

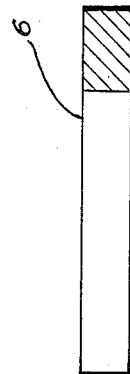
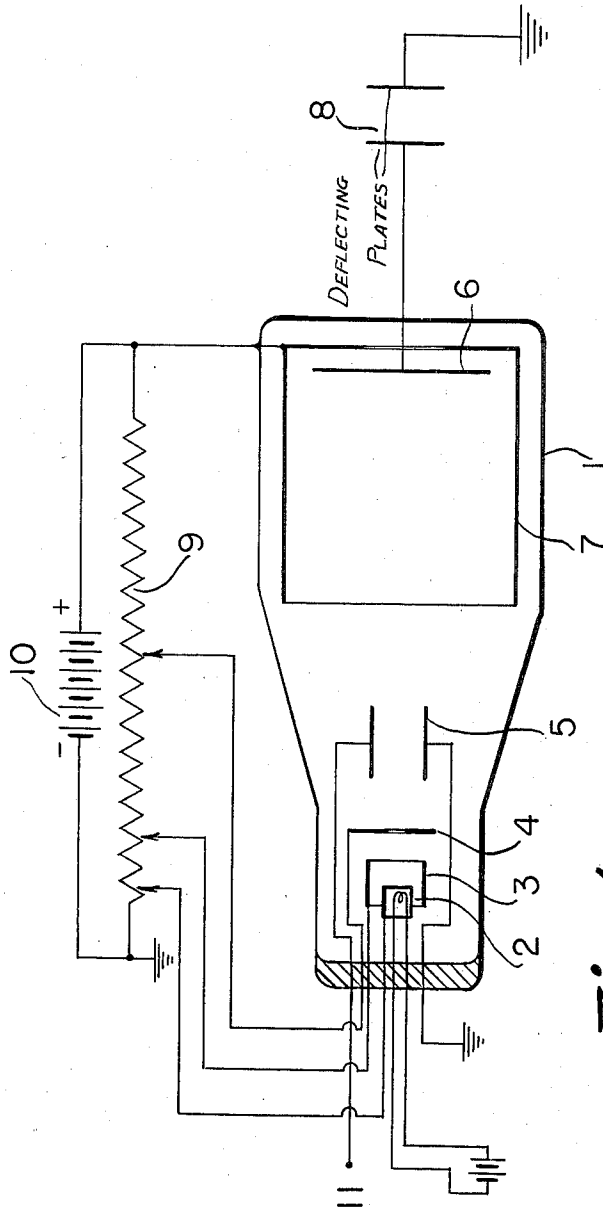
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CATHODE RAY APPARATUS

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CATHODE RAY APPARATUS

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This invention relates to a method and means for generation of sawtooth waves, particularly in connection with use in cathode ray apparatus for television purposes.

Heretofore, sawtooth waves for deflection of cathode ray beams have been generated by charging a condenser through a high impedance and periodically discharging it through a low impedance, or vice versa, or by means of relaxation oscillators. All of these methods involve a considerable amount of apparatus, particularly when used for television purposes, where it is necessary to synchronize such sawtooth wave generators with transmitted synchronizing signals.

It is the object of this invention to provide simpler means for sawtooth generation; to provide a more efficient method of sawtooth generation; to provide simpler means for synchronism of deflecting-wave generation in television receivers; other advantages and objects will become apparent from the following.

Broadly considered, this invention makes use of the fact that different materials, or differently treated surfaces, emit secondary electrons upon electron impact at ratios greater or smaller than unity. If an electron beam is alternately directed upon a surface possessing a secondary-emission ratio greater than unity, and upon a surface possessing a secondary-emission ratio smaller than unity, this can be used to increase its potential and to cause its decrease alternately.

Figure 1 is a view of the saw-tooth generator connected to one set of deflection plates of a cathode ray tube.

Figure 2 is a front view of the secondary emitting surface of Figure 1.

The invention will now be described in detail in connection with the drawing. In Figure 1, a vacuum receptacle 1 houses an electron gun structure consisting of a cathode 2, a control element 3 and an anode 4. Envelope 1 also contains a pair of deflecting plates 5, a strip of metal 6, the surface of which, as shown in Figure 2, is divided into two portions, the shaded portion possessing a secondary-emission ratio greater than unity while the unshaded portion has a ratio smaller than unity, and a secondary electron collector 7. One of a pair of deflecting plates 8 of a cathode ray tube, not shown in the drawing for simplicity's sake, is directly connected with secondary-emitting electrode 6, while the other plate is grounded. A voltage divider 9 across voltage source 10 energizes the sawtooth wave generator.

In operation, a cathode ray beam is produced

by the electron gun 2, 3 and 4, the construction of which may be any one of those known in the art most suitable for the purpose. The cathode ray beam is directed upon electrode 6 where it liberates secondary electrons, which are collected by electrode 7, to which is applied the highest positive potential in the system. The cathode ray beam can be scanned across electrode 6 by means of a varying potential applied to deflecting plates 5 at point 11. Electrode 6 is isolated, so that it may be spoken of as a "floating" electrode. When the cathode ray beam impacts that portion of electrode 6 possessing a secondary emission ratio greater than unity, the potential of electrode 6 will become increasingly positive by virtue of the fact that more secondary electrons depart from electrode 6 than primaries arrive. This rise in potential would theoretically continue until electrode 6 had almost reached the potential of anode 7, at which point equilibrium would be established, that is, the number of electrons collected by anode 7 would be equal to the number of electrons impacting electrode 6. However, in operation equilibrium is not allowed to be reached, the process being interrupted before this takes place. An increase in potential of electrode 6 will, of course, increase the impacting velocity of the oncoming primary electrons. To avoid changes in the secondary-emission ratio caused thereby, the device is operated at such velocities of the primary electrons that the secondary-emission ratio versus electron velocity curve is substantially flat, that is, in the region of saturation, where changes in electron velocity no longer produce changes in secondary-emission ratio. Therefore, the rise of potential of electrode 6 will be a function of the intensity of the oncoming cathode ray beam, the secondary-emission ratio and the time, provided, however, that anode 7 is at all times held at a potential sufficiently more positive than electrode 6 so that it is capable of collecting all secondary electrons produced by electrode 6.

If the cathode ray beam is directed upon that portion of electrode 6 which possesses a secondary-emission ratio smaller than unity, the potential of electrode 6 will decrease by virtue of the fact that the number of oncoming electrons is greater than that of the departing electrons.

If now the cathode ray beam is alternately caused to impact the two portions of electrode 6 possessing different secondary-emission ratios, this will cause an alternate increase and decrease in potential of electrode 6. As explained above, the change in potential is proportional

to the intensity of the cathode ray beam, the secondary-emission ratio and the time. Thus, if the first two factors remain constant, it will readily be seen that the increase and decrease in potential are a linear function of time and, therefore, it is possible to produce straight-line waves, such as, for instance, asymmetrical sawtooth waves, by allowing the cathode ray beam to impact the portions of different secondary-emission ratios of electrode 6 for different lengths of time. This may be accomplished by applying a deflecting voltage to plates 5, as mentioned above. It will be understood from the foregoing that the wave shape of the deflecting voltage applied to plates 5 has no influence upon the linearity of the produced sawtooth wave inasmuch as the increase and decrease of potential are merely a function of time. Of influence on the wave shape of the produced sawtooth wave is merely the instant at which the cathode ray beam is deflected across the dividing line between the portions of electrode 6 of different secondary emissivity, because this controls the start of the rising and the falling portions of the produced sawtooth wave.

In operation for television purposes, the produced sawtooth wave must be synchronized with incoming synchronizing signals. It is possible to superimpose synchronizing signals upon the deflecting voltage applied to plates 5 at point 11 in such polarity as to deflect the cathode ray beam upon that portion of electrode 6 determining the shorter portion of the produced sawtooth wave, which will in most cases be the retracting period of the line-scanning cycle, as it is customary in television to transmit synchronizing signals during this period. It is also possible to apply the composite television signal only at point 11 for deflection of the cathode ray beam. Thus, during the time of picture signal transmission, the cathode ray beam is caused to impact that portion of electrode 6 causing the decrease of the potential of this electrode, and in turn during the synchronizing period the cathode ray beam is caused to impact that portion of electrode 6 causing the rise in potential. Thus, it may be seen that a sawtooth wave for horizontal scanning is produced in strict synchronism with the scanning at the television transmitter. It is necessary only to adjust the deflection of the cathode ray beam in such a manner that the traversal of the beam from one portion of electrode 6 to the other portion of different secondary emissivity occurs at the correct instant.

In conventional sawtooth generators for cathode ray beam deflection, it is necessary to shunt

a resistor across the deflecting plates, in which case this resistor dissipates the greater portion of the energy developed. In the arrangement according to my invention, this resistor becomes unnecessary due to the fact that electrode 6 is isolated. This provides a more efficient method of producing sawtooth voltage waves.

In case a sawtooth current wave for magnetic deflection is desired, the potential produced at electrode 6 can be applied to the control grid of a conventional vacuum tube, such as, for instance, a triode, in the output circuit of which scanning coils are arranged for magnetic deflection of cathode ray beams.

What I claim is:

1. In a television system the combination of a first cathode-ray tube including means for generating an electron beam, a target comprising materials of different secondary-emissive characteristics and means for deflecting said electron beam across said target in accordance with a television signal comprising picture signal components and synchronizing signal components, thereby alternately to raise and lower the potential of said target, a second cathode-ray tube for reproducing said picture signals including means for generating an electron beam and electrostatic means for deflecting said beam, and means for coupling said electrostatic deflecting means to said target, thereby to deflect said electron beam of said second cathode-ray tube.

2. In a television system the combination of a first cathode-ray tube including means for generating an electron beam, a target comprising materials of different secondary-emissive characteristics, a pair of deflecting plates, and means for applying a television signal comprising picture signal components and synchronizing signal components to said deflecting plates for deflecting said electron beam across said target in accordance therewith, thereby alternately to raise and lower the potential of said target, a second cathode-ray tube for reproducing said picture signals including means for generating an electron beam, a pair of deflecting plates for deflecting said last-named electron beam, a conductive connection between one of said last-named deflecting plates and said target for maintaining said plate at substantially the potential of said target, and means for maintaining the other of said last-named deflecting plates at a substantially steady potential, thereby to deflect said electron beam of said second cathode-ray tube.

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