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IMPULSE GENERATOR

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FIG. 1

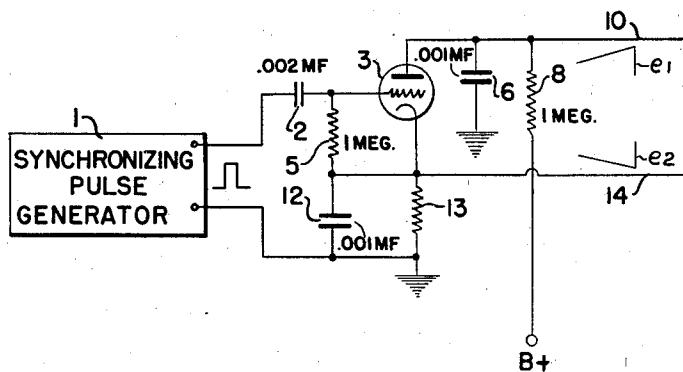
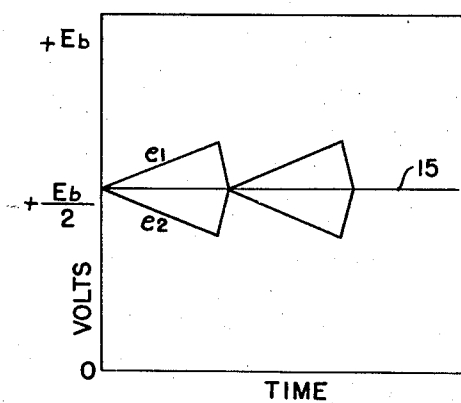


FIG. 2



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IMPULSE GENERATOR

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4 Claims. (Cl. 250-27)

This invention relates generally to scanning circuits for controlling the deflection of an electron beam in cathode ray tubes such as are used in television, and more particularly to circuits for generating or developing voltages of saw-tooth wave form of the type which are controlled by synchronizing pulses of square top wave form.

It is frequently desirable in television systems to utilize push-pull modulation circuits particularly in scanning control circuits wherein it is desired to introduce control voltages for altering the scanning voltage to correct for Keystone distortion in iconoscope tubes or other cathode ray tubes. It is necessary in modulators of this type to eliminate higher order distortion which occurs as a result of modulating a line scanning frequency voltage by the field-scanning frequency voltage. While it is comparatively simple to eliminate the fundamental field frequency component in the modulated scanning voltage, it is more difficult to eliminate the higher order field frequency components. It is possible to improve the performance of the modulator, and thereby facilitate elimination of distortion by supplying a balanced input to the push-pull modulator thereby obtaining a more nearly balanced output in the modulator.

Push-pull modulation is also desirable in scanning circuits designed to supply a balanced scanning voltage to the deflector plates of a cathode ray tube, because of the fact that various electrodes of such tubes must be balanced with respect to ground in order to eliminate distortion and disturbances originating within such tubes. However, nothing is gained, for instance, by balancing the deflection plates to ground unless the signals supplied thereto are also balanced to ground.

Accordingly, the primary object of this invention is to provide a novel circuit for generating saw-tooth voltage waves of the type required in the input of a balanced push-pull amplifier or modulator circuit.

It is also an object of this invention to provide a circuit for generating separate voltages of saw-tooth wave form, equal in amplitude but of opposite polarities.

The invention comprises a novel saw-tooth wave generating circuit, including a first time-constant circuit consisting of capacitance and resistance elements together with a second substantially identical time-constant circuit and a source of potential for charging the condensers. The first time-constant circuit is in the plate circuit of a thermionic discharge device and the second time-constant circuit is in the cathode circuit of the same device. The capacitance element of the first time-constant circuit becomes gradually charged while at the same time the

sapacitance element of the second time-constant circuit is gradually discharged, thus forming a pair of gradually sloping voltage waves, one increasing and the other decreasing. Synchronizing impulses or other recurrent impulses are fed into the input of the thermionic discharge device and each synchronizing impulse overcomes the normal grid bias therein to render the thermionic discharge device periodically conductive, whereby the capacitance element in the first discharge circuit is suddenly discharged and the capacitance element in the second discharge circuit is suddenly charged. Thus, there appears across the resistance element in each time-constant circuit a train of saw-tooth voltage waves of equal amplitude but of opposite polarity or phase.

For a better understanding of the present invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

In the accompanying drawing, Fig. 1 is a circuit diagram illustrating the invention, while Fig. 2 is a graph illustrating the wave forms of the output of the circuit shown in Fig. 1.

Referring to the drawing, Fig. 1 thereof illustrates a circuit for generating saw-tooth waves of the type described heretofore. The block 1, labeled "synchronizing pulse generator," may be any conventional form of pulse generator such as, for example, one of the type used in television systems designed to generate pulses having square topped wave form, as illustrated in Fig. 1. If it is desired to produce 30 frames per second and a 525 line picture, the pulse generator 1 would be designed to generate a frequency of the order of 15,750 cycles per second.

The output of pulse generator 1 is coupled through a condenser 2 to the grid of a thermionic discharge device or vacuum tube 3. A grid leak resistor 5 is connected between the grid and cathode of the tube 3. The anode circuit of tube 3 includes a first time-constant circuit comprising a condenser 6 connected between the anode of tube 3 and ground, together with a resistor 8 connected to a source of plate supply labeled B+. The anode output voltage developed across the resistor 8 may be applied through conductor 10 to whatever circuit may be desired, such as a modulator or amplifier.

A second time-constant circuit is connected between the cathode of tube 3 and ground, and consists of a condenser 12 connected in parallel with a resistor 13. The cathode circuit is also connected to a conductor 14 whereby the voltage developed across the resistor 13 may be applied to the same circuit as that appearing in conductor 10.

In operation, the output of the synchronizing pulse generator which consists of a series of square top impulses, such as that illustrated in Fig. 1 which may, for example, have a frequency of the order of 15,750 cycles is impressed on the grid of tube 3 through coupling condenser 2 to overcome the normal bias which appears across grid resistor 5. Thus, tube 3 becomes conductive periodically, according to the frequency of the synchronizing pulse.

Referring to Fig. 2 of the drawing, it will be seen that at zero time, or the initiation of a cycle, the saw-tooth wave voltages e_1 and e_2 begin to build up across resistors 8 and 13 neglecting the drop in tube 3 of Fig. 1. This is true because of the fact that the time-constant circuits 6, 8, 12 and 13 respectively are connected in series across the anode supply. More particularly, and again referring to Fig. 2, it will be noted that datum line 15 is drawn to indicate an average or predetermined level of the saw-tooth wave and this will, therefore, be assumed as the zero voltage of the saw-tooth. If it be assumed that condenser 6 has just discharged, it will subsequently charge at a gradual rate from the plate supply through resistor 8, and the voltage across resistor 8 will gradually increase as shown by the slope of e_1 in Fig. 2. At the same time the voltage across condenser 12 will be gradually decreased as its charge leaks away through resistor 13, and therefore, the voltage across resistor 13 will have a slope as indicated by e_2 in Fig. 2. The condensers 6 and 12 will continue, respectively, to charge and discharge until such time as a synchronizing impulse from source 1 changes the bias on the grid of tube 3 to render it conductive. At this time condenser 6 is rapidly discharged to the voltage represented by the datum line 15 and condenser 12 is rapidly charged to the same voltage. The synchronizing pulse from source 1 being of short duration, tube 3 becomes immediately non-conductive so that the charging and discharging of condensers 6 and 12 are repeated at a rate determined by the frequency of the synchronizing impulses.

Since the time-constant circuits 6, 8, 12 and 13 are identical, and since they are simultaneously charged and discharged by tube 3, a train of saw-tooth voltage waves is impressed on each of the conductors 10 and 14, these waves being of exactly the same duration, and of exactly the same amplitude but opposite in phase polarity. Hence this invention provides a circuit particularly well adapted for generating signals identical in wave form but opposite in phase. Such signals are ideal as input signals in push-pull or balanced modulator circuits.

It is not desired that this invention shall be limited to the exact circuit elements illustrated in the drawing or to use with synchronizing impulses of the exact form and frequency illustrated in the drawing. As this circuit is useful, as pointed out heretofore, in any connection where a pair of equal and opposed saw-tooth voltage waves are desirable, the values of the resistors and condensers have been noted, by way of example only, for the purpose of illustrating a workable form of the invention. It will be obvious to those skilled in the art that these values are determined by the frequency and amplitude of the waves which may be required in the particular work circuit in which the invention is used.

While there has been described what is at present considered the preferred embodiment of the

invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A circuit for producing equal and opposite saw-tooth voltages comprising a thermionic discharge tube, a time-constant circuit including resistance and capacitance elements connected to the anode circuit of said discharge tube, a second time-constant circuit including resistance and capacitance elements having the same constants as the said first time-constant circuit and connected in the cathode circuit of said discharge tube, a source of synchronizing impulses connected to the control electrode of said tube for periodically rendering it conductive and means for energizing the anode and cathode circuit of said tube whereby when said tube is conductive the capacitance element in said first time-constant circuit is discharged to form a saw-tooth voltage and the capacitance element in said second time-constant circuit is simultaneously charged to form a second saw-tooth voltage equal and opposite to the first saw-tooth voltage.

2. A circuit for producing equal and opposite saw-tooth voltages comprising a thermionic discharge tube, a storage circuit connected in the anode circuit of said discharge tube for forming a voltage wave of substantially linearly increasing amplitude, a second identical storage circuit connected in the cathode circuit of said discharge tube for simultaneously forming a voltage wave of substantially linearly decreasing amplitude, a source of synchronizing impulses connected to the control electrode of said discharge tube for periodically rendering said tube conductive and means for energizing the anode and cathode circuit of said tube whereby to decrease the potential across said first storage circuit and to simultaneously increase the potential across said second storage circuit when said tube is conductive.

3. A circuit for producing equal and opposite saw-tooth voltages comprising a thermionic discharge tube, means coupled with said tube for establishing a predetermined voltage, means connected in the anode circuit of said discharge tube for forming a voltage wave increasing from said voltage, a second means connected in the cathode circuit of said discharge tube for forming a voltage wave decreasing from said voltage, a source of synchronizing impulses connected to the control electrode of said discharge tube for periodically rendering said tube conductive and means for energizing the anode and cathode circuit of said tube whereby said first voltage is sharply decreased to said predetermined voltage and said second voltage is sharply increased to said predetermined voltage when said tube is conductive.

4. A method of producing equal and opposite saw-tooth voltages comprising the steps of charging a first storage device over a certain period of time, discharging a second storage device over the same period of time and utilizing a synchronizing impulse to simultaneously and substantially instantaneously discharge said first storage device and charge said second storage device whereby the voltages across said storage devices are substantially equal in magnitude and opposite in polarity.

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