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CATHODE RAY SWEEP CIRCUIT

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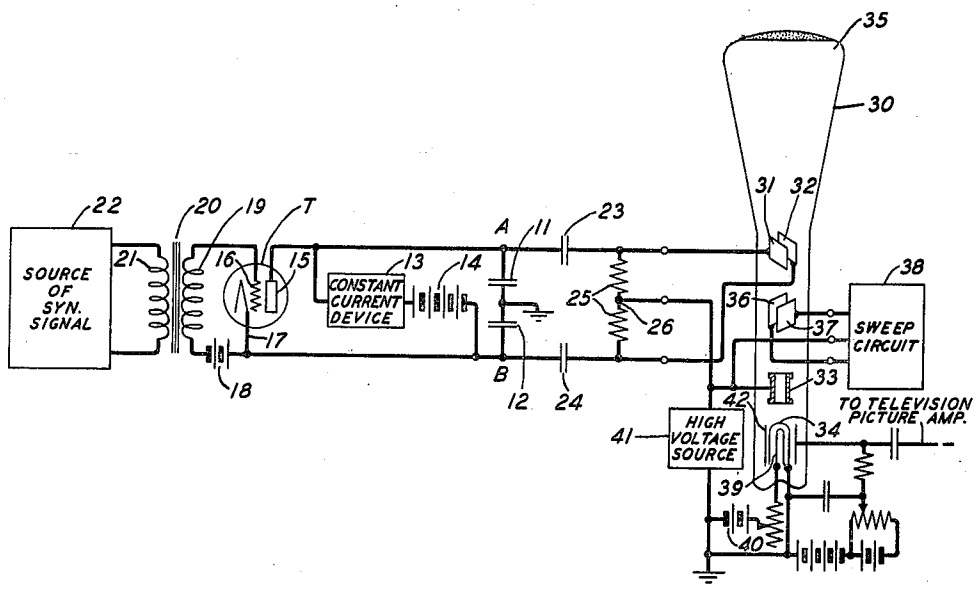

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CATHODE RAY SWEEP CIRCUIT

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4 Claims. (Cl. 250—36)

This invention relates to cathode ray devices and more specifically to cathode ray sweep circuits suitable for television scanning.

In the operation of cathode ray tubes suitable for television scanning, the sweep circuits used have been of a form in which there is an unbalance, i. e., the instantaneous average of the potentials to ground generated by the sweep circuit and applied to the deflecting plates of a cathode ray tube does not equal the potential to ground of the accelerating anode immediately preceding the deflecting plates in the cathode ray tube at all times. It has been found that this is the cause of the field on the screen of the cathode ray tube being somewhat wedge-shaped and so producing a distorted image, the reason therefor being that the velocity of the beam depends upon the average of the potentials applied to the speed plates and hence the deflection in certain beam positions when this average is not constant is greater or less than it should be. This unbalance also accounts for an unwanted intensity deviation and a loss of clear focus in parts of the image. These three manifestations are all due to the change in velocity of the beam. In a copending application of Frank Gray, Serial No. 65,606, filed February 25, 1936, there are disclosed a number of sweep circuits for producing saw-toothed potential wave forms suitable for television scanning in which the potentials are substantially balanced with respect to the potential of an anode of the cathode ray tube. The present application relates to improvements in that type of circuit which produces balanced sweep potentials.

It is an object of this invention to provide an improved balanced sweep circuit.

According to the invention, two substantially equal condensers which are connected in series and have their common terminal connected to a point of fixed potential, such as ground, are charged through a suitable constant current device substantially linearly with respect to time. These condensers are discharged periodically by the action of a suitable gas-filled electron discharge device of the general type known by the name of "Thyratron". Whenever the grid of the Thyratron is made sufficiently less negative by a received signal, such as a synchronizing signal, the discharge circuit is completed through the tube. The external terminals of the condensers are connected through coupling condensers of high capacity to the respective plates of one pair of deflecting plates of a cathode ray tube. Across these plates is connected a high resistance, the mid-point of which is connected to the last anode of the cathode ray tube. This circuit produces a potential wave shape of the well-known saw-toothed wave form which is substantially balanced with respect to the potential applied to this anode.

The invention will be more readily understood from the following description taken in connection with the accompanying drawing forming a part thereof in which the single figure shows a circuit for producing balanced sweep potentials.

Referring more particularly to the single figure of the drawing, a sweep circuit is shown for producing balanced potentials of saw-toothed wave form for application to the deflecting plates of a cathode ray tube to cause, in cooperation with another sweep circuit of appropriate frequency the cathode ray beam generated therein to scan in turn all of the elemental areas of a screen. The circuit comprises two substantially equal condensers 11 and 12 connected in series, the common terminal of which is connected to ground, and means for charging and discharging these condensers. The term "condenser" is considered to be broad enough to describe the electrical action of any two conductors separated by a dielectric. Shunted across these condensers is a suitable thermionic leak or constant current device 13 and a source of potential 14. Preferably the device 13 comprises a pentode electron discharge device having an anode, a cathode, a control grid, a screen grid and a suppressor grid and having circuits so arranged that the current through the tube varies the bias of one or more of the grids so as to tend to produce a constant flow of current through the tube regardless of potential changes. Such a constant current device is fully described in and reference should be made to an application of Frank R. Norton, Serial No. 65,607, filed February 25, 1936.

Also shunted across the condensers 11 and 12 is the anode-cathode path of a gas-filled grid-controlled electron discharge device T comprising an envelope enclosing an anode 15, a grid 16, and a cathode 17. The device may be of the type generally known as a "Thyratron" or "trigger" tube. The grid 16 of the device 15 may be negatively biased with respect to the cathode 17 by any suitable means, such as, for example, a battery 18. Also included in the circuit between the grid 16 and the cathode 17 is the secondary winding 19 of a transformer 20, the primary winding 21 of which is connected to a source of synchronizing signals 22. This source 22 may be located at the transmitter or the receiver and may take any of a number of well-known forms. For example, if the circuit now being described is used in connection

with a cathode ray tube at the receiver, and a scanning disc is used to generate the image and synchronizing signals, an arrangement for generating the synchronizing signals may be used similar to the one described in Patent 2,050,363, Aug. 11, 1936 to E. R. Morton. If a cathode ray device is used at the transmitting station, the return pulses of the horizontal and vertical deflecting circuits may be used to generate the synchronizing signals for the corresponding sweep circuits at the receiving station.

When the source 22 generates a synchronizing signal, the potential of the grid 16 is made more positive, thus allowing the gas-filled tube T to discharge the condensers 11 and 12.

For coupling the sweep circuit to the deflecting plates 31 and 32 of the cathode ray tube 30, coupling condensers 23 and 24 and high resistance 25 are used. The resistance 25 which may be of the order of millions of ohms is connected across the plates 31 and 32, the mid-point 26 of this resistance being connected to the accelerating anode 33 of the cathode ray device 30. Coupling condensers 23 and 24 assume charges such that in the steady state the average value of the potential difference existing between deflector plates 31 and 32 is zero, causing the deflections of the cathode ray beam to be substantially equal in both directions from the center of the fluorescent screen. Coupling condensers 23 and 24 also serve to block off the high average potential of the deflector plates 31 and 32 from the circuit elements to the left of condensers 23 and 24 in the drawing.

The cathode ray device 30 has a means, such as a cathode 34, for generating an electron beam, proper focussing means for giving this beam the proper diameter (all of the focussing means not being shown but including an accelerating anode 33), and two sets of deflecting plates 31, 32 and 36, 37 for causing the beam to scan in turn every elemental area of the screen 35. Across deflecting plates 31, 32 is connected a sweep circuit such as described in this specification for generating saw-toothed wave forms. Across the other set of plates 36, 37 is connected a sweep circuit 38 similar to that connected to the plates 31, 32 except that the frequency of oscillations is different, which difference requires that the resulting circuit constants be also different. To better understand this, let it be assumed that the circuit described above and which is connected to the plates 31 and 32 is adapted to deflect the beam horizontally across the screen 35. A synchronizing signal is generated at the conclusion of every scanning line and the frequency of oscillations is thus the number of frames scanned per second times the number of elemental lines. The sweep circuit 38 may be used to produce vertical deflection and a source of synchronizing signals (not shown) then generates a signal once every frame. The lower frequency oscillations thus resulting necessarily require condensers of larger capacities.

The cathode 34 of the cathode ray device 30 is heated by any suitable means such as a heater 39 receiving current from a suitable source such as the battery 40. The cathode 34 may be placed at ground potential and the high voltage source 41 connected between the cathode 34 and the accelerating anode 33. Any suitable means such as the modulating element 42 may be used to control the intensity of the cathode ray beam in accordance with the varying intensity of the image current generated at the transmitting station.

The operation of the sweep circuit described above is as follows: The condensers 11 and 12 are charged by the battery 14 through the constant current device 13 substantially linearly with respect to time. As the common terminal of the condensers 11 and 12 is connected to ground and these condensers are of equal capacity, points A and B assume potentials which are equal in magnitude but opposite in polarity. For example, point A will gradually and linearly assume a positive potential while point B will assume in the same manner a negative potential of the same magnitude. At periodic intervals, as, for example, at the end of each line of the scanned object at the transmitter, a synchronizing signal is generated by the source 22 which is sufficient to overcome the negative bias on the grid 16 and initiate a discharge in the "Thyratron" or trigger tube T. This discharge of the condensers 11 and 12 causes the potentials of the points A and B to almost reach ground potential. This drop in potential across the anode-cathode path of the "Thyratron" tube T will cause the discharge to cease and allow the grid 16 to regain control. The condensers 11 and 12 are now being charged again as before. These repeated chargings and dischargings cyclically cause the points A and B to gradually build up to high potentials and then to suddenly discharge to substantially zero again. These changes in potential are applied across the sweep plates 31 and 32 through the coupling condensers 23 and 24. As the common terminal of the substantially equal capacities 11 and 12 is connected to ground and as the anode 33 of the cathode ray tube 30 is connected to the mid-point 26 of the high resistance 25, the sweep potentials applied to the deflecting plates 31 and 32 of the device 30 are balanced with respect to the potential of the anode 33, that is, the instantaneous average of the potentials applied to the two plates is substantially equal to the anode voltage at all times. Because of the balanced sweep potentials, there is no loss of focus or distortion which would otherwise result if the sweep potentials were unbalanced. Furthermore, a square or rectangular pattern is produced on the screen of the tube in place of the wedge-shaped pattern which would be produced with unbalanced sweep potentials.

While the cathode ray device 30 is described above in connection with television reception, it is of course to be understood that a sweep circuit embodying this invention may be used with cathode ray transmitting tubes or with similar tubes for oscillographic or other purposes requiring sweep potentials. Various other modifications may obviously be made without departing from the spirit of the invention, the scope of the invention being defined by the appended claims.

What is claimed is:

1. A sweep circuit comprising two condensers connected in series, means for maintaining the common terminal of said condensers at a fixed potential, means comprising a source of potential and a constant current device for charging said condensers substantially linearly with respect to time, and means comprising a gas-filled electron discharge device for discharging said condensers at predetermined intervals.

2. In a sweep circuit, two condensers of equal capacity connected in series, means for maintaining the common terminal of said condensers in series at a fixed potential, means comprising

a source of potential and a constant current device for charging said condensers substantially linearly with respect to time, and means comprising a gas-filled electron discharge device actuated at predetermined intervals by synchronizing signals for discharging said condensers at predetermined intervals.

3. A sweep circuit comprising two condensers connected in series and having a common terminal, means for maintaining the common terminal at a fixed potential, and means for periodically varying the potential between the other terminals of said condensers to produce a substantially linear saw-toothed voltage wave across said other terminals.

4. A sweep circuit comprising two condensers connected in series and having a common terminal, means for maintaining the common terminal at affixed potential, and means for periodically varying the potential between the other terminals of said condensers to produce a substantially linear saw-toothed voltage wave across said other terminals, said varying means comprising a source of uni-directional current for charging said condensers.

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