

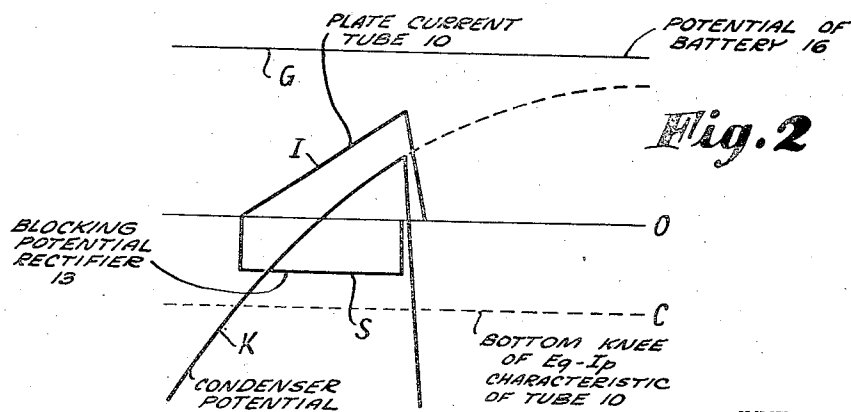
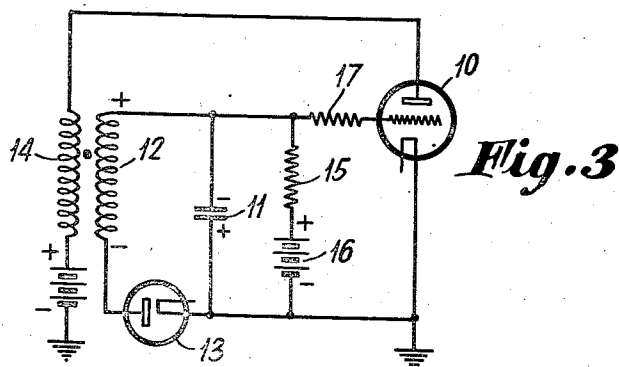
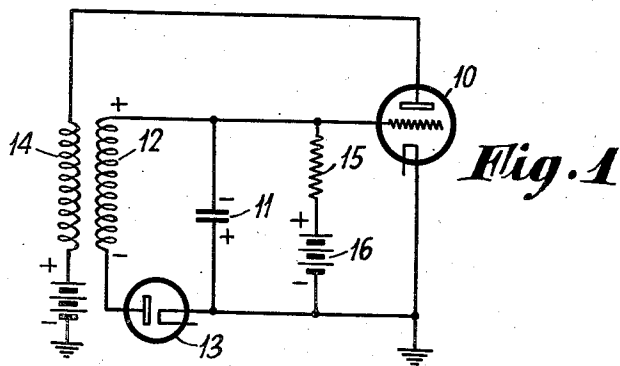
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SAW-TOOTH WAVE GENERATOR

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SAW-TOOTH WAVE GENERATOR

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A saw-tooth generator has been disclosed in the prior art comprising a parallel resonance circuit in the grid circuit of a controlled tube, the inductance branch of the said resonance circuit comprising a rectifier, with voltage feedback being established between the plate circuit of the said controlled tube and its grid circuit. According to this suggested arrangement, the deflector coil of a cathode-ray tube is connected between the filament and the plate of the controlled tube by capacitive means.

The present invention has as its object to connect, in saw-tooth wave or time-base generators predicated upon the same principle as the said organization disclosed in the earlier art, a resistance in series with the control grid of the tube, in a way as shall hereinafter be described in more detail, with the result that the chances of disturbing actions arising in the circuit organization are greatly diminished.

To more fully and clearly explain the invention, the layout and the operation of a circuit arrangement without the said resistance shall first be discussed.

My invention will best be understood by reference to the drawing in which

Fig. 1 is an example of the prior art,

Fig. 2 is an explanatory curve, and

Fig. 3 is an embodiment of my invention.

Referring to Fig. 1, there is shown an embodiment of the prior art. A thermionic vacuum tube 10, which in this instance is illustrated as a triode, has connected to the control grid thereof three parallel circuits which are shunted across the control grid-cathode path of the tube. The first comprises a resistor 15 and a source of positive biasing potential 16 connected serially each to the other. A condenser 11 is connected in shunt with the resistor 15 in the source of biasing potential 16, and the third shunt circuit is a coupling coil 12 connected serially with a rectifier 13. The anode circuit of the tube is connected serially with a coil 14 which is inductively coupled with the coil 12, and the circuit is completed through a source of energizing potential indicated, the negative side of the source of potential being connected to the cathode of the tube.

To more clearly explain the operation of an organization as illustrated in Fig. 1, the assumption shall be made that at the condenser 11 prevails a strong charge with the terminal thereof directly connected to the coil 12 being negative. The said charge shall be supposed to be so high that the tube as a result is biased to

a point below the bottom knee of its plate current grid voltage characteristic. The coil 14 in the plate circuit of tube 10 as a result carries no current, and hence, no potential exists across the coil 12. The rectifier 13 is subject to voltage action in its backward sense. The condenser 11 is then charged through the resistance 15 from the D. C. voltage source 16, the potential at the upper condenser coat being such as indicated by curve K in Fig. 2. Over the zero line 0 which corresponds to the filament potential of tube 10 there is plotted in Fig. 2 the potential of the D. C. voltage source 16 indicated by the straight line G in addition to the potential at the upper condenser coat. Graph K obeys an e function, with the straight line G being the asymptote. When the curve K intersects the dotted (dash) line C which corresponds to the bottom knee of the plate current-grid voltage characteristic of tube 10, a rise of current is initiated in the plate circuit of this tube which is indicated by I in Fig. 2. To this rising current in the winding 14 corresponds a constant voltage across the coil 12, the latter to have by assumption a polarity such that the terminal thereof connected directly to condenser 11 has a positive polarity. This last-mentioned potential is designated by S, in Fig. 2. It is also a blocking potential for the rectifier 13. When graph K crosses the zero line, the potential at condenser 11 is reversed, with the result that the condenser voltage now has a sign so that the rectifier 13 is acted upon in its forward direction. The voltage at the condenser 11 must then rise to a level which lies above the voltage to occasion incipient current flow in the rectifier 13. However, as the rectifier 13 conducts current again, the voltage at the condenser 11 diminishes again because of the discharge through the rectifier, and simultaneously with the decline of the plate current of tube 10 a voltage reversal will happen across the coil 12. Incidentally, the magnetic energy of the coil 14 will be discharged through the rectifier 13 and re-appears in the form of an electric charge at the condenser 11 of a polarity such that the terminal thereof directly connected to the inductance coil 12 has a negative polarity.

Under practical operating conditions, the process as hereinbefore outlined is not exactly as described on the ground that a grid current begins to flow in the tube 10 as soon as the curve K intersects with the zero line 0 and because thus the slope of the voltage rise at the condenser 11 experiences a change. At the same time there occurs also an alteration of the voltage across

the coil 12, that is, in a sense so that the polarity thereof is such that the terminal connected directly to the condenser 11 has a positive polarity, while the size thereof diminishes. The instant of incipient current flow in rectifier 13, as will be seen, is governed by the instant at which the line exhibiting a flatter rise than curve K, Fig. 2, has assumed a greater amplitude than the reduced voltage across the coil 12. This flat intersection of the curve which represents the potential actually prevailing at the upper condenser coat across the horizontal line which corresponds to the altered potential at the coil 12 is attended with a serious uncertainty of the time of initiation of the short stroke of the saw-tooth wave. For one has to figure with the chance that a certain noise or disturbing (stray) voltage level prevails at the control grid of the tube 10, which has this consequence that the incipency of the saw-tooth return or flyback stroke, comparatively speaking, may happen far earlier or later, according to the noise voltage level.

Hence, it is here suggested to insert a resistance 17 in series with the control grid of the tube 10 as shown in Fig. 3. The result and action of the said resistance is two-fold, namely, the curve K after crossing the zero line 0 will continue to rise with practically unvaried slope or rate. Moreover, the grid potential of the tube 10 because of incipient grid current flow, will now stay practically constant and stable. As a consequence, however, the voltage across the coil 12 disappears, so that, as soon as the condenser has assumed a small charge of such polarity that the terminal thereof connected directly to the inductance coil 12 has a positive polarity, the rectifier 13 is rendered conducting so that the return stroke is caused to commence. As will be noticed, the noise level will then have far less chance to cause a shift in the time of initiation of the saw-tooth return stroke inasmuch as the curve K and the graph giving the potential shape as a function of the time at the coil 12 no longer intersect at a comparatively sharp angle.

Referring to Fig. 3, there is shown an embodiment of my invention in which similar reference numerals refer to similar parts as explained hereinbefore with respect to Fig. 1. In this case, the cathode of tube 10 is grounded and the anode of tube 10 is connected to ground through a coupling coil 14 and a source of energizing potential indicated, the negative terminal of the source of energizing potential being grounded. The control grid is connected serially to a resistor 17, the terminal of the resistor 17 remote from the termination thereof connected to the control grid of tube 10 being electrically connected to the cathode of the tube through the three parallel circuits referred to in regard to Fig. 1. These circuits comprise a serially connected resistor 15 and source of energizing potential 16, condenser 11 connected in shunt with said resistor and source of energizing potential, and a series circuit comprising coil 12 which is inductively coupled to coil 14 and rectifier 13 connected in series therewith, the combination of the inductance 12 and the rectifier 13

being connected in shunt with condenser 11 and resistor 15 and source of potential 16.

In an arrangement of circuits according to the invention a saw-tooth voltage wave is obtained at the condenser 11, while moreover, if desired, a saw-tooth current wave may be obtained from the plate circuit of tube 10, that is, when the bottom point of curve K is made to coincide with the incipient flow of plate current of tube 10. The coil 14 may be used directly as the deflector coil in a cathode-ray tube.

It is, moreover, readily feasible to synchronize a saw-tooth wave generator according to the invention by impulses. These impulses, to the said end in view, must be made to act upon the plate current of tube 10 in a sense to cause a reduction thereof, and this is accomplishable, for instance, by a further control grid of tube 10. For television purposes, therefore, a saw-tooth wave generator according to the present disclosure may be readily controlled with line or line-series impulses.

It is also to be emphasized that the invention is useful not only with generators for which potential feedback is effected by a transformer, but that the invention is useful also with saw-tooth wave generators comprising any desired regeneration scheme which furnishes a potential of suitable phase such as is insured, for instance, by a reversing tube or a device presenting negative slope.

What is claimed is:

1. A saw-tooth wave generator comprising a thermionic vacuum tube comprising anode, cathode and at least one control electrode, a parallel resonant circuit comprising an inductance and a condenser connected in the control electrode-cathode path of said tube, a uni-directional conductor connected serially with said inductance and condenser comprising the parallel resonant circuit, a series circuit comprising a resistor and a source of potential connected substantially in shunt with said parallel resonant circuit, resistive means connected to said control electrode and connected serially to said parallel resonant circuit, means for feeding back a portion of the anode-cathode circuit energy to said parallel resonant circuit.

2. A saw-tooth wave generator comprising a thermionic vacuum tube having anode, cathode and at least one control electrode, a first inductive member, a uni-directional conductor, condenser means, said first inductive member and said uni-directional conducting means being serially connected each with the other and connected in parallel with said condenser means, a source of fixed potential, an impedance means, said source of fixed potential and said impedance means being serially connected each with the other and connected in shunt with said condenser means, said condenser means being connected in the control electrode-cathode circuit of said thermionic tube, impedance means connected serially with said control electrode and said condenser means, and a second inductive member coupled to said first inductive member and connected in the anode-cathode path of said thermionic tube.

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