

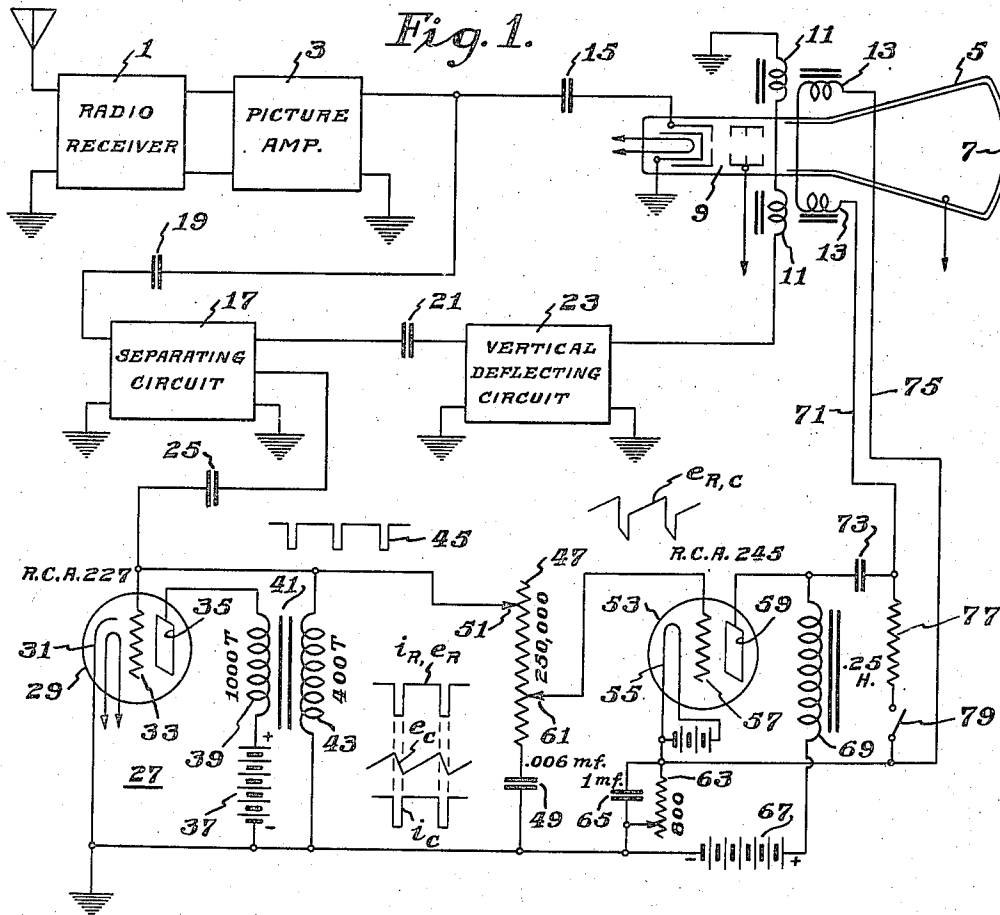
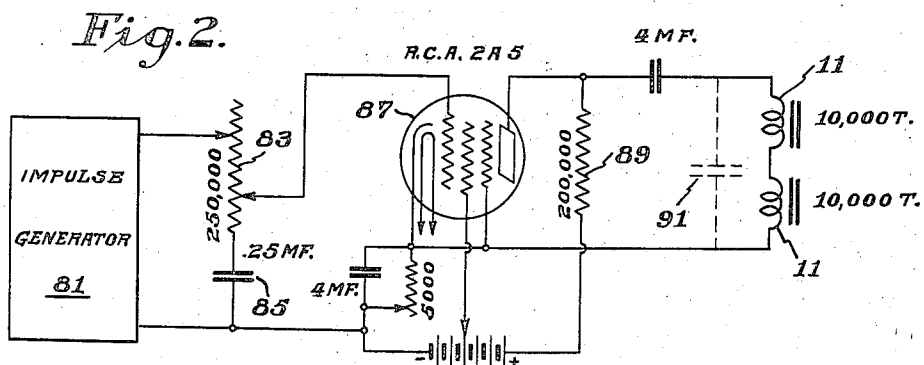
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DEFLECTING CIRCUIT

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DEFLECTING CIRCUIT

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Delaware

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7 Claims. (Cl. 250—36)

My invention relates to deflecting circuits for cathode-ray tubes and particularly to television deflecting circuits which are operated in synchronism with controlling or synchronizing impulses.

An object of my invention is to provide an improved deflecting circuit which is comparatively low in cost.

A further object of my invention is to provide a simplified deflecting circuit which will produce a voltage of the desired wave form and which may be synchronized readily with a controlling signal.

A still further object of my invention is to provide an improved deflecting circuit which will produce a voltage wave containing a saw-tooth component and a large impulse component.

In the preferred embodiment of my invention, an electric discharge tube is so connected with associated circuit elements that it oscillates to produce substantially square-top voltage impulses periodically. These impulses are impressed upon a resistor and a capacitor which are connected in series, the resistor having a comparatively high resistance value. Voltage appearing across a portion of the resistor-capacitor combination is applied to a second electric discharge tube which supplies either a saw-tooth current or a saw-tooth voltage to a cathode-ray tube deflecting device.

Other objects, features and advantages of my invention will appear from the following description taken in connection with the accompanying drawing, in which—

Figure 1 is a circuit diagram of a television receiver embodying my invention, and

Fig. 2 is a circuit diagram illustrating another embodiment of my invention.

In Fig. 1, my improved deflecting circuit is shown applied to a television receiver which includes a radio receiver 1, a picture amplifier 3 and a cathode-ray receiver tube 5. The cathode-ray tube 5 comprises an evacuated envelope having a fluorescent screen 7 at one end and an electron gun 9 at the other end for producing an electron beam.

Suitable deflecting devices, such as deflecting coils 11 and 13, are provided for deflecting the electron beam vertically and horizontally, respectively, for scanning the fluorescent screen 7.

The output of the picture amplifier 3 includes both picture signals and synchronizing signals, all these signals being impressed upon the control grid of the cathode-ray tube 5 through a coupling capacitor 15 and upon a separating

circuit 17 through a coupling capacitor 19. The synchronizing signals consist of horizontal synchronizing impulses which occur at the end of each scanning line and of framing impulses which occur at the end of each picture frame. The separating circuit 17 separates the picture signals from synchronizing signals, and the horizontal synchronizing impulses from the vertical framing impulses.

The vertical framing impulses are impressed through a coupling capacitor 21 upon a vertical deflecting circuit 23 which produces a flow of saw-tooth current through the deflecting coils 11 in synchronism with the framing impulses.

The horizontal synchronizing impulses are impressed through a coupling capacitor 25 upon a horizontal deflecting circuit designed in accordance with a preferred embodiment of my invention. One unit of the horizontal deflecting circuit is an oscillator 27 of the type described and claimed in my copending application, Serial No. 718,353, filed March 31, 1934, and assigned to the Radio Corporation of America. This oscillator comprises an electric discharge tube 29 such as a vacuum tube having a cathode 31, a control grid 33 and a plate 35. The plate 35 is supplied with positive potential from a suitable source such as a battery 37 through the primary winding 39 of a transformer 41. The control grid 33 is connected through the secondary winding 43 of the transformer 41 to the cathode 31 whereby the plate and grid circuits of the vacuum tube 29 are inductively coupled.

As explained, in the above mentioned copending application, the plate and grid circuits of the tube 29 are coupled in such phase that as the flow of plate current through the primary winding 39 increases, a positive voltage is applied to the control grid 33 through the transformer 41. The plate current increases until saturation is reached, at which time a negative voltage is impressed upon the control grid 33 through the transformer 41 whereby the tube 29 is rapidly driven beyond the cut-off point. As a result of this action, negative voltage impulses of the character indicated by the curve 45 are produced across the secondary winding 43.

In practice it has been found that in order to produce a substantially perfect saw-tooth current flow through a deflecting coil, the voltage impressed upon the deflecting coil circuit must contain a saw-tooth component in addition to the square-top impulse component, this being necessary since the deflecting coil circuit is not purely inductive. In order to produce such a

composite voltage wave, I provide a resistor 47 having a comparatively high resistance value and a capacitor 49 connected in series. The secondary winding 43 of the transformer is connected across this resistor-capacitor combination, the connection to the resistor 47 being through a slidable contact point 51. By varying the position of the contact point 51 the magnitude of the electron beam deflection may be varied as will be apparent from the following description.

The impedance of the resistor 47 is so high that the flow of current through the capacitor 49 produced by the square top voltage impulses 45 is substantially independent of the voltage built up across the capacitor 49 as it becomes charged. Therefore, the flow of current through the capacitor 49 and resistor 47 has substantially the same wave form as the voltage as indicated by the curve i_c . The voltage appearing across the capacitor 49 will have a saw-tooth wave form as indicated by the curve e_c . The voltage appearing across the resistor 47 will have the form indicated by the curve i_r , e_r . It will be apparent that the desired composite wave form for producing a flow of saw-tooth current through a deflecting coil may be obtained by adding the saw-tooth voltage appearing across the capacitor 49 to the square-top voltage impulse appearing across a portion of the resistor 47.

The composite voltage wave is impressed upon the input terminals of an electric discharge tube 53 which preferably is a vacuum tube having a low plate impedance. As illustrated, the tube is a vacuum tube comprising a cathode 55, a control grille 57 and a plate 59. The control grille 57 is connected through a slidable contact point 61 to the resistor 47. The cathode 55 is connected through a self-biasing resistor 63 to the lower end of the capacitor 49, the self-biasing resistor being provided with the usual by-pass capacitor 65.

The plate 59 of the vacuum tube 53 is supplied with a positive potential from a suitable source, such as a battery 67, through an inductance coil 69. One terminal of the deflecting coils 13 is connected to the plate 59 through a conductor 71 and a blocking capacitor 73, while the other terminal of the coils 13 is connected to the cathode 55 through a conductor 75. A resistor 77 is provided which may be connected across the deflecting coils 13 by means of a switch 79 for a purpose which will be described hereinafter.

An important characteristic of my improved deflecting circuit is that the impulse component of the voltage wave applied to the deflecting coils may be much larger than the voltage of any battery or another power supply. For this reason my circuit is especially valuable where it is desired to employ a low plate impedance output tube such as the one illustrated. It will be understood that because of its low plate impedance, such a tube requires only a small saw-tooth component in the voltage impressed upon its input electrodes.

It may be noted that there are several advantages in employing an output tube having a low plate impedance. One advantage is that because of the small saw-tooth voltage component required, any imperfection in this saw-tooth component has comparatively little effect on the shape of the deflecting current wave form. Therefore, with a low impedance tube it is easier to obtain a good saw-tooth current in the deflecting coils.

A further advantage in the use of a low im-

pedance output tube is pointed out in my copending application, Serial No. 741,230, filed August 24, 1934, and assigned to RCA Victor Company, Inc. In the said application it is shown how a resistor, such as the resistor 77, may be connected across the deflecting coils whereby energy stored in these coils will be discharged through the resistor instead of through the vacuum tube during the return line period. This makes it possible to obtain a greater deflection 10 with a given size vacuum tube by increasing the plate voltage and, at the same time, increasing the number of turns on the deflecting coils. With the circuit operated in this manner, the plate voltage is raised considerably above the rated 15 plate voltage with a corresponding increase in plate current, providing a low plate impedance type of tube is employed. In the case of a screen grid tube, which has a high plate impedance, an increase in the plate voltage above the rated 20 value will not materially increase the plate current output.

If the circuit is adjusted to operate with the deflecting coils discharging through a resistor, instead of through the vacuum tube, the preferred adjustment is such that the impulse component of the voltage impressed upon the grid of the output tube is great enough to drive the tube beyond the cut-off point.

My deflecting circuit is easily synchronized 30 with the incoming synchronizing impulses in the manner described in my above mentioned application, Serial No. 718,353. As stated in that application, the oscillator readily oscillates in synchronism with negative synchronizing impulses 35 applied to the control grid.

In Fig. 2, an embodiment of my invention is shown applied to a vertical deflecting circuit. In this circuit a generator of square-top voltage impulses is indicated at 81. The square-top impulses, similar to the impulses 45, are impressed across a resistor 83 and a capacitor 85 connected in series whereby a voltage wave having a saw-tooth component and an impulse component is produced which may be impressed upon a vacuum tube indicated at 87. In this embodiment, the output tube 87 is shown as a pentode although it will be understood that a different type of tube may be utilized if desired. Positive potential is applied to the plate of the tube 87 50 through a plate resistor 89 instead of through an inductance coil because of the difficulty in obtaining an inductance coil having the desired high impedance at the low vertical deflecting frequency.

The output circuit of the tube is coupled to the vertical deflecting coils 11. It may be noted that deflecting coils always have a certain amount of distributed capacity as indicated in dotted lines at 91. This causes certain undesired resonant effects which are minimized by damping the resonant circuit. If a low impedance tube, such as illustrated in Fig. 1, is employed as the output tube, its plate impedance may be low enough to provide the necessary damping. In 65 Fig. 2 the necessary damping is provided by the plate resistor 89 which is effectively shunted across the deflecting coils 11 and the distributed capacity.

While certain types of tubes and certain circuit values have been indicated in Figs. 1 and 2, it will be understood that these are merely given by way of example. The circuit values are indicated in ohms, micro-farads, henrys, and number of turns. Also, although only one form of 75

impulse generator has been illustrated, it should be understood that other forms may be substituted. For example, in a television transmitter deflecting circuit, the vacuum tube oscillator 27 may be replaced by a rotatable disc having openings therein through which a light beam passes to strike a photoelectric cell for the production of voltage impulses in a manner well known.

It will be apparent that various other modifications may be made in my invention without departing from the spirit and scope thereof and I desire, therefore, that only such limitations shall be imposed thereon as are necessitated by the prior art and set forth in the appended claims.

I claim as my invention:

1. In combination, means for producing substantially square-top voltage impulses periodically, a resistor and a capacitor connected in series, means for impressing said impulses across said resistor-capacitor combination, an electric discharge tube having an input circuit and an output circuit, means for applying the voltage drop appearing across said capacitor to said input circuit, and a utilization device coupled to said output circuit, said resistor having such high impedance that the flow of current produced through said capacitor by said voltage impulses is substantially independent of the voltage built up across said capacitor.

2. Apparatus according to claim 1 characterized in that said utilization device is an inductance coil and further characterized in that, in addition to the voltage drop across said capacitor, the voltage appearing across a portion of said resistor is applied to said input circuit.

3. Apparatus according to claim 1 characterized in that said tube is a low plate impedance tube of the three element type.

4. Apparatus according to claim 1 character-

ized in that said first means comprises an electric discharge tube having plate and grid circuits which are inductively coupled and which are non-resonant at the frequency of occurrence of said impulses.

5. In combination, means for producing substantially square-top voltage impulses periodically, a resistor and a capacitor connected in series, means for impressing said impulses across said resistor-capacitor combination, a three element vacuum tube having an input circuit and an output circuit, said tube having a low plate impedance, inductance coils coupled to said output circuit, and means for applying the voltage appearing across said capacitor and the voltage appearing across a portion of said resistor to said input circuit, said resistor having such high impedance that the flow of current produced through said capacitor by said voltage impulses is substantially independent of the voltage built up across said capacitor.

6. Apparatus according to claim 5 characterized in that a resistor element is shunted across said inductance coils, and further characterized in that the voltage appearing across said resistor portion is of the proper polarity and magnitude to drive said tube beyond cut-off.

7. In combination, means for producing substantially square-top voltage impulses periodically, a resistor and a capacitor connected in series, and means for impressing said impulses across said resistor-capacitor combination whereby a voltage having an impulse component and a saw-tooth component may be taken therefrom, said resistor having such high impedance that the flow of current produced through said capacitor by said voltage impulses is substantially independent of the voltage built up across said capacitor.

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