

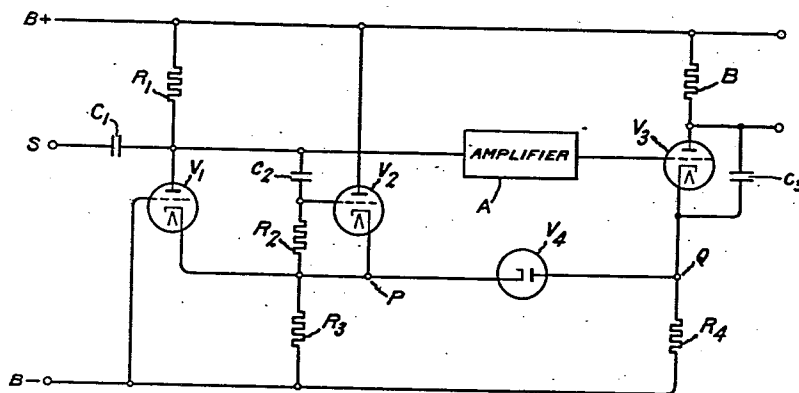
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TIME BASE CIRCUIT

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TIME BASE CIRCUIT

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This invention relates to time base circuits for cathode ray tubes and has particular application to circuits of the type in which the excursion of the spot only occupies a fraction of the periodic time of the phenomenon under investigation. In such circuits it is usually desirable that the amplitude of excursion of the spot shall remain approximately constant under conditions of variable sweep speed; it is also desirable to ensure that when the amplitude of the spot excursion reaches a predetermined value the flyback is at once initiated so that during the non-useful portion of the cycle the spot is largely undeflected so that the current is kept at a minimum and thus it is possible to use smaller valves and components than would otherwise be the case. The object of the present invention is to provide an improved circuit of this type.

According to the present invention, a time base circuit comprising a trigger circuit adapted so to control a time base valve as to render it conductive to produce a time base, is characterized in that the time base valve has a cathode resistor and a connection from the cathode end of said resistor through a rectifier to said trigger circuit whereby when the voltage drop across the cathode resistor exceeds a predetermined value a voltage is applied to the trigger circuit which terminates the time base and resets the trigger circuit.

Preferably the trigger circuit comprises a cathode-coupled Eccles-Jordan or flip-flop circuit, the time sweep being initiated by an externally applied impulse and the terminating voltage, derived from the time sweep valve, being applied to the cathodes of the flip-flop valves.

In some cases the trigger circuit instead of being actuated by an external impulse to initiate a time base may be self-starting.

In a particular arrangement of the present invention a resistor is inserted in the cathode circuit of a valve so that the voltage across it is a measure of the current flowing through the valve. In the anode circuit are either coils (for a magnetic deflection system) or a resistive load (for an electrostatic deflection system) while the time base is controlled by means of a circuit of the type commonly called a cathode-coupled flip-flop circuit. A diode valve is connected between the cathode of the time base valve and the cathodes of the flip-flop valves in such a way that current flows through it only when the potential of the former cathode is higher than that of the other two.

The term time base valve as employed herein

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includes, for example, a valve connected across a time base capacitor or a valve which itself generates a time base, for example, a Miller time base or it may be the output valve from a time base circuit.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof may best be understood by reference to the following description taken in connection with the single figure of the accompanying drawing in which is shown a diagram of a time base generator according to the invention.

Referring to the drawing, the valves V_1 and V_2 together with capacitor C_2 and grid resistor R_2 and common cathode resistor R_3 constitute a cathode coupled flip-flop. The valve V_3 is the time base valve having time base controlling equipment generally indicated by the resistor B in the anode circuit and a cathode resistor R_4 .

Impulses from the flip-flop circuit are fed through suitable amplifying apparatus generally indicated by rectangle A to the grid of the time sweep valve V_3 . A back connection is made between the cathode end of resistor R_4 and the cathode end of resistor R_3 through diode V_4 whereby voltages developed across the cathode resistor R_4 are applied to the flip-flop circuit.

In the figure the actual time base circuit has been indicated as a capacitor C_3 connected across V_3 , but the actual time base generating circuit may be included in the apparatus indicated by rectangle A in which case the time base valve V_3 with C_3 disconnected would constitute an output valve for the time base circuit.

The action of the circuit is as follows:

Normally valve V_2 conducts, having its grid resistor R_2 connected to the cathode, while V_1 is cut off due to the resultant voltage drop across R_3 . V_3 is non-conducting so that the point P at the cathodes of V_1 and V_2 is at a higher positive potential than Q and therefore V_4 is non-conducting. The flip-flop circuit is tripped in known manner, such as by the application of a negative going pulse to the terminal S . This imparts a negative pulse to the grid of V_2 through C_1 and C_2 , thus reducing the anode current through V_2 and hence the voltage drop in R_3 . V_1 now commences to conduct, so that its anode voltage falls still further and thus, on account of the capacitor C_2 , the grid of valve V_2 is driven still further negative. This effect is cumulative, with

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the result that V_1 now conducts and V_2 does not. This serves to initiate the time base sweep by way of known circuits indicated at A and the valve V_3 , or by way of capacitor C_3 and valve V_3 , so that the current through R_4 increases steadily. When the potential on the cathode of V_3 , at Q, exceeds that at P, V_4 conducts and thus the potential at P also increases. This at once reduces the current through V_1 and causes its anode potential to rise so as to cause V_2 to conduct once more. This still further raises the potential of P and the circuit rapidly resets to its original condition. In this way the time base automatically stops at a pre-selected amplitude (determined by the constants of the circuit in general, but readily adjustable by altering the value of R_4) and resets to its resting or normal condition immediately on the completion of the required sweep.

When employed as the time base generating circuit, A may comprise any of the many well known sawtooth generating circuits which are triggered by the application of a negative going signal to their input to produce a positive going sawtooth wave at their output. The positive going sawtooth when applied to the grid of tube V_3 , now acting as a driver tube with condenser C_3 removed, causes conduction thereof such that a positive going sawtooth wave voltage is developed across R_4 . The point at which tube V_4 conducts depends on the relative voltages developed across resistors R_3 and R_4 as explained above. In the event the tube V_3 , with C_3 now in the circuit, comprises the sawtooth generator, the amplifier A operates to amplify the negative going signal from the plate of V_1 such that a positive going gating signal is applied to the grid of tube V_3 to cause conduction. Tube V_3 normally is non-conducting before application of the gating signal such that the condenser C_3 has charged through B and R_4 to the $B+$ level and hence the plate electrode of tube V_3 is at $B+$ whereas the point Q is at the $B-$ potential. When tube V_3 is caused to conduct by the positive going gate from amplifier A, condenser C_3 bearing the full charge of the $B+$ supply discharges through the plate to cathode electron discharge path of tube V_3 . Due to the finite effective resistance of the triode V_3 , the condenser C_3 discharges in the normal sawtooth fashion with the result that a positive going sawtooth wave is developed across the resistance R_4 . While a particular sawtooth generator circuit comprising V_3 has been shown many other sawtooth generator circuit arrangements may be employed without departing from the scope of this invention.

The apparatus indicated as resistor B may comprise deflecting coils in the case of a magnetically controlled cathode ray tube or the resistive load B may be provided where the deflection is electrostatic, with the deflecting plates connected to the terminals at opposite ends of the resistor B.

While I have shown only certain preferred embodiments of my invention by way of illustration, many modifications will occur to those skilled in the art and I therefore wish to have it understood that I intend, in the appended claims, to cover all such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A time base wave generator comprising a pair of electron discharge valves, each with an anode, a cathode and a control electrode, a common cathode impedance for said valves whereby

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conduction of either of said valve tends to bias the other of said valves to a non-conductive condition, means for biasing a first one of said valves to be normally conductive, the second valve being normally biased to a non-conductive condition by the potential produced in said impedance due to conduction of said first valve, an anode impedance for the second of said valves, means for coupling the anode of said second valve to the control electrode of said first valve, whereby the normal conditions of said respective valves may be reversed by a synchronizing signal applied to one of the electrodes of one of said valves, time base generating means coupled to one of said valves to receive a triggering signal therefrom upon said reversal, said last means being operable when triggered to produce an increasing positive potential, and one way conductive means for applying said positive potential to said cathodes when said positive potential exceeds the potential of said cathodes as produced in said impedance whereby said valves are returned to their respective normal conditions.

2. A time base sweep generator comprising a cathode coupled flip-flop circuit with two operative conditions, sweep signal generating means including a time constant circuit and an electron discharge device, said device being connected to receive a sweep signal initiating signal upon a change from a first to a second condition of said flip-flop circuit and a sweep signal terminating signal upon a change from said second to said first condition, said sweep signal generating means comprising a resistor in series with the cathode of said device for providing energy at an increasing positive potential during generation of said sweep signal, said flip-flop circuit comprising biasing means responsive to current flow in said flip-flop circuit during generation of said sweep signal for maintaining said flip-flop circuit in said second condition, and means for furnishing said energy to the coupled cathodes of said flip-flop circuit to overcome said biasing means and actuate said flip-flop circuit into its first condition.

3. A time base sweep generator comprising a trigger circuit with two operative conditions, said circuit providing a signal in response to a change from one to the other of said conditions, a time base generator comprising an electron discharge device and a time constant circuit for said device, said device comprising a resistor in series with the cathode of said device, said electron discharge device and time constant circuit being responsive to said signal to initiate generation of a sweep voltage across said resistor, one way conductive means interposed between said cathode and said trigger circuit, means for maintaining said one way conductive means non-conductive comprising means for generating a biasing voltage in said trigger circuit during operation thereof in said other condition, said one way conductive means being responsive to a predetermined amplitude of said sweep voltage developed across said resistor for overcoming said biasing voltage for actuating said trigger circuit into said one condition.

4. An arrangement comprising a trigger circuit having two stable operating conditions, means for actuating said trigger circuit into its second stable condition, said circuit comprising a load impedance having a biasing voltage developed thereacross for maintaining said second stable condition, a time base generator responsive to actuation of said circuit into its second

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condition for generating a time base wave of increasing amplitude, a unidirectional coupling element coupled between the output of said time base generator and said load impedance, said element being normally inoperative due to the voltage difference existing between said impedance and said time base generator output, said element being responsive to said time base generator output rising above a given level for overcoming said biasing voltage to return said trigger circuit to its first condition, said time base generator being responsive to the return of said circuit to its first condition for halting the producing of said time base wave.

5. An arrangement according to claim 3 wherein said trigger circuit comprises a flip-flop multivibrator, said load impedance comprising the common unbypassed cathode load resistance of said multivibrator, said time base generator comprising a cathode follower output circuit, said cathode follower circuit comprising a cathode load and a plate load resistor, a condenser connected between said resistors, and said time base generator output being developed across said cathode load resistor.

6. An arrangement according to claim 3 wherein said time base generator comprises a cathode follower circuit having an input circuit, a cathode load and a plate load output circuit, a time constant circuit coupled to said cathode follower circuit to produce a time base voltage across each of said output circuits, means for applying the output of said multivibrator to said input circuit, means for coupling said unidirectional element across said cathode load output circuit.

7. An arrangement comprising a trigger circuit having two stable operating conditions, means for actuating said trigger circuit into its second stable condition, said circuit comprising a load impedance having a biasing voltage developed thereacross for maintaining said second stable condition, a time base generator responsive to actuation of said circuit into its second condition for generating a time base wave of increasing amplitude, a unidirectional coupling element coupled between the output of said time base generator and said load impedance, said element being normally inoperative due to the voltage difference existing between said imped-

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ance and said time base output, said element being responsive to said time base output rising above a given level for overcoming said biasing voltage to return said trigger circuit to its first condition, said time base generator being responsive to the return of said circuit to its first condition for halting the producing of said time base wave, said time base generator comprising a cathode follower circuit having an input circuit, a cathode load and a plate load output circuit, a time constant circuit coupled to said cathode follower circuit to produce a time base voltage across each of said output circuits, means for applying the output of said multivibrator to said input circuit, means for coupling said unidirectional element across said cathode load output circuit and a time base utilization circuit coupled across said plate load output circuit.

8. A time base generator comprising a trigger circuit with two operative conditions, a time base sweep generator triggered by said circuit in one of said conditions and comprising an electron discharge device with a cathode, means for causing an increasing current to flow in said device in response to said triggering thereof, a resistor connected to said cathode and responsive to said current flow for developing a positive voltage on said cathode, biasing means in said circuit responsive to current flow therein corresponding to operation in said one condition for normally biasing said circuit to remain in said one condition, and one way conductive means for supplying the positive voltage developed by said resistor to said biasing means to overcome said biasing and actuate said circuit into said other condition.

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