of output voltage, E_o , depends primarily upon the size of the load impedance Z_L across which it is developed. Variations in this impedance therefore directly effect the characteristics of the positive rectangular pulse generated by the multivibrator. By the addition of diode 10, however, the performance of the circuit is modified and as a result the magnitude of the output trigger pulse is held substantially constant throughout the operational cycle of the multivibrator and the time duration of the output pulses is substantially homogeneous.

When the input negative trigger pulse causes the plate potential of triode 1 to increase towards the value of source 11 and the plate of triode 2 to decrease towards the value mentioned hereinbefore, diode 10 is rendered conductive because of the favorable potential level of its anode with respect to its cathode. When this occurs, subsequent variations in the magnitude of load impedance Z_L , within relatively broad limits, cause only small changes in E_o . This result obtains because of the feedback path now present between the plate and control grid of triode 2. If the plate potential of triode 2 now diminishes because of an increase in Z_L , the control grid goes slightly negative, reduces the plate current drawn by the tube and a constant voltage is maintained across the increased load impedance. If the reverse happens and the plate potential increases, signifying a decrease in the magnitude of Z_L , the control grid goes slightly more positive and increases the plate current drawn by the tube so that the same voltage now exists across this smaller load impedance. It will thus be seen that due to the feedback path the plate and grid of triode 2 move in the same electrical direction when external conditions disturb the magnitude of the load impedance. Thus, close regulation of the magnitude of the output voltage E_o is had and a constant gate duration for wide variations in load impedance is realized.

Obviously many modifications and variations of the present invention are possible in the light of the above teaching. It is, therefore, to be understood that within

the scope of the appended claims the invention may be practiced otherwise than as specifically described.

We claim:

1. In a monostable plate-coupled multivibrator of the type wherein a first electron tube is normally held in a conducting status and a second tube is normally held in a non-conducting status, an RC circuit interconnecting the plate of said first tube and the control grid of said second tube, a diode having its cathode electrically connected to the anode of said second tube and its anode electrically connected to the anode of said first tube, voltage dropping means interconnecting said diode anode and a positive potential source, said diode being adapted to be rendered conducting in response to the institution of conduction in said second tube for establishing with said RC circuit a feedback path between the anode and control grid of said second tube, said feedback path providing current regulation for said second tube, whereby a constant output voltage is maintained across a load impedance connected in the plate circuit of said last-mentioned tube.

2. In a monostable multivibrator of the type wherein a first electron tube is normally held nonconducting, a second tube is normally held conducting, and a circuit interconnects the grid of said first tube and the anode of said second tube, the improvement comprising, a diode having its cathode connected to the anode of said first tube and its anode connected to the anode of said second tube, a resistance interconnecting the diode anode with a positive potential source, and a load impedance connected between the diode cathode and a positive potential source.

3. A monostable multivibrator comprising a first electron tube normally held conducting, a second electron tube normally held nonconducting, means for applying an input trigger to said first electron tube, a timing circuit interconnecting the anode of said first tube and the control grid of said second tube, a unidirectionally conductive member connected between the anodes of said first and second tubes, a source of positive potential, a resistance electrically interconnecting one terminal of said member and said source, an impedance load electrically interconnecting the other terminal of said member and said source, and said unidirectionally conductive member permitting conduction from its impedance load end toward its resistance connected end.

4. In combination, a first and second multi-electrode tube, each tube having at least an anode, a control grid, a cathode, means for connecting the cathodes of said tubes to a reference potential first and second load impedances, said first impedance being connected between the anode of said first tube and a voltage source positive with respect to said reference potential, said second load impedance being connected between the anode of said second tube and said voltage source, means for biasing said first tube to cutoff and means for biasing said second tube to conduction, a parallel resistance-capacitance network intercoupling the anode of said second tube and the control grid of said first tube thereby to form a monostable plate-coupled multivibrator wherein said first tube constitutes the normally "off" tube and the second tube constitutes the normally "on" tube, a diode, said diode having its cathode coupled to the anode of said first tube and its anode connected to the anode of said second tube whereby variations in the magnitude of the voltage developed across said first load impedance, occasioned by changes in the magnitude of this impedance during that portion of the multivibrator cycle during which first tube is in a conducting status, are coupled via said diode and said parallel resistance-capacitance network to the control grid of said first tube thereby to modify the current drawn by said first tube so as to produce a constant voltage across said first load impedance.

References Cited in the file of this patent

UNITED STATES PATENTS

1,613,954	Knoop	Jan. 11, 1927
2,470,028	Gordon	May 10, 1949
2,536,808	Higinbotham	Jan. 2, 1951
2,611,824	Van Duuren	Sept. 23, 1952
2,636,985	Weissman	Apr. 28, 1953
2,683,806	Moody	July 13, 1954
2,696,557	Gray	Dec. 7, 1954

OTHER REFERENCES

Kandiah: Sensitive Pulse Trigger Circuit with Stable Threshold, Proc. Inst. of Electric Engineers, vol. 101 (June 1954), pp. 242-244.