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2,402,270

OSCILLATING CIRCUIT

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FIG. 1.

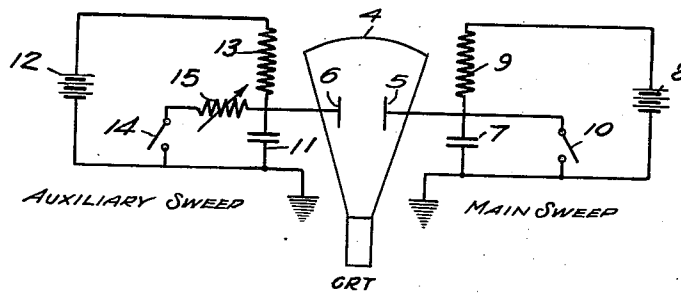


FIG. 2.

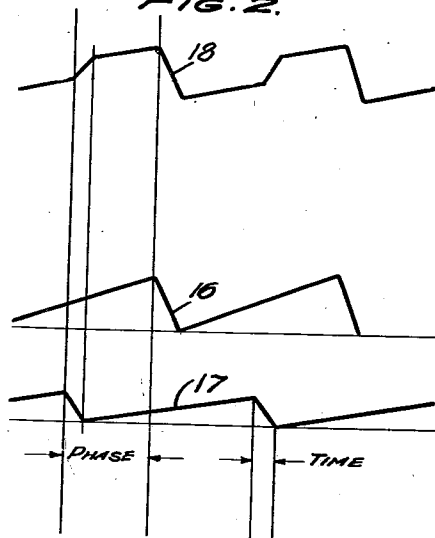
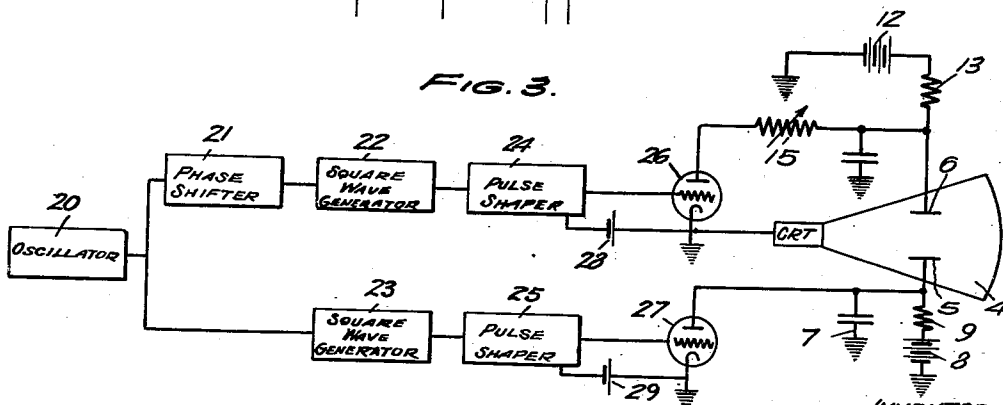


FIG. 3.



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OSCILLATING CIRCUIT

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11 Claims. (Cl. 315-26)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to radio circuits and particularly circuits for producing a voltage for the deflection of a beam of a cathode ray tube.

In order to deflect the beam of a cathode ray tube across the screen in a desired fashion it is common to use either magnetic or electrostatic means. In the electrostatic means deflecting plates are provided within the tube. The electron stream passing between these plates will be deflected in accordance with the potential existing across the plates. In order that the beam may sweep across the screen linearly with a quick return for the next cycle, an electrical voltage of saw-tooth wave shape is applied to the horizontal plate. Circuits for producing this saw-tooth wave shape are well known in the art.

There has recently been a growing need for a more detailed study of one portion of the figuration represented on the cathode ray tube. In order to accomplish this it has been proposed that the desired portion be applied to a second cathode ray tube for expansion and more complete study. This has the disadvantage of requiring two cathode ray tubes in each system. Accordingly, it is an object of this invention to provide means to expand the desired portion on the same cathode ray tube whereon the original figuration appears.

It is another object of this invention to provide a circuit for the generation of a voltage which will cause the electron beam to vary in a desired fashion as it sweeps the screen of the cathode ray tube.

A further object is to provide a circuit for altering the saw-tooth wave shape so as to vary the velocity of the electron beam sweep.

An additional object is to provide a novel means for controlling the deflection of a cathode ray beam.

Other objects will be apparent from the following description and claims and reference to the drawing in which:

Figure 1 is a circuit illustrating the basic principles involved;

Figure 2 shows the wave shape of the voltages applied to the horizontal deflecting plate of the cathode ray tube;

Figure 3 is a complete circuit of the elements involved.

Reverting now in more detail to Figure 1, there is shown a cathode ray tube 4 with a pair of

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horizontal deflecting plates 5 and 6. Connected from one plate 5 to ground is capacitor 7. Across capacitor 7 there is connected a source of potential 8. The D.-C. voltage from source 8 is utilized to charge capacitor 7 to a desired value controlled by resistor 9 shown connected in series with source 8. Also across capacitor 7, directly to ground, there is shown a switching device 10. When switching device 10 is open capacitor 7 will be charged at a rate dependent upon circuit constants. When switching device 10 is closed capacitor 7 will discharge rapidly through the closed circuit.

Connected between plate 6 and ground is another capacitor 11. Across capacitor 11 there is a source 12 of D.-C. voltage in series with resistor 13 for charging capacitor 11 in the manner explained above. Also across capacitor 11 directly to ground there is a switching device 14 in series with a variable resistor 15. As previously explained, capacitor 11 will discharge through switching device 14 when closed and charged when switch 14 is open. However, in this circuit the rate of discharge will be slowed and controlled by resistor 15.

The potential difference across plates 5 and 6 controlling the deflection of the electron beam of cathode ray tube 4 will thus vary in accordance with the difference of voltages applied to plate 5 and plate 6. The circuit constants are so chosen that with switches 10 and 14 open the resulting charges across capacitors 7 and 11 will create a potential difference between plates 5 and 6.

If switching device 10 is periodically opened and closed, capacitor 7 will periodically charge and discharge, thus creating a potential of saw-tooth wave shape on plate 5 in a well known manner. Similarly, periodic closing and opening of switch 14 will create a saw-tooth wave shape of electrical voltage on plate 6.

Referring now to Figure 2, there is shown the saw-tooth wave shape 16 which appears on plate 5. The voltage applied to plate 6 is the saw-tooth wave shape 17.

The difference in potential which exists between deflecting plates 5 and 6, as a result of the voltages represented by wave shapes 16 and 17, is shown as the resultant of these wave shapes and marked 18 in Figure 2. Wave shape 18 in other words, depicts the difference of potential which effects the shifting of the electron stream of the cathode ray tube 4.

Figure 3 is a block diagram of the component parts of the device. The cathode ray tube 4 con-

tains the deflecting plates 5 and 6. The sources of direct current 8 and 12 charge condensers 7 and 11 through resistors 9 and 13, respectively. Adjustable resistor 15 slows down and controls the discharge of condenser 11. The switches indicated in Figure 1 at 10 and 14 are here shown as electronic switches. An oscillator 20 supplies sine waves to both electronic switches. A phase shifter 21 provides that the expanded portion of the sweep may be moved anywhere with relation to the main sweep. Square wave generators 22 and 23 feed the waves to pulse shapers 24 and 25 where the waves are shaped into short pulses which pulses cause the vacuum tubes 26 and 27 to conduct while the pulse lasts and thus provide a path for the discharge of condensers 7 and 11, respectively. Batteries 28 and 29 provide bias for vacuum tubes 26 and 27.

The mode of operation of my device is believed to be obvious. The capacitors 7 and 11 are charged and periodically discharged each time one of the vacuum tubes 26 or 27 is rendered conducting. Since the pulses which render vacuum tubes 26 and 27 conducting originate at the same source the result is that voltages of the same frequency but differing in phase are applied to the deflecting plates 5 and 6. Due to the shape of the resulting wave, the electron beam of cathode ray tube 4 is moved at parts of its sweep or trace over the face of the tube at an increased speed. This causes a portion of its path of travel to have the effect of being expanded and thus permits a closer inspection of the wave figuration over this portion of the movement of the beam.

The foregoing is merely one embodiment of my invention. Other modifications will readily occur to those skilled in the art. There are two important features to this invention: first, the separate use of each of a pair of deflecting plates in order to apply the difference of two voltages to an electron beam; and, second, the production of an expanded sweep wherein a controlled length of main sweep may be expanded.

A small, cheaper cathode ray tube with a plate grounded to an anode may be used, the two sweep voltages being combined by connecting two resistors between the generators and obtaining the voltage from the common point.

One fact that is worthy of mention is the relationship between the retrace time of the auxiliary sweep and the length of the electronic switch pulse. It is evident that the pulse must last long enough to permit nearly complete discharge of the condenser ($t=3RC$, for instance). It might be desirable, for a wide latitude of control, to couple the variable resistor in series with the switch, and a pulse length control.

I claim:

1. In an oscilloscope circuit, a cathode ray tube with a pair of horizontal deflecting plates, an oscillator for generating an alternating potential of desired frequency, a first circuit for generating impulses of the square-wave type connected to said oscillator and means for varying the phase of the output of said first circuit, a second circuit for generating impulses of the square-wave type connected to said oscillator, a first tube normally biased beyond cut-off connected to said first circuit, and a second tube normally biased beyond cut-off connected to said second circuit, a first capacitor, a variable resistor connecting said first capacitor to said first tube, means for charging said first capacitor, and a connection between said first capacitor and one of said horizontal deflecting plates, a second capacitor connected directly

to said second tube, and means for charging said second capacitor, said second capacitor being connected to the second of said horizontal deflecting plates.

2. In an oscilloscope circuit, a cathode ray tube with a pair of horizontal deflecting plates, a first circuit for generating an electrical potential of saw-tooth wave shape and means for applying said potential to one of said horizontal deflecting plates, a second circuit for generating an electrical potential of saw-tooth wave shape and means for applying the output of said second circuit to the second of said deflecting plates, means for varying the amplitude of said first potential and means for adjusting the phase of said first potential, and an oscillator, connected to said first circuit and to said second circuit whereby the outputs of said first circuit and said second circuit are of the same frequency.

3. In an oscilloscope circuit a cathode ray tube with a set of deflecting plates, a first capacitor connected to one of said deflecting plates, and a second capacitor connected to the second of said deflecting plates, a source of electrical potential for charging said first and said second capacitors, switching means for periodically discharging said first capacitor, and switching means for discharging said second capacitor at the same frequency of periodic discharge as said first capacitor, means for controlling the rate of discharge of said second capacitor, and means for controlling the phase of periodic discharge of said second capacitor with respect to discharge of said first capacitor.

4. In an oscilloscope circuit, a cathode ray tube with a pair of deflecting plates, a source of electrical potential of saw-tooth wave shape applied to one of said deflecting plates and a source of electrical potential of saw-tooth wave shape applied to the second of said deflecting plates and means for varying the phase of said second potential, said second potential being of the same frequency as said first potential.

5. In an oscilloscope circuit, a cathode ray tube with a pair of deflecting plates, means for generating an electrical potential of saw-tooth wave shape and means for applying said potential to one of said deflecting plates, means for generating a second electrical potential of saw-tooth wave shape, means for varying the amplitude of said second potential, means for varying the phase of said second potential, and means for applying said second potential to the second of said deflecting plates.

6. In an oscilloscope circuit a cathode ray tube with a set of deflecting plates, a first circuit for generating an alternating electrical voltage connected to one of said deflecting plates, and a second circuit connected to the second of said deflecting plates, for generating an electrical voltage of alternating frequency equal to the output frequency of said first circuit, means for varying the amplitude of the output of said second circuit, and means for varying the phase of the output of said second circuit.

7. The method of varying the sweep velocity of a cathode ray tube which comprises periodically charging and discharging a capacitor, applying the resultant potential across said capacitor to one plate of a pair of deflecting plates on said cathode ray tube, periodically charging and discharging a second capacitor and applying the resultant potential across said second capacitor to the second plate of said pair of deflecting plates, the frequency of periodic discharge of said first capacitor being equal to the frequency of periodic

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discharge of said second capacitor, and adjusting the phase of discharge frequency of said second capacitor relative to discharge frequency of said first capacitor.

8. The method of varying the velocity of electron sweep of a cathode ray tube which comprises generating an electrical voltage of desired frequency, utilizing a portion of said voltage to excite a first circuit for the generation of electrical impulses, applying the output of said first circuit to a first tube normally biased beyond cut-off whereby said first tube conducts during the time that electrical impulses are applied thereto, charging a first capacitor, discharging said first capacitor through said first tube during the time said first tube is conducting, applying the potential across said first capacitor to one of a pair of deflecting plates on said cathode ray tube, adjusting the phase of a second portion of said alternating voltage, utilizing said second portion to excite a second circuit for generating electrical impulses, applying the output of said second circuit to a second tube normally biased beyond cut-off whereby said second tube conducts during the time that electrical impulses are applied thereto, charging a second capacitor, and discharging said second capacitor through a variable resistor and through said second tube during the time said second tube is conducting and applying the potential across said second capacitor to the second of said pair of deflecting plates.

9. The method of deflecting an electron beam

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of a cathode ray tube which comprises applying a variable electrical potential to one plate of a pair of deflecting plates on said cathode ray tube, applying a variable electrical potential to the second plate of said pair of deflecting plates, adjusting the phase and amplitude of the potential applied to said second plate whereby the electron beam is deflected at a varying rate in accordance with the varying potential across the said deflecting plates.

10. The method of varying the velocity of sweep of a cathode ray tube which comprises applying a voltage of saw-tooth wave shape to one of a pair of deflecting plates on said cathode ray tube, applying a voltage of saw-tooth wave shape to the second of said pair of deflecting plates, the voltage applied to said second plate being of the same frequency as the voltage applied to said first plate, adjusting the amplitude and phase of the voltage applied to said second plate, relative to the voltage applied to said first plate.

11. The method of varying the velocity of sweep of a cathode ray tube which comprises generating a voltage of saw-tooth wave shape and applying said voltage to one of a pair of deflecting plates in said cathode ray tube, generating a second voltage of saw-tooth wave shape and applying said second voltage to the second of said pair of deflecting plates, adjusting the amplitude of said second voltage, adjusting the phase of said second voltage relative to said first voltage.

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