

July 13, 1937.

A. C. STOCKER

2,086,926

DEFLECTING CIRCUITS

Filed Dec. 29, 1934

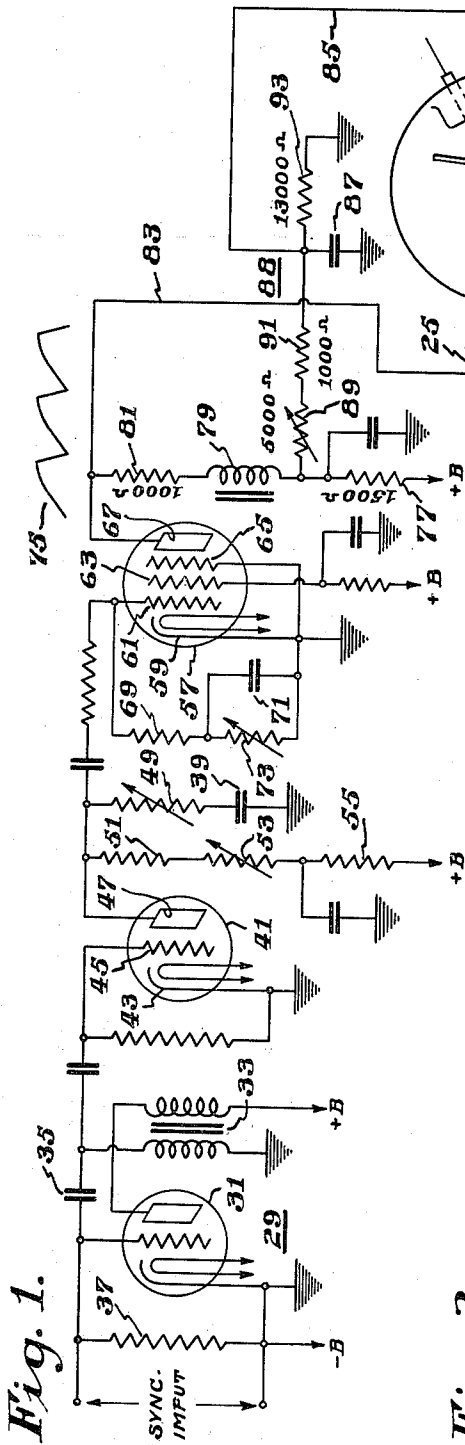


Fig. 1.

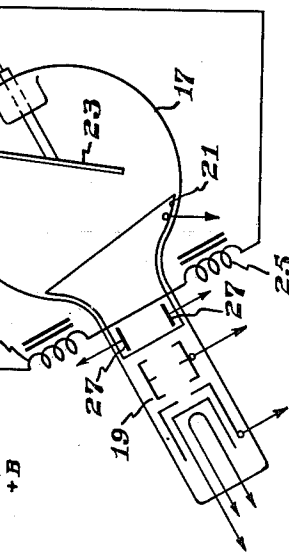


Fig. 2.

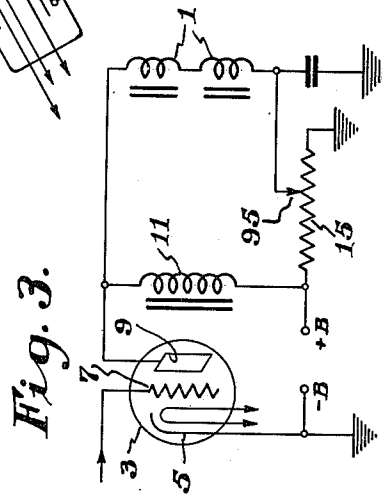


Fig. 3.

INVENTOR
Arthur C. Stocker
BY *D. G. Leaborough*
ATTORNEY

UNITED STATES PATENT OFFICE

2,086,926

DEFLECTING CIRCUITS

Arthur C. Stocker, Haddon Heights, N. J., assignor to Radio Corporation of America, a corporation of Delaware

Application December 29, 1934, Serial No. 759,628

12 Claims. (Cl. 250—27)

My invention relates to cathode ray tube deflecting circuits and particularly to deflecting circuits which include deflecting coils.

It has been found that for various reasons the undeflected electron beam of a cathode ray tube usually does not travel down the exact center of the tube to strike the center of the fluorescent screen, light-sensitive mosaic, or other surface to be traversed by the beam. Among the reasons for this are inaccuracies in tube manufacture, the effect of the earth's magnetic field, and the presence of local magnetic fields.

An object of my invention is to provide an improved means for centering the electron beam of a cathode ray tube.

More specifically, an object of my invention is to provide an improved centering means in electron beam deflecting circuits which include deflecting coils.

A further object of my invention is to provide in electron beam deflecting circuits of the type including deflecting coils a centering means which will center the beam regardless of the direction in which it diverges from the center of the cathode ray tube.

In a preferred embodiment of my invention the deflecting coils of a cathode ray tube are supplied with saw-tooth current from the output electrodes of a vacuum tube, the plate electrode having positive potential applied thereto through a choke coil. In order to provide a flow of direct current through the deflecting coils in the desired direction for centering the electron beam, I take advantage of the fact that there is a direct current voltage drop across the choke coil and connect the alternating current low potential end of the deflecting coils to the positive terminal of the plate voltage supply through a resistor.

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

Fig. 1 is a circuit diagram of a television transmitter deflecting circuit embodying my invention, and

Figs. 2 and 3 are circuit diagrams showing other embodiments of my invention.

Referring to Fig. 2, there is illustrated a simplified form of my invention for producing a flow of direct current through the deflecting coils 1 of a cathode ray tube for the purpose of centering the cathode ray. The circuit includes an electric discharge tube 3 which may be of the three-element type having a cathode 5, a control grid 7, and an anode 9. A positive operating potential

is applied to the anode 9 through an impedance unit such as a choke coil 11 from a suitable source of potential, such as a battery (not shown).

One end of the deflecting coils 1 is connected through a direct current connection to the anode 9 and upper end of the choke coil 11. The other end of the deflecting coils 1 is connected through an alternating current connection including a condenser 13 to the cathode 5. It is through this alternating current circuit that the current having a saw-tooth wave form flows for the purpose of deflecting the cathode ray.

In accordance with my invention, direct current for centering purposes is caused to flow through the deflecting coils by connecting a resistor 15 from the lower end of the choke coil 11 to the alternating current low potential end of the deflecting coils 1. It will be apparent that since the choke coil 11 has a certain amount of resistance, the flow of plate current therethrough will cause the upper end of the choke coil to be negative with respect to the lower end, and that, as a result, direct current will flow from the lower end of the choke coil 11 through the resistor 15 and deflecting coils 1 to the upper end of the choke coil 11. The magnitude of this direct current flow may be adjusted to the desired value by varying the value of the resistor 15.

Referring to Fig. 1, there is shown a preferred embodiment of my invention as applied to the deflecting circuit of a cathode ray transmitter tube 17. The cathode ray tube 17 is of a well-known type comprising an evacuated envelope having therein an electron gun 19, a second anode 21, and a mosaic 23 of light-sensitive elements. Deflecting coils 25 and deflecting plates 27 are provided for causing the cathode ray to scan the mosaic 23.

The circuit for producing a flow of saw-tooth current through the cathode ray tube deflecting coils 25 includes an oscillator 29 which, as illustrated, is of the blocking oscillator type. The oscillator 29 includes an electric discharge tube 31 and a transformer 33, the primary of a transformer 33 being included in the plate circuit of the tube 31, and the secondary being included in the grid circuit of the tube. The grid circuit also includes a condenser 35 and a grid leak resistor 37, whereby the condenser 35 is charged periodically to put a negative potential on the grid of tube 31 such that the tube is blocked, after which the charge leaks off the condenser through the resistor 37 to permit the generation of another voltage impulse. The oscillator 29 is caused to oscillate at the desired frequency by impressing

synchronizing voltage impulses upon the input circuit of the oscillator in the usual manner.

The voltage impulses produced by the blocking oscillator 29 are impressed upon a circuit which generates a saw-tooth voltage wave. This circuit includes a condenser 39 and an electric discharge tube 41 having a cathode 43, a control grid 45 and a plate 47. The condenser 39 is included in a circuit in series with a resistor 49 which may be termed a "peaking resistor," the plate resistors 51 and 53 of the tube 41, a filter resistor 55 and a battery or other source of potential (not shown). The impedance of the plate resistors 51 and 53 is so high that the condenser 39 charges slowly in a substantially linear manner until a positive voltage impulse is impressed upon grid 45 of the tube 41 by the blocking oscillator 29. At this time the plate impedance of the tube 41 is reduced from a very high value to a low value and the condenser 39 discharges through the peaking resistor 49 and tube 41. This charging and discharging of the condenser 39 causes a saw-tooth voltage wave to appear there-across. Any desired value of impulse voltage may be added to the saw-tooth voltage by adjusting the value of the peaking resistor 49. Where a pentode output tube is utilized it may be desirable to omit the peaking resistor entirely.

The output tube 57, which in the circuit illustrated is of the pentode type, includes a cathode 59, a control grid 61, a screen grid 63, a suppressor grid 65, and an anode 67. The input circuit of the tube 57 includes a resistor 69 and a condenser 71 connected in series between the control grid 61 and the cathode 59, the condenser 71 being shunted by a variable resistor 73. If a substantially perfect saw-tooth voltage wave is impressed upon the input circuit of the pentode 57, the wave may be bent over, as indicated by the curve 75, to any desired value by adjusting the resistor 73, whereby the effectiveness of the condenser 71 in accentuating low frequencies is determined. This bending over of the saw-tooth current flowing through the deflecting coils 25 is desired in order to compensate during the upward deflection of the cathode ray for the picture distorting effect due to the mosaic 23 being located at an acute angle to the axis of the electron gun.

The desired positive voltage is applied to the anode 67 of the output tube 57 through a filter resistor 77, a choke coil 79, and a resistor 81. Either the resistor 81 or the choke coil 79 may be omitted providing the remaining unit is given a suitable value of resistance. Of course, it is preferred to apply the plate voltage through a choke coil, since a lower plate supply voltage may be used than when the voltage is applied through a resistor alone.

One end of the deflecting coils 25 is connected to the anode 67 through a direct current connection 83. The other end of the deflecting coils 25, which will be referred to as the low potential end, is connected through a conductor 85 and through a condenser 87 to ground and through ground to the cathode 59 of the output tube 57. The above mentioned connections couple the deflecting coils 25 across the output electrodes of the pentode whereby the saw-tooth current may flow therethrough. The deflecting coils, of course, may be connected either in series or parallel.

For centering purposes, a resistor 88, which may consist of three resistor units 89, 91, and 93 in series, as shown on the drawing, is connected between the lower end of the choke coil 79 and

ground. It will be noted that this ground connection is also a connection to the cathode 59 of the pentode and to the negative terminal of the plate supply source. Therefore, the grounded end of the resistor 88 is connected to a point in the circuit which is negative with respect to the anode 67 of the output tube. The centering circuit is completed by the connection of the low potential end of the deflecting coils 25 to a point on the resistor 88. This point is so selected with respect to the values of the resistor units 89, 91 and 93 that by varying the value of one resistor unit, such as the 5,000 ohm unit 89 indicated as variable on the drawing, the direct current may be caused to flow through the deflecting coils 25 in either direction. This is a great aid in properly centering the cathode ray on the mosaic, or on the fluorescent screen in case the invention is being applied to a circuit employing the receiver type of cathode ray tube.

The way in which direct current may be caused to flow through the deflecting coils in either direction will be better understood by referring to the embodiment of the invention shown in Fig. 3. In this circuit, parts similar to those in Fig. 2 are indicated by the same reference numerals. The difference between the two circuits is that in Fig. 3 one end of the resistor 15 is connected to ground, while the alternating current low potential end of the deflecting coils 1 is connected to the resistor through a variable tap 95. It will be evident that by moving the tap 95 in Fig. 3, or by varying the value of the resistor 89 in Fig. 1, one may vary the ratio of the impedances of the resistor sections to the left and to the right of the point on the resistor to which the deflecting coils are connected. The effect of this can easily be seen by referring to the circuit shown in Fig. 3.

As previously pointed out, the upper end of the choke coil 11 is negative with respect to its lower end due to the flow of plate current therethrough. It is evident that at some point on the resistor 15 the potential is the same as the potential at the upper end of the choke coil. Therefore, if the variable tap 95 is moved to this position, there will be no flow of direct current through the deflecting coils 1. If the variable tap 95 is moved to the left of this position, direct current will flow upwardly in the deflecting coils 1, while if the variable tap 95 is moved to the right of this position, direct current will flow downwardly in the deflecting coils 1. The same result may be obtained by varying the value of the 5,000 ohm resistor 89 shown in Fig. 1.

It will be understood that my invention may be applied to any type of cathode ray tube employing deflecting coils and that the particular form of deflecting circuit is immaterial. Also, it should be understood that the resistance values indicated in ohms in Fig. 1 and the values given below are given merely by way of example. Other values selected to have the proper relation to each other would be equally suitable. In addition to the values given on the drawing, the following values are involved in the direct current balance of the circuit: Direct current resistance of choke coil 79 equals 350 ohms; direct current plate resistance of tube 57 equals 7350 ohms. The resistance of the two coils 25 in series is 200 ohms.

From the foregoing description, 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 placed

thereon as are necessitated by the prior art and set forth in the appended claims.

I claim as my invention:

1. In a deflecting circuit for cathode ray tubes, a deflecting coil, an electric discharge tube having output electrodes, one of said electrodes being a plate electrode, means for coupling said deflecting coil across said output electrodes whereby a saw-tooth current may be supplied thereto, said coupling means including a direct current connection between one end of said deflecting coil and said plate electrode, a choke coil having one end connected to said plate electrode and the other end connected to a source of potential for maintaining said plate electrode positive, and a resistor connected between the other end of said deflecting coil and the junction point of said other end of the choke coil and said source of potential.
2. The invention according to claim 1 characterized in that said resistor is variable whereby the flow of direct current through the deflecting coil may be adjusted.
3. In a deflecting circuit for cathode ray tubes, a deflecting coil, an electric discharge tube having output electrodes, one of said electrodes being a plate electrode, an impedance unit, means for applying an operating potential to said plate electrode through said impedance unit, a direct current connection between one end of said deflecting coil and said plate electrode whereby said one coil end is connected to one end of said impedance unit, a direct current connection including a resistor between the other end of said deflecting coil and the junction point of the other end of said impedance unit and said means for applying operating potential, and an alternating current connection between said other coil end and the other of said output electrodes.
4. In a deflecting circuit for cathode ray tubes, a deflecting coil, an electric discharge tube having output electrodes, one of said electrodes being a plate electrode, an impedance unit, a source of potential connected to apply an operating potential to said plate electrode through said impedance unit, a direct current connection between one end of said deflecting coil and said plate electrode whereby said one coil end is connected to one end of said impedance unit, a resistor connected in shunt to said source of potential, a direct current connection between the other end of said deflecting coil and a point on said resistor, and a condenser connecting said other coil end to the other of said output electrodes.
5. The invention according to claim 4 characterized in that a portion of said resistor is variable whereby the flow of direct current through the deflecting coil may be varied.
6. The invention according to claim 4 characterized in that the connection to said point on the resistor is through a variable tap on said resistor.
7. In a deflecting circuit for cathode ray tubes, a deflecting coil, an electric discharge tube of the type having a control electrode, a cathode and an anode, an impedance unit, a source of potential connected to impress a positive potential upon said anode through said impedance unit, a direct current connection between one end of said deflecting coil and said anode whereby

said one coil end is connected to one end of said impedance unit, a resistor section connected between the other end of said deflecting coil and the other end of said impedance unit, a second resistor section connected between said other coil end and a point on said source of potential which is negative with respect to said anode, and a condenser connecting said other coil end to said cathode.

8. The invention according to claim 7 characterized in that means is provided for varying the ratio of the impedances of said two resistor sections.

9. In a deflecting circuit for cathode ray tubes, a deflecting coil, an electric discharge tube having output electrodes, one of said electrodes being a plate electrode, an impedance unit, means for applying an operating potential to said plate electrode through said impedance unit, a direct current connection between one end of said deflecting coil and a point on said impedance unit adjacent to said plate electrode, a direct current connection including a resistor between the other end of said deflecting coil and another point on said impedance unit further removed from said plate electrode than said first point, and an alternating current connection between said other coil end and said other output electrode.

10. In a deflecting circuit for cathode ray tubes, a deflecting coil, an electric discharge tube having output electrodes, one of said electrodes being a plate electrode, an impedance unit, means for applying an operating potential to said plate electrode through said impedance unit, a direct current connection between one end of said deflecting coil and a point on said impedance unit, means for making the direct current potential of the other end of said deflecting coil either positive or negative with respect to said point, and an alternating current connection between said other end and the other of said electrodes.

11. In a deflecting circuit for cathode ray tubes, a deflecting coil, an electric discharge tube having output electrodes, one of said electrodes being a plate electrode, an impedance unit, means for applying an operating potential to said plate electrode through said impedance unit, means for coupling said deflecting coil across at least a portion of said impedance unit through a direct current circuit whereby the direct current voltage drop in said impedance unit may cause a flow of direct current through said deflecting coil, and means for also coupling said deflecting coil across at least a portion of said impedance unit through a comparatively low impedance alternating current circuit.

12. In a deflecting circuit for cathode ray tubes, a deflecting coil, an electric discharge tube having output electrodes, one of said electrodes being a plate electrode, an impedance unit, means for applying an operating potential to said plate electrode through said impedance unit, means for coupling said deflecting coil across at least a portion of said impedance unit through a direct current circuit which includes a resistor, and a by-pass condenser connected in parallel to said resistor with respect to said deflecting coil and the internal impedance of said tube.

ARTHUR C. STOCKER.