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2,084,157

GENERATOR

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Fig. 1.

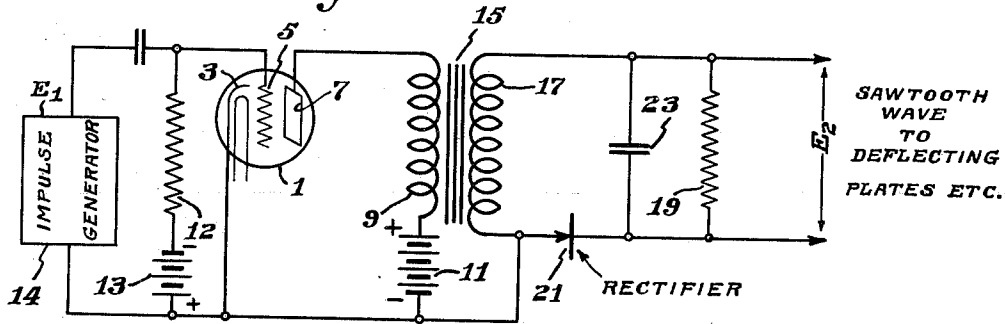


Fig. 2.

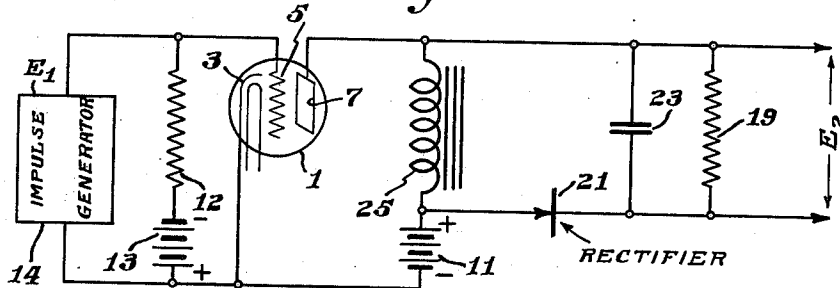
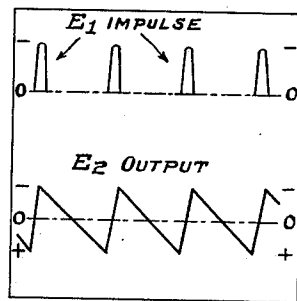


Fig. 3.



VOLTAGE WAVES
IN CIRCUIT

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2,084,157

GENERATOR

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4 Claims. (Cl. 250—36)

My invention relates to electric wave generators and it has particular relation to generators of types useful in television transmitting and receiving systems.

In television transmitting systems regularly recurring non-sinusoidal waves are utilized for a number of purposes. For example, they may be impressed as a synchronizing frequency upon a carrier wave or they may be utilized to deflect a cathode ray in a transmitting tube both horizontally and vertically.

In television receivers, waves of the type referred to are utilized for the purpose of periodically deflecting the electron-stream in a receiving tube of the cathode-ray type and they may also be useful for other purposes such as providing a time-axis in an oscilloscope.

By reason of the fact that the current-time graph of a train of waves of the type under discussion resembles the edge of a saw, such waves are generally referred to as "saw-tooth" and this nomenclature will hereinafter be used for simplicity. The phrase, "saw-tooth", is equally as well applicable to the potential-time graph of the wave-train and it is to be understood that when I refer to a saw-tooth wave either a current or a voltage wave is intended.

Heretofore, numerous devices have been proposed for generating saw-tooth waves as, for example, relaxation oscillators. Insofar as I am aware, however, the peak voltage obtainable in previously used systems has not been greater than the potential of some fixed potential supply system. Obviously, with such systems, if saw-tooth waves having a high maximum potential are necessary, a correspondingly high potential source must be utilized which, in general, is bulky and expensive.

It is, accordingly, an object of my invention to provide a generator that shall be capable of delivering a saw-tooth wave having a maximum potential higher than the potential of a given potential source which is utilized to energize the generator.

In accordance with my invention I make use of the fact that a high potential is developed across an inductor through which current is flowing at the instant when the current is interrupted. Specifically, I connect an inductor in series with a potential source and, periodically, through application of a suitable negative potential impulse to the grid of the device, I cause the said device to abruptly become non-conductive with the result that a high potential is developed across the inductor in such direction as to tend to keep the current flowing therethrough in the same direction. This abrupt rise in potential is utilized to abruptly charge a capacitor through a rectifier. Between impulses the condenser, previous-

ly charged to substantially the peak potential appearing across the inductor, discharges relatively slowly through a shunt resistor. This operation, repeated, gives rise to recurrent potential variations across the resistor which have the desired wave shape.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment, when read in connection with the accompanying drawing, in which:

Figure 1 is a diagrammatic view of a saw-tooth wave generator including a preferred embodiment of my invention;

Fig. 2 is a diagrammatic view of a modified form of generator; and

Fig. 3 is a graphic representation of the relation between the input or trigger impulses applied to the generator and the output voltage wave therefrom.

In Figures 1 and 2 of the drawing, equivalent elements are similarly designated.

Referring now to the drawing, a preferred embodiment of my invention includes a thermionic tube 1 which, for purpose of explanation, has been illustrated as being of the equi-potential cathode type having a cathode 3, a control grid 5, and an anode 7. In some instances I find it desirable to use a pentode. The tube is provided with an output circuit including an output inductor 9 and any convenient source of uni-directional current exemplified in the drawing by a battery 11. The tube 1 is provided with a grid leak 12 and it is normally so biased by a battery 13 or the like that the space current is high in the absence of negative trigger-impulses on its grid. These impulses may be derived from any suitable source 14, and they are such as to periodically abruptly bias the grid to a high negative potential E_1 as indicated in Fig. 3 of the drawing.

In the operation of the generator, at each instant when the trigger impulses are applied to the grid of the tube, the space current therein is abruptly stopped. This stoppage of current in the inductor causes an abrupt rise in potential thereacross in such direction as to tend to keep the current flowing therein.

I take advantage of this phenomenon by utilizing the output inductor 9 as the primary winding of a transformer 15, the secondary winding 17 of which is connected in series with a resistor 19 and a rectifier 21. A capacitor 23 is connected in shunt to the resistor 19, which capacitor, at the instant the current is broken in the primary winding of the transformer, begins to acquire a charge through the rectifier and almost imme-

diately charges up to a peak potential of the order of the potential appearing across the secondary winding. The rate of charging and the peak voltage of the charge are exemplified by the steep portions of the output wave graph in Fig. 3.

The condenser discharges through the resistor 19 at a relatively slow rate compared to the charging rate, since it is prevented from discharging back through the secondary winding by reason of the uni-directional conductivity of the rectifier. The voltage appearing across the resistor, if plotted against time, may be represented by the output graph in Fig. 3.

In the modified generator exemplified by Fig. 2 of the drawing, I dispense with the secondary winding and use instead a single choke coil 25, the terminals of which are connected to the output rectifier circuit in the same manner as are connected the terminals of the secondary winding shown in Fig. 1. The operation of the modified generator in no wise differs from that of the generator first described, except that the potentials available across the output resistor may not be so high.

In order that my disclosure may be complete I am giving below a list of the various circuit components in a satisfactory saw-tooth generating system.

Frequency of impulse generator,		
	cycles...	2,000-4,000
Peak impulse of generator 14	volts...	—80
C battery 13	volts...	—10
Thermionic tube 1	pentode...	2A5
(Space charge grid and screen grid omitted from drawing)		
Grid leak 12	megohm...	$\frac{1}{2}$
Output transformer primary inductance	henry...	1
Output transformer resistance, each winding	ohms...	100-200
Potential of battery 11	volts...	250
Rectifier device 21	radiotron...	227 or 56
Capacitor 23	mfd...	.001
Output resistor 19	megohm...	$\frac{1}{2}$
Peak to peak a-c output potential obtained	volts...	500
(Higher at lower impulse frequencies)		

It will be apparent from the foregoing that I have, by my invention, provided a very simple and inexpensive saw-tooth wave generator through the use of which peak potentials considerably higher than those of the primary potential source are made available.

Numerous modifications of my invention will be apparent and need not be illustrated.

Although I have chosen several specific embodiments of my invention for purposes of explanation, it is not my intention to be restricted thereto. My invention, therefore, is not to be limited except insofar as is necessitated by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. In a saw-tooth wave generator, a circuit network including an inductor, a rectifier and a capacitor in series, a resistor connected in shunt relation to the capacitor and means for periodically causing an abruptly changing potential to appear across the inductor, said capacitor and said resistor having relative values such that substantially the entire voltage appearing across said resistor has a saw-tooth wave form.

2. In a saw-tooth wave generator, an inductor, means for causing a current to flow in the inductor, means for periodically and abruptly interrupting the current flow to thereby develop a high potential across the inductor, said second means including an electric discharge tube having an input circuit across which is connected an impulse generator and having an output circuit in which said inductor is included, a capacitor, means for utilizing the high potential to apply a charge to the capacitor, and means for causing the charge to leak off at a relatively slow rate whereby a saw-tooth wave appears across said capacitor.

3. The invention set forth in claim 2 additionally characterized in that said third means includes a rectifier in series with said capacitor.

4. The invention set forth in claim 2 additionally characterized in that said third means includes a rectifier in series with said capacitor and in that said last means is a resistor connected in shunt relation to said capacitor.

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