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SAW-TOOTHED WAVE FORM GENERATOR

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Fig. 1

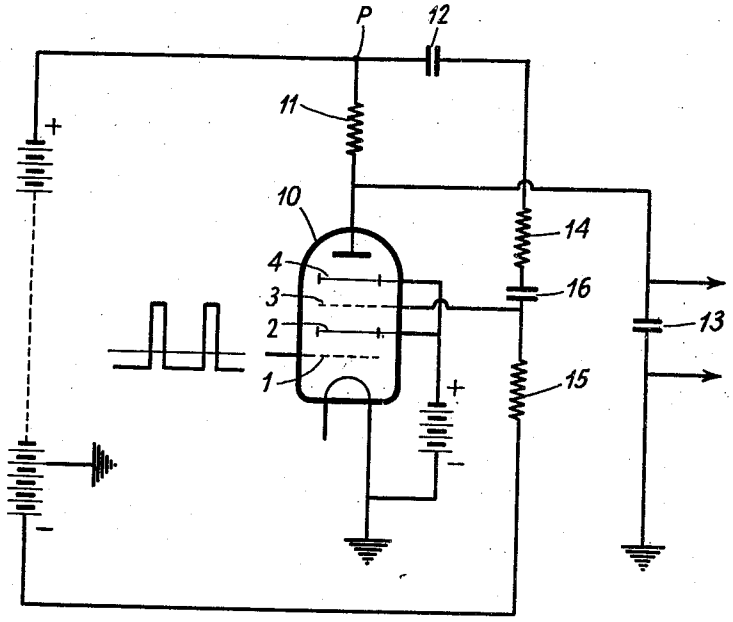
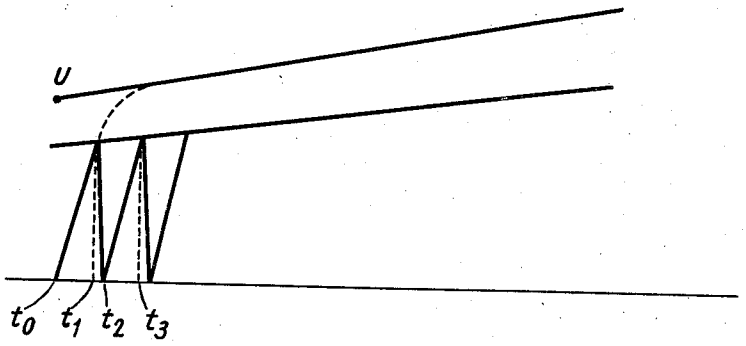


Fig. 2



INVENTORS
RUDOLF URTEL
ROBERT ANDRIEU
BY H. B. Grover
ATTORNEY

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SAW-TOOTHED WAVE FORM GENERATOR

Rudolf Urtel and Robert Andrieu, Berlin, Germany, assignors to Telefunken Gesellschaft für Drahtlose Telegraphie m. b. H., Berlin, Germany, a corporation of Germany

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5 Claims. (Cl. 250—36)

The invention relates to a circuit arrangement for producing saw-tooth shaped voltage curves for trapezoidal scanning and the trapezoidal composition of television images. It is possible to produce a line deviation having a variable position in the course of the duration of a line series, by connecting an amplifier tube having a condenser placed in parallel thereto to a plate voltage source across a resistor, said source not only furnishing a constant voltage, but, in addition, a saw-tooth shaped voltage having the frequency of the line series alternation. The definition of the line series alternation will be employed in the following description with respect to the line skip method. Where a transmission other than that according to this method is considered, the definition of the line series alternation is identical with the picture alternation. From the constant voltage source the condenser is at first charged across the said resistor with constant current within each line duration, and the amplifier tube following the termination of each line duration is rendered permeable to current, so that the condenser charge disappears across the tube. This circuit arrangement has the further advantage that the produced sequence of saw-tooth shaped line voltages receives an additional saw-tooth shaped component having the frequency of the line series alternation, since the amplifier tube cannot completely discharge the condenser within each line pause. Therefore, it is necessary at any rate to provide means by which only the desired number of saw-teeth of the line growing within a duration of the line series will be obtained.

The invention relates to a circuit arrangement by which the desired number of saw-teeth of the line can be produced directly without superimposing a component having the frequency of the line series. To this end, according to the invention, a multi-grid tube is used as amplifier tube, and a current-free grid of this tube is fed with a voltage which is in equal phase with the saw-tooth shaped component of the condenser charging voltage, and having line series frequency.

An embodiment of the invention is schematically illustrated in Figure 1 of the drawing. Fig. 2 is an explanatory curve.

10 designates a hexode whose grid 1 which blocks the current passage during the line duration, has positive pulses applied thereto during the line pause. Grid 2 just as grid 4 has a positive potential relative to the cathode. 11 is a resistor placed between the positive pole of a direct voltage source, and the anode of the tube, and 12 designates a blocking condenser across which a saw-tooth shaped voltage having line series frequency is applied. There is connected in parallel to the hexode, a condenser 13, which is charged across the resistor 11, and discharged across the tube 10. The grid 3 of the tube is connected to a voltage divider consisting of resistors 14 and 15, and which may contain a blocking condenser 16.

In its details the circuit arrangement, according to Figure 1, operates in the following manner. The voltage effective at point P charges the condenser 13 across resistor 11 as long as the tube 10 is blocked, whereby the course of the condenser voltage follows approximately an e-function such as shown in Figure 2. It is assumed that the condenser may at first have zero charge, and that the charging begins at the time zero.

The charge at the condenser then increases at first in a linear fashion, approaching later asymptotically the voltage U active at point P, and composed of a direct voltage and a saw-tooth voltage having line series frequency. The increase in the voltage at the condenser corresponds to an e-function when assuming the voltage at point P to be constant within the duration of the line. Since, however, this voltage is variable within the duration of the line although only in a small degree, the voltage course at the condenser deviates slightly from an e-function. Notwithstanding this fact, the first part of the voltage increase at the condenser remains practically linear. During the line pause a positive potential is applied to grid 1 of the hexode, thus rendering the tube permeable to current, at a moment t_1 up to which there still exists a practically linear voltage increase at the condenser. The condenser whose voltage has the direction indicated by the plus and minus signs, will then be discharged across the tube to a value and with a current determined by the voltage at grid 3 which is tapped from the voltage divider 14, 15. This voltage at grid 3 becomes the more positive, the higher the incidental value of the saw-tooth voltage having line series frequency. Therefore also the charge at the condenser decreases the more during the pause between lines, the more positive grid 3.

In Figure 2, the voltage course at condenser 13 during the line pause (t_1t_2) is shown as straight line, but actually also this voltage course is an e-function in the sense above explained, but which can be considered linear during the line interval with sufficient accuracy. At the

time t_2, the current passage through tube **10** is again blocked, so that a new discharge of the condenser **13** takes place, but which leads to a higher condenser voltage within the duration of the line, since now owing to the increased component of the line series saw-tooth, the charging voltage of the condenser is higher. The discharge current of the condenser which begins at the time t_3 is likewise larger than that in the moment t_1t_2 in view of the voltage at grid **3** being higher than in the moment t_1. Consequently, within the line interval, the condenser will be discharged down to a lower voltage than the voltage reached at the time t_2. In the moment t_3 the current passage through the tube **10** will again be blocked, and thus a new charge of the condenser initiated and so forth. The maximum value of the condenser voltage at each new charge is therefore higher within each line series, than at the preceding charge within the same line series, and the minimum value of the condenser voltage following each discharge is lower than at the termination of the preceding discharge. Thus at condenser **13** there appears a sequence of line saw-teeth with increasing amplitude without superimposition of a component having line series frequency, such as is the case when using an ordinary amplifier tube for the discharge of the condenser.

It is especially notable that it is possible to eliminate the saw-tooth component having line series frequency without power being required. The grid **3** of the hexode has no current and is to be considered as current free in the same sense as for instance a negatively biased control grid of an ordinary triode. In the same way the voltage divider **14**, **15** likewise does not require direct current from the plate current source if a block condenser **16** is inserted in the voltage divider circuit as shown in Figure 1. As indicated in this figure, in place of the block condenser **16** the condenser **12** may also be provided.

We claim:

1. A circuit for producing a current and voltage of modulated sawtooth wave form comprising a vacuum tube having a cathode, a first control grid, a second control grid and an anode, a condenser connected in the cathode anode circuit of said tube, a source of potential connected to said anode, a resistance connected to said source of positive potential, said resistance, condenser and source of positive potential being connected in series, means for applying an external source of regularly re-occurring impulses to said first control grid to cause the tube to become alternately conducting and non-conducting whereby a sawtooth voltage is developed and means for applying at least a portion of said voltage of sawtooth wave form developed within said circuit to said anode and said second control grid whereby a current and voltage of modulated sawtooth wave form will appear across said condenser, the frequency of said applied voltage of sawtooth wave form being substantially less than the frequency of said applied impulses.

2. A circuit for producing a current and voltage of sawtooth wave form having a constant frequency and a modulated amplitude comprising a vacuum tube including a cathode, a first control grid, a second control grid and an anode, a condenser connected in the anode-cathode circuit of said tube, a source of potential connected to said anode, a resistance connected to said source of positive potential, said resistance, condenser and source of positive potential being connected in series, means for maintaining said second control grid at a potential negative with respect to the cathode, means for regularly varying the potential of said first control grid at a frequency materially greater than the frequency of said voltage of sawtooth wave form whereby said tube is rendered alternately conducting and non-conducting whereby a sawtooth voltage is developed, and means for superimposing at least a portion of said sawtooth voltage developed within said circuit upon the anode and the second control grid of said tube.

3. A circuit for producing modulated sawtooth wave form comprising a vacuum tube having a cathode, at least one control grid and an anode, a condenser connected in parallel with the space path of said tube, a source of potential connected to the anode of said tube, a resistance connected to said source of positive potential, said resistance, condenser and source of positive potential being connected in series, means for causing said tube to become alternately conducting and non-conducting whereby a sawtooth voltage is developed at a frequency in excess of the frequency of the said sawtooth wave, and means for superimposing at least a portion of said developed sawtooth voltage on to the anode of said tube whereby a current or voltage of modulated sawtooth wave form will appear across the condenser.

4. A circuit for producing a current and voltage of modulated sawtooth wave form comprising a vacuum tube having a cathode, at least one control grid, and an anode, a condenser connected in the cathode-anode circuit of said tube, a source of potential connected to said anode, a resistance, said resistance being serially connected in a series circuit including said condenser and said source of potential whereby said condenser is charged from said source of potential through said resistance, means for applying an external source of regularly re-occurring impulses to a control grid of said tube to cause the tube to become alternately conducting and non-conducting whereby a sawtooth voltage is developed, and means for applying at least a portion of said sawtooth voltage developed in said circuit to the anode of the tube whereby a current and voltage of modulated sawtooth wave form will appear across the condenser.

5. A circuit for producing a current and voltage of modulating sawtooth wave form comprising a vacuum tube having an anode, a first control grid, a second control grid, and an anode, a condenser connected in the cathode-anode circuit of said tube, a source of energizing potential connected to said anode, a resistance, said resistance, said source of potential and said condenser being connected in series, means for applying an external source of regularly re-occurring impulses to said first control grid to cause the tube to become alternately conducting and non-conducting, whereby a sawtooth voltage is developed within said circuit and means for applying at least a portion of said sawtooth voltage developed within said circuit of said anode and said second control grid whereby a current and voltage of modulated sawtooth wave form will appear across said condenser.

RUDOLF URTEL.
ROBERT ANDRIEU.