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CATHODE-RAY OSCILLOGRAPH CIRCUIT

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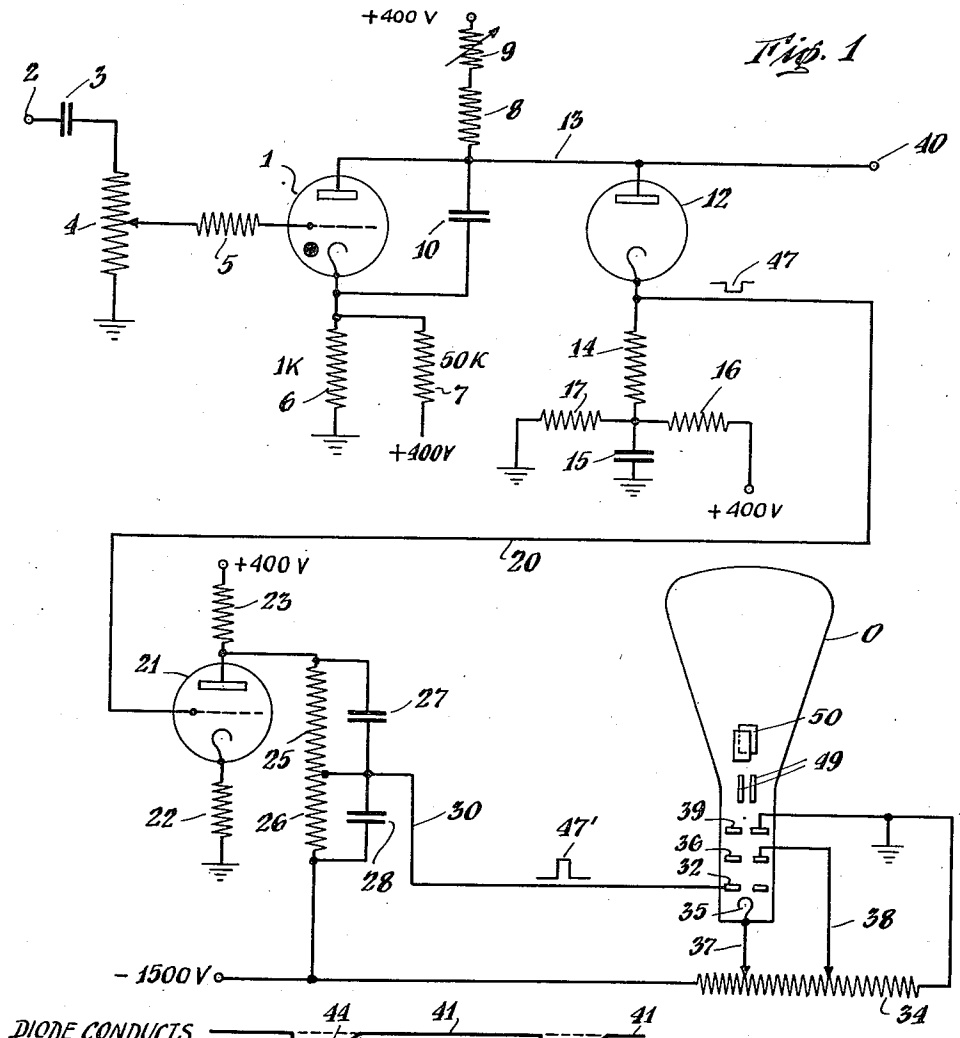

Fig. 1

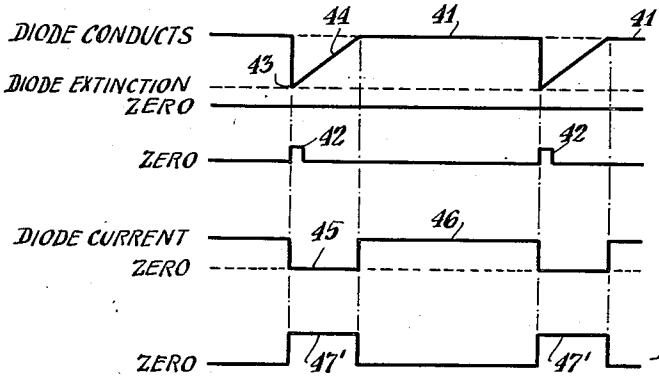

Fig. 2

Fig. 3

Fig. 4

Fig. 5

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CATHODE-RAY OSCILLOGRAPH CIRCUIT

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3 Claims. (Cl. 315—22)

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This invention relates to a device for generating a controlling signal for use in connection with single sweep or repetitive time bases in a cathode-ray oscillograph. By this invention the beam intensity of an oscillograph can be controlled in such a manner that it is kept at zero intensity except during its forward trace.

In carrying out the invention a single sweep of the beam may be obtained from a circuit that normally yields a recurrent sawtooth wave. The controlling signal is used to turn on the beam just before it begins and to turn it off as soon as it has completed its forward trace.

The invention may be undersood from the description in connection with the accompanying drawing, in which:

Fig. 1 is a diagram of connections showing how the invention may be carried out;

Figs. 2 to 5 are curves that will aid in explaining how the invention operates.

In the drawing, reference character 1 indicates a gas filled vacuum tube, to the grid of which a controlling signal is coupled from terminal 2 through capacitance 3, variable attenuator 4 and resistance 5. Operating grid bias 6 is provided in the cathode of tube 1 by means of the potential divider 6 and 7 connected to a source of positive potential. A source of positive potential is connected to the plate of tube 1 through resistance 8 and variable resistance 9. A condenser 10 is located between this plate and cathode of tube 1. The circuit so far described provides a sawtooth wave in the known way which can be synchronized by applying signals at terminal 2.

A diode 12 has its plate connected by lead 13 to the plate of tube 1, and resistance 14 is located between the cathode of tube 12 and a point on potential divider 16, 17. A condenser 15 is connected between the lower end of this resistance 14 and ground. One end of resistance 16 is connected to a source of positive potential and the other end of this resistance is connected to a point between resistance 14 and condenser 15. One end of resistance 17 is connected to this point and the other end thereof is connected to ground.

A lead 20 extends from the cathode of diode 12 to the grid of vacuum tube amplifier 21 which has its cathode biased by resistance 22. A positive potential is applied to the plate of tube 21 through load resistance 23 in the usual way. This plate is coupled to resistances 25 and 26 in series. They are shown with condensers 27 and 28, respectively, in parallel therewith. A lead 30 extends from points between resistances 25 and 26 and condensers 27 and 28 to the control grid 32

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of cathode-ray tube O. A source of negative potential, which may, for example, be minus 1500 volts, is connected to the lower end of the network 25—26 and to a voltage divider 34. The potential of the cathode 35 and first anode 36 of tube O are controlled by connections 37 and 38 to variable points on voltage divider 34, while one end of this voltage divider and the second anode 39 are connected to ground.

The operation is as follows:

It is obvious that if the diode 12 were disconnected a sawtooth signal would appear at the terminal 40 in the usual way. The frequency is controlled by resistances 8 and 9 and condenser 10, and can be synchronized within narrow limits by a synchronizing signal applied at 2.

With this invention a single sweep can be obtained:

(1) By making the bias of diode 12 lower than the ionization potential of gas triode 1 and making the voltage drop across resistance 6 sufficiently high;

(2) Or by keeping a fixed potential at the cathode of tube 1 and decreasing the potential at the lower end of resistance 14;

(3) Or by adjusting the potential at both of these points so as to maintain the desired fixed range of potential on lead 13, thus maintaining a constant amplitude of the signal at terminal 40 to be used as the horizontal sweep for tube O.

By this invention a signal is obtained from a recurrent sweep. This signal is used to turn on the beam of the tube O just before and during the interval of its horizontal sweep, the beam being extinguished the remainder of the time.

When the 400 v. potential is applied through resistances 8 and 9, the potential on the plates of tubes 1 and 12 increases along the exponential curve 44 of Fig. 2 until it reaches the level 41, whereupon the diode 12 conducts, maintaining the potential at 41, which is below the firing potential of gas triode 1. When one of the synchronizing signals indicated at 42 in Fig. 3 reaches the grid of tube 1, this tube conducts or fires and lowers the potential to the point 43, Fig. 2, at which the diode 12 ceases to conduct, whereupon the potential on the plates of tubes 1 and 12 rise along the line 44, Fig. 2, to the level 41 and remains there until the next synchronizing signal is applied to the terminal 2. During this interval the current through diode 12 remains zero as shown at 45 in Fig. 4 and then rises abruptly to the line 46 when the diode begins to conduct, and remains there until the next synchronizing signal 42 arrives. During the interval 45 (Fig. 4) a

rectangularly shaped pulse 47 of potential of negative polarity appears on the lead 20 that is connected to the cathode of the diode 12.

The pulse 47 on lead 20 is amplified and reversed in polarity by the amplifier 21. The amplified pulse 47' is then applied in reversed positive polarity to the grid 32 after having been attenuated by the compensated resistance-capacitance attenuator 25—28, thus turning the cathode-ray beam on at or just prior to the beginning of its forward trace and while it is accelerated by the first and second anodes 36 and 39 and is deflected by signals applied to the pairs of horizontal and vertical deflecting plates 49 and 50. The beam is cut off again at the end of the time interval represented by the line 47', Fig. 5.

The pulse 47, inverted and amplified in tube 21, could be coupled to the grid 32 of cathode-ray tube O in the usual way through a coupling condenser, with a resistor between grid 32 and the high-voltage source of negative potential. A disadvantage of this method is the difficulty of maintaining uniform beam intensity, corresponding to freedom from slope of the pulse 47', when the interval of 47' is long. This difficulty might be overcome by increasing the time constant of the coupling circuit, but this would often require the use of impractically large components because of the large difference in potentials of the two circuits.

By the present invention the coupling 25—28 is such that this difficulty is overcome, and the advantages of direct coupling are obtained. It will be seen that by this invention the high D. C. negative potential at the grid 32 of tube O is attenuated in the resistances 25 and 23, while the amplified pulse signal appearing at the plate of tube 21 is attenuated in resistances 25 and 26, paralleled by condensers 27 and 28, and appears as 47' at the grid 32 of tube O. It has been found that attenuations as low as 1 part in 5 are practicable in this arrangement.

Voltages and resistances represented on the drawing are illustrative.

What is claimed is:

1. In a device for increasing the intensity of the cathode-ray beam in the cathode-ray tube of an oscillograph during the application of a sweep deflection potential to said cathode-ray tube, means for generating a rectangularly shaped pulse of potential during the interval of said sweep potential, said means comprising a sawtooth signal generator, an electron discharge device of which the space current is made to vary between two predetermined values corresponding substantially to the extreme potentials of said sawtooth signal, said electron discharge device being connected to the output of said sawtooth signal generator, a load resistor connected to the output of said discharge device and across which said current generates said rectangularly shaped pulse of potential, and means for coupling said rectangularly shaped pulse of potential to a current-controlling electrode of said cathode-ray tube.

2. In a device for increasing the intensity of the cathode-ray beam in the cathode-ray tube of an oscillograph during the application of a sweep deflection potential to said cathode-ray tube, means for generating a rectangularly shaped pulse of potential during the interval of said sweep potential, said means comprising a sawtooth signal generator, an electron discharge device of which the space current is made to vary between two predetermined values corresponding substantially to the extreme potentials of said sawtooth signal, said electron discharge device being connected to the output of said sawtooth signal generator, a load resistor connected to the output of said discharge device and across which said current generates said rectangularly shaped pulse of potential, and means for coupling said rectangularly shaped pulse of potential to a current-controlling electrode of said cathode-ray tube said last named means comprising a resistive network compensated by capacitance to provide uniform frequency response.

3. The device of claim 1 in which said coupling means comprises a conductive three-terminal network, adapted to couple signals between two points having different potentials with respect to a third point, one terminal of said network being common to both input and output circuits, an input terminal to which signals are applied from the first one of said two points, an output terminal from which corresponding signals are taken and connected to the second one of said two points, said network having substantially uniform frequency transmission characteristics and being adapted for setting the potential which the output terminal assumes in the absence of signals.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,622,851	Smith	Mar. 29, 1927
2,059,004	Leeds	Oct. 27, 1936
2,137,354	Schlesinger	Nov. 22, 1938
2,179,111	Young	Nov. 7, 1939
2,196,838	Rogowski et al.	Apr. 9, 1940
2,210,702	Bowman-Manifold	Aug. 6, 1940
2,222,943	George	Nov. 26, 1940
2,230,926	Bingley	Feb. 4, 1941
2,265,744	Rath	Dec. 9, 1941
2,289,821	Boucke	July 14, 1942
2,313,122	Brubaker	Mar. 9, 1943
2,315,369	Foster	Mar. 30, 1943
2,343,988	Mahoney	Mar. 14, 1944
2,363,810	Schrader	Nov. 28, 1944
2,369,138	Cook	Feb. 13, 1945