

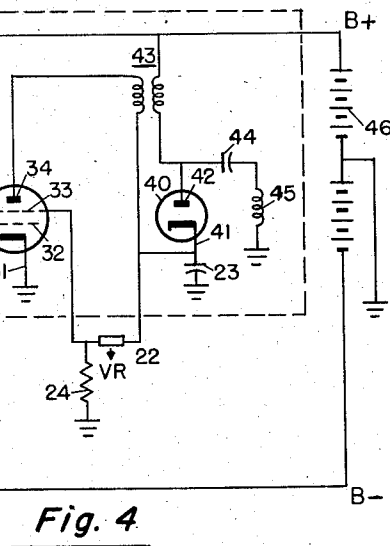
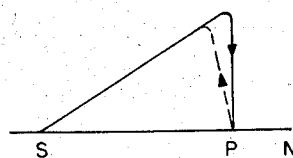
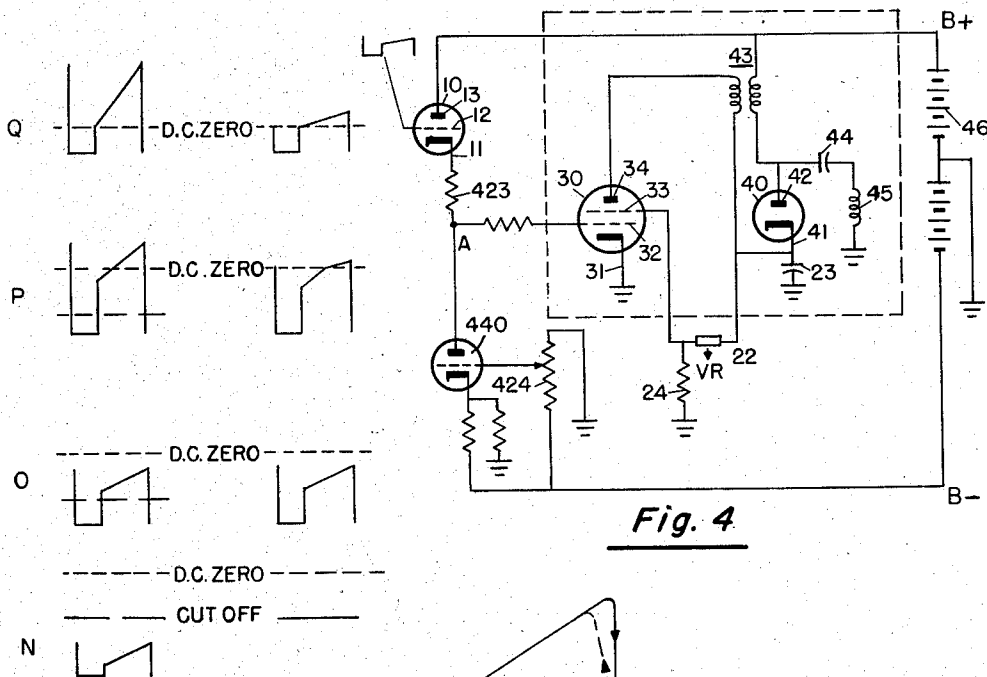
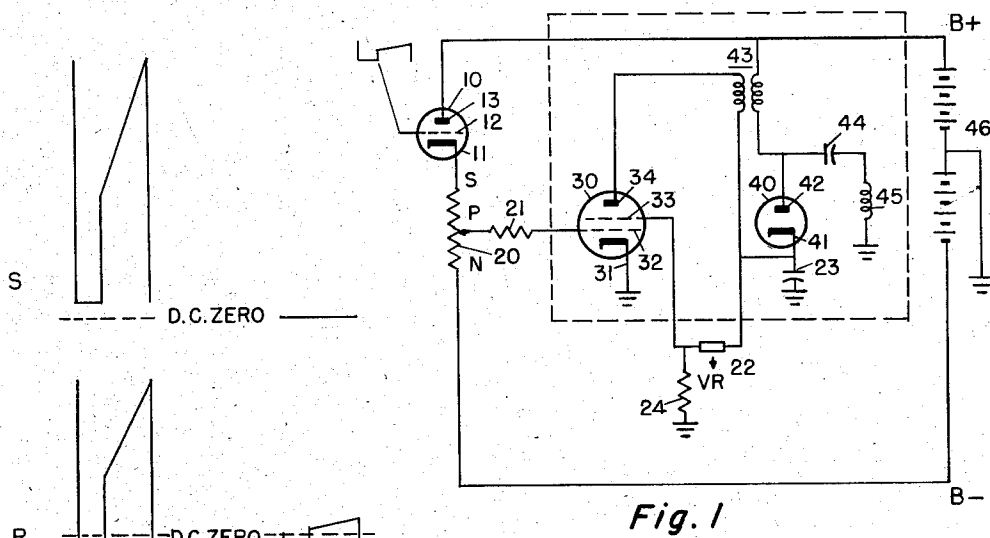
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R. F. CASEY

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ADJUSTABLE HORIZONTAL SWEEP CIRCUIT

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INVENTOR.
ROBERT F. CASEY

BY

Darby & Darby
ATTORNEYS

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ADJUSTABLE HORIZONTAL SWEEP CIRCUIT

Robert F. Casey, Pompton Plains, N.J., assignor to Allen B. Du Mont Laboratories, Inc., Clifton, N.J., a corporation of Delaware

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This invention relates in general to sweep circuits for generating sweep voltages and is particularly concerned with a circuit for changing the amplitude thereof.

While it is a broad object of this invention to provide a circuit of the above type, it is noted that it is of special use in changing the horizontal raster size.

For uses of circuits of this type and particularly in connection with cathode ray tube operation, it is desirable to change the horizontal sweep of the sweep generator output, but unfortunately prior methods of accomplishing this induce changes in linearity, flyback time, power drain, or other important characteristics.

One object of this invention is to provide a circuit for changing the horizontal sweep or size without inducing non-linearity.

Another object of the invention is to accomplish the above without altering other characteristics of the sweep waveform generator.

Still another object is to provide in such a circuit for a wide range of sweep change or raster size.

A more specific object of the invention is to accomplish all of the above by means of a single control.

For numerous reasons beyond the scope of this disclosure adjustment of size by the usual methods of grid control are either inapplicable or of such nature as to limit the size range to a ratio of 5 to 1. In accordance with the system herein disclosed, by means of but a single control it is possible to effect a change ratio of better than 100 to 1 without inducing any non-linearity.

Briefly stated, the circuit is one in which, when the horizontal sweep is cut off, high oscillating voltages in the deflection yoke of a cathode ray tube are induced. These are rectified in a damper tube and used to charge up a boost-capacitor whose voltage is added to that of B+. Thus by this means a boosted voltage is obtained which is used for beneficial purposes. By this invention a boot-strapping voltage-regulator is employed as an automatic transconductance control together with a selectively attenuating input circuit. This circuit combination, which will be described in detail in connection with the attached drawings, permits a wide range of sweep voltage variation or when applied to a cathode ray oscillograph a wide range of horizontal size with substantially constant power demands.

In the accompanying drawings,

Figure 1 is a diagrammatic and schematic illustration of a circuit combination in accordance with this invention;

Figures 2 and 3 are graphic charts illustrating waveforms of operative conditions in said circuit; and

Figure 4 is a diagrammatic illustration of a modified circuit combination in accordance with this invention.

The energizing circuit of this invention comprises in part the electron tube 10 having a cathode 11, a control electrode 12 and an anode 13. A desired pulse of a waveform such as illustrated in Figure 1 is applied from any suitable source, not shown, to the control electrode 12. As will be understood by those skilled in the art, a similar energizing waveform appears at the cathode

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load-resistor 20 which, as shown, is connected between the cathode 11 and the B- terminal of a suitable operating potential source 46 having an intermediate point grounded as shown. The load-resistor 20 is in the form of a potentiometer which acts as a voltage divider through the interconnection of its movable contact with the control electrode 32 of electron tube 30 through a resistor 21. Tube 30 is the horizontal amplifier and, as is clear from the drawing, potentiometer 20 is continuously variable from setting N to setting S. The anode 13 of tube 10 is connected to the positive side of source 46. Cathode 31 of tube 30 is grounded while anode 34 is connected to the primary of a coupling transformer 43 coupled to the yoke system, and through voltage regulator 22 to the screen electrode 33. This screen electrode is connected to ground through a resistor 24. The secondary of transformer 43 is connected to ground through a coupling capacitor 44 and the deflection yoke 45 (in the example described the horizontal deflection yoke). The common terminal of the secondary and capacitor 44 is connected to the anode 42 of a unidirectional conductive diode 40 which functions as a damper tube to dampen the oscillations. The cathode 41 is interconnected with the common terminal of the primary of transformer 43 and the voltage regulator 22 and is grounded through a boost-capacitor 23. The portion of the circuit within the dash lines represents the boost-voltage circuit where 40 is the damper tube referred to above and of course 23 is the boost capacitor.

A study of this circuit shows that its operation with the N setting will pick off cathode load resistor 20 a very small energizing signal at an extremely negative bias. Obviously, as the potentiometer slide approaches the S setting a progressively larger energizing signal at a progressively less negative bias will be picked off. This latter condition is conducive to the flow of grid current which is attenuated by resistor 21. This attenuation is desirable in order that tubes 10 and 30 not be dangerously overloaded; tube 30 because of operation with a positive grid, and tube 10 because it supplied current to this positive grid.

The resultant input signal applied to grid 32 therefore has a negative portion depending upon the amplitude of the energizing signal picked off potentiometer 20 and a positive portion depending upon the attenuation caused by resistor 21.

These energizing and input waveforms for various setting of the potentiometer are shown in Figure 2. They are here shown as they are picked off load 20 (energizing signals) and as they are applied to grid 32 (input signals). In this figure the dotted lines indicate the D.C. zero level, and the dashed lines indicate the cut-off level. It will be noted that the positive portions of the energizing signal are attenuated as the slider moves from setting P to setting S, and the negative portions diminish from P to N, as a result of the voltage divider action of potentiometer 20. The net result is that at either extreme position the input signal is minute while the maximum input signal is at some intermediate setting.

As previously explained, the boost-voltage varies with the value of the induced voltage in the deflection yoke. This of course depends on the magnitude of current flow which is interrupted which in turn is controlled by the amplitude of the input signal. As the slider of the potentiometer is moved further from setting S a progressively larger input signal is applied to grid 32 causing a larger current flow through the deflection yoke 45. This in turn causes a larger induced voltage at cut-off and hence a higher boost-voltage. Thus at settings progressively further from the point S not only is there an input signal of greater magnitude, but also a progressively higher boost-voltage is generated.

As is clear from Figure 1 the boost-voltage is applied through voltage regulator 22 to the screen electrode 33 of the drive-tube 30. When the boost-voltage is low it has no appreciable effect. As it becomes higher it raises the potential of screen electrode 33 automatically raising the grid-to-anode transconductance of the tube 30. Now as the input signal is applied to control grid 32, the increased transconductance, due to the upvolted screen electrode 33, increases the effectiveness of the applied input signal, maintaining a linear increase of current through the yoke as indicated by the curve in Figure 3.

Actually, the extremely linear control exists in the portion of the potentiometer near the cathode of tube 10 as there is sharp dropping-off near the other extreme, accompanied by a condition similar to a hysteresis loop. Thus it may be seen that the yoke may receive a high current to cause a large deflection or it may receive a small current for a small deflection. If this change is made suddenly the reduced boost-voltage quickly lowers the potential of screen electrode 33 protecting the tube and associated circuits. Previously, complicated feedback circuits and a multiplicity of controls were required to cope with this condition.

The power required by driver-tube 30 is substantially constant and may be understood from the following explanation. At settings near the point S, control grid 32 has a positive relatively high bias, but since the input signal is small so is the boost-voltage and the potential transmitted to screen grid 33 is relatively low. At settings near the point P the input signal is larger, generating a higher boost-voltage and therefore a higher screen grid potential, but control grid 32 is at a lower bias. It is seen, therefore, that a small control grid bias is associated with a large screen grid voltage and conversely a large control grid voltage is associated with a small screen grid voltage. Therefore the D.C. current is substantially constant over the complete range of operation requiring substantially constant power. However, the A.C. voltage varies widely depending as it does on the magnitude of the applied signal, thus producing a wide range of amplitude.

Under some conditions a modified boost-voltage may be desired at screen-electrode 33. In such cases the voltage regulator 22 may be advantageously replaced by a resistor or some other combination of elements.

It is occasionally desirable to effect control of raster size from a remote station. Since potentiometer 20 carries a high frequency, 15.7 kc., long lines must be avoided. Provision for this condition is made in the circuit of Figure 4. The major portion of the circuit of Figure 4 is the same as the circuit of Figure 1 and so it will not be re-described although the same reference numerals are used. In this arrangement cathode 11 of the tube 10 is connected through a resistor 423 to the anode of a control electron tube 440 which combination replaces the potentiometer 20 of the circuit of Figure 1. Control grid 32 is connected to the common terminal of resistor 423 and the anode of tube 440 through resistor 21 as shown in Fig. 1. The cathode of this tube is returned to B— through the usual resistor arrangement while its grid is connected to the movable contact of a potentiometer 424 connected between B— and ground. By means of this potentiometer the D.C. bias of tube 440 is controlled and since it carries direct current only this potentiometer can be located at any convenient remote point with respect to the rest of the system. As those skilled in the art will appreciate, changing the bias on the grid of tube 440 effectively changes the potential at the point A to which point the grid 32 is connected. The electrically equivalent result is the same as moving the slider of potentiometer 20.

From the above description it will be apparent to those skilled in the art that many changes in the details of construction and other variations may be effected without departing from the novel subject matter herein disclosed.

I prefer not to be limited to the embodiments of the invention described herein for illustrative purposes, but only as required by the appended claims.

What is claimed is:

1. In combination with a sweep generator having boost voltage circuitry, a sweep amplitude control circuit comprising: means to provide input signals progressively variable from a large amplitude at a low D.C. level to a small amplitude at a relatively high D.C. level; an amplifier having a control grid and a screen grid; means to apply said input signals to said control grid; and means to apply to said screen grid a high potential during the application of said large amplitude, low D.C. level input signals, and a low potential during the application of said small amplitude, high D.C. level input signals.

2. In a sweep generator having a boost voltage circuit, a circuit for varying the amplitude of the sweep, comprising: means to provide energizing signals progressively variable from a small amplitude at a low D.C. level to a large amplitude at a relatively high D.C. level; an amplifier having an input grid and a screen grid; means to apply said energizing signals to said input grid, said means progressively attenuating the positive portions of said energizing signals to produce input signals having a small amplitude at a relatively high D.C. level and a large amplitude at a low D.C. level; and means causing said small input signals to apply a small potential to said screen grid and said large input signals to apply a higher potential to said screen grid, said means comprising a boot-strapping arrangement between said screen grid and the source of boost voltage, whereby a small input signal is associated with a low screen grid potential, and a large input signal is associated with a higher screen grid potential.

3. In combination with a sweep generator having boost voltage circuitry, a circuit for adjusting the amplitude of the drive comprising: means to provide energizing signals progressively variable from a small amplitude at a low D.C. level to a large amplitude at a high D.C. level, said means comprising a cathode follower having a cathode load consisting of a variable voltage divider; an amplifier having an input grid and a screen grid; means, including a resistance connected between said control grid and the varying point on said voltage divider, to apply said energizing signals to said control grid, said means progressively attenuating the positive portions of said energizing signal to produce input signals having a small amplitude at a high D.C. level and a large amplitude at a low D.C. level; means to apply a high potential to said screen grid during the application of said large amplitude input signals, and to apply a low potential to said screen grid during the application of said low amplitude input signals, said means comprising a boot-strapping arrangement between said screen grid and the source of boost voltage, whereby a large input signal at a low D.C. level is associated with a high screen grid potential (high transconductance), and a small input signal at a high D.C. level is associated with a low screen grid potential (low transconductance), thus tending to maintain a constant D.C. current through said amplifier.

4. The circuit of claim 2 wherein said voltage divider comprises the fixed portion of a potentiometer; and said signal applying means comprises a connection between the slider of said potentiometer and said resistance.

5. The circuit of claim 2 wherein said voltage divider comprises a series-connected fixed resistance and an electron discharge device having a control grid; and said signal applying means comprises a connection from the common junction of said electron discharge device and said resistance.

6. The circuit of claim 5 including means to vary the impedance of said electron discharge device, said means comprising a variable source of potential applied to said control grid.

(References on following page)

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References Cited in the file of this patent

UNITED STATES PATENTS

2,428,926	Bliss	Oct. 14, 1947
2,482,737	Shaw	Sept. 20, 1949
2,510,027	Torsch	May 30, 1950
2,559,316	Parker	July 3, 1951

2,657,332
2,712,092
2,712,616
2,715,182
2,743,382
2,752,528

6

Lockhart	Oct. 27, 1953
Schwarz	June 28, 1955
Leeds	July 5, 1955
Bishop	Aug. 9, 1955
Lufkin	Apr. 24, 1956
Aires	June 26, 1956