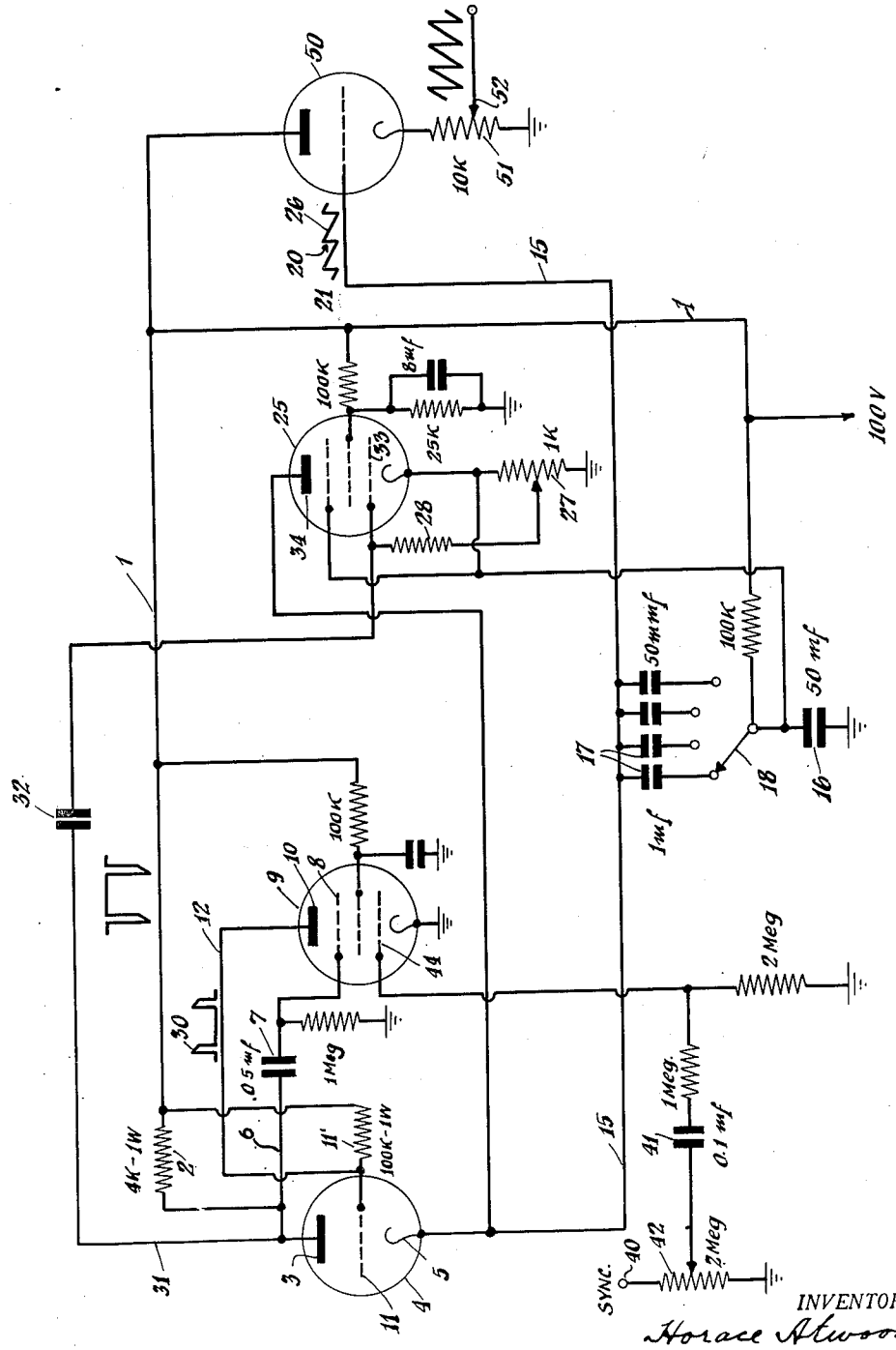
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LINEAR TIME BASE SWEEP GENERATOR

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INVENTOR.
Horace Atwood, Jr.

BY

Charles W. Mortimer,
ATTORNEY

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LINEAR TIME BASE SWEEP GENERATOR

Horace Atwood, Jr., Belleville, N. J., assignor to Allen B. Du Mont Laboratories, Inc., Passaic, N. J., a corporation of Delaware

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8 Claims. (Cl. 250—36)

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This invention relates to means by which provision is made for generating a sweep signal that has a substantially linear characteristic and an extraordinarily rapid return. It is particularly useful for oscillographs but is not restricted to this use.

It has been found heretofore that when gas triode relaxation oscillators are used in generating sweep voltages the upper limit of reasonably satisfactory usefulness is at about 50 kc. For higher frequencies high vacuum oscillators are needed.

By the present invention high vacuum tubes are used in such a way that a good linearity of the sweep voltage is provided, the ratio of return to sweep time is very small, the frequency range is wide, synchronization is easy, the output level can be controlled, and only a small number of variables are needed even for wide frequency ranges.

The invention may be understood from the following description of the operation of the invention in connection with the accompanying drawing, which is a diagram showing two triodes and two pentodes with suitable connections for generating the desired sweep signals.

In the drawing, reference character 1 indicates a lead from a source of positive potential which may, for example, be 100 volts, through resistor 2 to the plate 3 of triode 4. The cathode 5 of this triode is connected to the plate of pentode 25. The plate 3 of tube 4 is coupled by lead 6 and condenser 7 to the grid 8 of pentode 9. The plate 10 of this pentode is connected by lead 12 to the control grid 11 of tube 4.

The cathode 5 of tube 4 is also connected by lead 15 to the grid of triode 50 which has a resistance 51 in its cathode circuit with a sliding contact 52 for taking off signals. The lead 1 is connected to the plate of tube 50.

One side of each of the condensers 17, which are of different sizes, is connected to lead 15 and a switch 18 is provided to connect any one of these condensers, in series with condenser 16. This switch 18 is connected to the lead 1 through a resistance.

A point between the switch 18 and condenser 16 is connected by a lead to the suppressor grid and to the cathode of pentode 25. The control grid 33 of this pentode is provided with a grid leak resistance which is connected by a sliding contactor to the resistance 27 in the cathode circuit of tube 25. This grid 33 is also coupled by lead 31 and condenser 32 to the plate 3 of tube 4. The screen grid of pentode 25 is connected through a resistance to lead 1 and through a resistance and condenser in parallel to ground.

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The terminal 40 is for a synchronizing signal. It is connected through resistance 42 to ground. A sliding contact on this resistance is coupled by condenser 41 and a resistance to the control grid 44 of tube 9.

When a positive potential is applied by lead 1 through resistance 2 to the plate 3 of triode 4, current flows through this tube to cathode 5, causing a drop in potential at the plate 3. This plate 3 is connected by lead 6 through condenser 7 to the suppressor grid 8 of pentode 9. The plate 10 of tube 9 is connected by lead 12 to the grid 11 of tube 4, thus providing an Eccles-Jordan type of trigger circuit so that the voltages change abruptly from one stable value to another at a critical value of input voltage and back abruptly at a different critical input voltage (page 206 et seq., Reich "Theory and application of electron tubes").

The increase in potential on plate 10 due to decrease of potential on grid 8 which is caused by a decrease of current through resistance 11' is applied with reversed or positive polarity as a short pulse, indicated by reference character 30, through lead 12 to the grid 11 of tube 4, causing a very short pulse of current of substantially the same shape as this short pulse 30 through tube 4. This sharp pulse of current passing from cathode 5 through lead 15 charges whichever one of the condensers 17 is connected in series with it by switch 18, as represented by the steep side 20 of curve 21.

The condenser 17 then starts to discharge through the constant current pentode 25, giving the linear side 26 of curve 21. When the cathode 5 potential of tube 4 is lowered to the point where plate current begins to flow to it again, the cycle begins over.

As already explained, the discharge of the condenser 17 through the pentode 25 constitutes the sweep time of the sawtooth voltage. This is particularly advantageous because the plate current of a pentode is independent of the plate voltage over wide limits and therefore linear discharge of the condenser 17 is provided. Also, provision is made for changing the impedance of this pentode 25 by changing the bias of the grid 33 by means of potentiometer 27 that is connected in series with grid bias resistance 28. By thus changing the impedance of tube 25 the time necessary to discharge condenser 17 may be varied so that the frequency of oscillation is thereby controlled. By using a condenser 17 of suitable value and adjusting resistance 27, any frequency

of sweep oscillation over a wide range may be obtained.

The pulse of negative polarity from plate 3 of tube 4 also passes through lead 31 and condenser 32 to the grid 33 of constant current discharge pentode 25. In this way the impedance of the tube 25 is made very high while the condenser 17 is being charged, thus greatly shortening the charging time of condenser 17.

Provision is made for applying a synchronizing signal to the terminal 40. This signal passes through condenser 41 from potentiometer 42 to the grid 44 of tube 9, thus controlling the discharge of this tube and regulating the frequency of the sawtooth wave 20.

The wave 20 on lead 15 may be applied to tube 50 which operates as an impedance transformer. A potentiometer 51 in the cathode circuit provided with the sliding contact 52 regulates the output. This output is suitable for application to the horizontal deflecting plates of an oscillograph or wherever such a signal is needed.

What is claimed is:

1. A device for generating a sawtooth wave, which comprises a first and a second vacuum tube with a plate of each coupled to a grid of the other one, a pentode to the plate of which the cathode of said first tube is coupled, said pentode also having a control grid to which the plate of said first tube is coupled through a condenser, said second tube having a grid to which a synchronizing signal is coupled, and a condenser and resistance in series between the positive terminal of a source of potential and the cathode of said first tube, the negative terminal of said source being connected to the cathodes of said pentode and said second vacuum tube.

2. The device of claim 1, in which said second vacuum tube is also a pentode.

3. The device of claim 1, in which the cathode of said second vacuum tube is grounded.

4. The device of claim 1, in which resistance is provided between the cathode of said pentode and ground.

5. The device of claim 1, in which a variable resistance is provided in the grid circuit of said pentode.

6. The device of claim 1, in which said pentode is provided with a grid that is connected to the positive terminal of a source of potential through resistance.

7. The device of claim 1, in which means are provided to control the amplitude of said synchronizing signal.

8. The device of claim 1, in which a resistance and a plurality of condensers are provided with means to connect said resistance and any one of said condensers in series between the positive terminal of said source of potential and the cathode of said first vacuum tube.

HORACE ATWOOD, JR.