

Dec. 3, 1940.

R. S. HOLMES

2,223,990

CATHODE RAY TUBE APPARATUS

Filed March 28, 1936

Fig. 1.

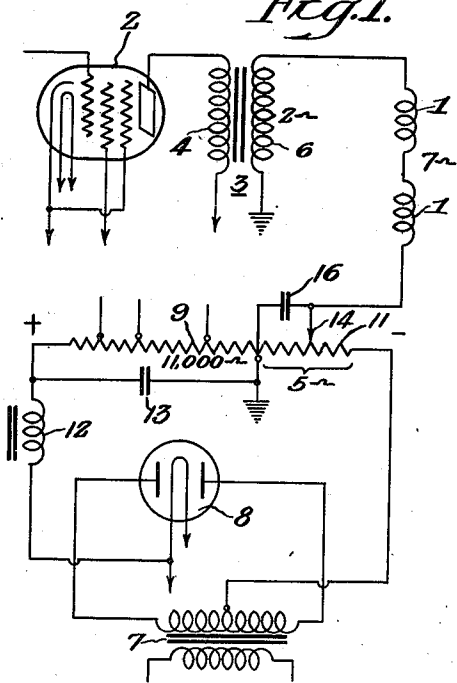


Fig. 2.

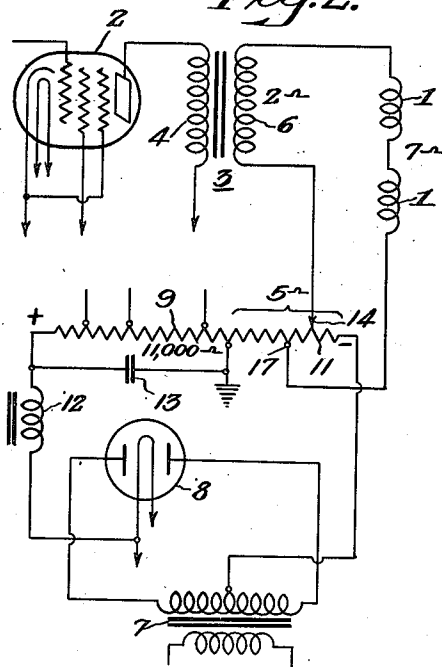


Fig. 3.

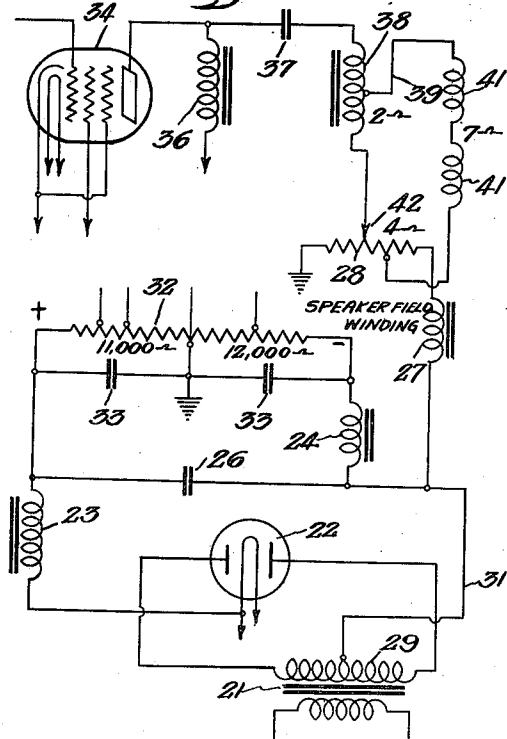
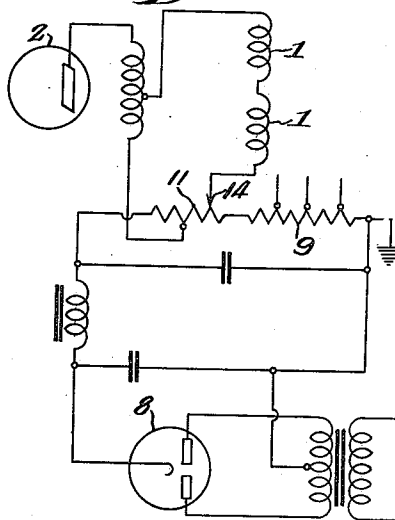


Fig. 4.



INVENTOR
Ralph S. Holmes

BY

[Signature]

ATTORNEY

UNITED STATES PATENT OFFICE

2,223,990

CATHODE RAY TUBE APPARATUS

Ralph S. Holmes, Haddonfield, N. J., assignor to
Radio Corporation of America, a corporation
of Delaware

Application March 28, 1936, Serial No. 71,391

7 Claims. (Cl. 250—27)

My invention relates to centering circuits for cathode ray tube deflecting devices and particularly to centering circuits for deflecting coils.

When a cathode ray tube is used to reproduce the image in television reception it is necessary that the image be centered with respect to a fixed mask near the tube screen. When electromagnetic deflection is used it is customary to accomplish this centering by passing direct current through the deflecting coils.

In the past it has been customary to obtain this direct current from an adjustable tap on a bleeder resistor shunting the power supply rectifier. This method of obtaining the current was very satisfactory so long as the number of turns on the deflecting coils was high so that only a small amount of current (in the order of a few milliamperes) was required to give sufficient centering control.

It has recently been found desirable for numerous reasons to use deflecting coils with only a few turns, particularly on the horizontal coils. In this case the direct current required to give satisfactory centering increases, since deflection is proportional NI , where N is the number of turns and I is the current for the given deflection. With coils now considered to be most satisfactory, the current required for satisfactory centering is of the order of 50 or more milliamperes. With the usual parallel bleeder resistor this current would represent a considerable load on the rectifier and would be very uneconomical of both power and apparatus.

It is accordingly an object of my invention to provide an improved centering circuit for cathode ray tube deflecting devices.

More specifically it is an object of my invention to provide an improved centering circuit for cathode ray tube deflecting coils.

A further object of my invention is to provide an improved centering circuit for low impedance deflecting coils.

A still further object of my invention is to provide, in a television receiver, a centering circuit for deflecting coils which places only a small load on the direct current power supply unit.

In a preferred embodiment of my invention a resistor, which is to function as a centering potentiometer, is placed in series with the power supply rectifier at a point where either all or a substantial amount of the rectified current flows through it. The deflecting coils and the secondary of the deflecting output transformer which are in series are connected across this resistor, one point of connection to the resistor being variable where-

by the amount of centering current flowing through the coils may be varied.

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

Figure 1 is a circuit diagram of one embodiment of my invention, and

Figures 2, 3 and 4 are circuit diagrams of other embodiments of my invention.

Referring to Figure 1, my invention is shown applied to the horizontal deflecting circuit of a television receiver. The output tube which supplies saw tooth current to the horizontal deflecting coils 1 is indicated at 2. Because of the low impedance of the deflecting coils 1 the output circuit of the output tube 2 is coupled to the deflecting coils through a step-down transformer 3 which has a primary winding 4 and a secondary winding 6.

The direct current for centering is obtained from a direct current power supply unit which comprises the usual step up transformer 7, rectifier tube 8 and voltage divider resistor 9.

In accordance with my invention a potentiometer resistor 11 of low impedance is connected in series with the rectifier 8 and voltage divider 9 whereby the voltage drop thereacross may be employed for centering purposes. The power supply unit is provided with the usual filter comprising a choke coil 12 and a condenser 13.

The series combination of deflecting coils 1 and transformer secondary 6 is connected across the potentiometer resistor 11, one end of the secondary 6 being connected to ground and through ground to one end of the potentiometer resistor 11, and one end of a deflecting coil being connected to a variable tap 14 on the potentiometer resistor. It will be seen that the amount of direct current flowing through the deflecting coils 1 may be varied by moving the variable tap 14 along the resistor 11. Although the deflecting coils require a rather large flow of direct current for proper centering, this does not place an unduly large load on the rectifier 8 since the centering current flows through the voltage divider resistor 9 to provide the desired voltage drop thereacross. It will be understood that this voltage drop is utilized for supplying suitable positive voltages to the amplifier tubes of the receiver.

In some cases it may be preferred to provide a by-pass condenser 16 between the variable tap 14 and ground but generally this is not necessary because of the low impedance of the potentiometer resistor 11.

It will be understood that the resistance of the potentiometer resistor and of the various other circuit elements is not critical. The resistance in ohms of certain of the circuit elements has been indicated on the drawing by way of example. Usually the resistance of the potentiometer resistor 11 is of the order of from 5 to 10 ohms. It will be noted that this is a very low resistance compared with the resistance of the voltage divider 9 which ordinarily has a resistance of several thousand ohms. On the other hand, the resistance of the potentiometer resistor is approximately of the same order as the resistance of the series combination of deflecting coils 1 and transformer secondary 6, their combined resistance being 9 ohms in the particular circuit being described. It may be mentioned that the deflecting coils may be connected in parallel instead of in series if preferred.

While the direct current impedances of the potentiometer resistor 11 and of the circuit consisting of the deflecting coils 1 and transformer secondary 6 are of approximately the same order, the alternating current impedance of the resistor 11 at the horizontal deflecting frequency is very low compared with the alternating current impedance of the rest of the deflecting circuit.

If it is desired to increase the amount of centering control, the resistance of the potentiometer resistor 11 may be increased whereby more direct current will be shunted through the deflecting coils 1. In that event, the by-pass condenser 16 will be desirable in order to reduce the alternating current impedance of the deflecting circuit to provide maximum deflection.

Referring to Figure 2, I have shown an embodiment of my invention which permits centering the picture or pattern on the fluorescent screen of the cathode ray tube either to the right or to the left. In Figures 1 and 2 like parts are indicated by the same reference numerals. The circuits in the two figures are the same except for the way in which the deflecting coils 1 and the transformer secondary 6 are connected across the potentiometer resistor 11. In Figure 2, one end of the series combination of deflecting coils 1 and transformer secondary 6 is connected to a point on the potentiometer resistor, preferably the mid-point 17. The other end of this series combination is connected to a point on the resistor through the variable tap 14. It will be apparent that when the variable tap is on one side of the mid-point connection, direct current will flow through the deflecting coils in one direction and that when the variable tap is on the other side of the mid-point connection, direct current will flow through the deflecting coils in the opposite direction.

Referring to Figure 3 of the drawing I have shown an embodiment of the invention in which the cathode ray may be centered in either direction as in the embodiment shown in Figure 2. The power supply shown in Figure 3 comprises the usual step-up transformer 21 and rectifier tube 22, filter chokes 23 and 24 and a filter condenser 26.

In this particular embodiment of the invention, most of the current supplied from the rectifier 22 flows thru the field winding 27 of a loud speaker to energize it, this field winding and a potentiometer resistor 28 being connected in series. The main output circuit of the rectifier 22 may be traced from the midpoint of the secondary 29 of transformer 21, thru a conductor 31 to the loud speaker field winding 27, thru

the field winding 27 and potentiometer resistor 28 to ground, thru ground to a voltage divider 32, and thru the left hand portion of the voltage divider 32 to the choke coil 23 and thru the choke coil 23 to the cathode of the rectifier 22. Positive potentials are supplied to the amplifier tubes of the television receiver from taps on the left hand portion of the voltage divider 32.

In parallel with the loud speaker field winding 27 and the potentiometer resistor 28 there is the choke coil 24 and the right hand portion of the voltage divider 32. Negative biasing potentials are supplied to the amplifier tubes of the receiver from the taps on the right hand portion of the voltage divider 32. The voltage divider is shunted by suitable by-pass condensers 33.

It will be noted that the impedance of the circuit comprising the choke coil 24 and right hand portion of the voltage divider 32 is very high compared to the impedance of the circuit in parallel therewith comprising the loud-speaker field winding 27 and the potentiometer resistor 28. Therefore substantially all of the rectifier output flows thru the resistor 28.

The output tube 34 of the deflecting circuit may be coupled through a plate choke coil 36 and a condenser 37 to an auto-transformer 38 as shown in the drawing. The lower portion of the transformer winding functions as the transformer secondary, its upper terminal being connected through a conductor 39 to one terminal of the deflecting coils 41 and its lower end being connected thru a variable tap 42 to the potentiometer resistor 28. The lower terminal of the deflecting coils 41 is connected to an intermediate point on the resistor 28 whereby the centering current may be caused to flow thru the deflecting coils in either direction by moving the variable tap 42 on either side of this intermediate point.

It will be understood that a two winding transformer may be substituted for the auto-transformer 38.

A simplified circuit may be obtained by employing an auto-transformer without the impedance coupling elements 36 and 37. In that case the potentiometer resistor is connected in series with the voltage divider at the high voltage side of the rectifier. Such a circuit is shown in Figure 4. In this figure and in Figure 1 like elements are indicated by the same reference characters.

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

I claim as my invention:

1. In combination, a pair of cathode ray tube deflecting coils, an output tube having an output circuit for supplying deflecting current, a transformer having a primary and a secondary, said primary being coupled to said output circuit and said secondary being connected in series with said deflecting coils, a direct current power supply unit including a rectifier and a voltage divider connected to be supplied from said rectifier, a potentiometer resistor connected in series with said rectifier and said voltage divider, the resistance of said potentiometer resistor being very low compared with the resistance of said voltage divider, said series combination of secondary and deflecting coils being con-

ected across at least a portion of said potentiometer resistor, and voltage supply taps on said voltage divider.

2. The invention according to claim 1 characterized in that the resistance of said potentiometer resistor is approximately of the same order as the resistance of said series combination.

3. In combination, a pair of cathode ray tube deflecting coils, a source of periodic deflecting current, a transformer having a primary and a secondary, said source being coupled to said coils through said transformer, a source of direct current, and a voltage divider and a comparatively low resistance potentiometer resistor connected in series with each other and said source of direct current, said coils and secondary being connected across at least a portion of said potentiometer resistor whereby a substantial portion of the current supplied by said direct current source flows through said coils, said voltage divider having voltage supply taps thereon.

4. The invention according to claim 3 characterized in that one end of the series combination comprising said secondary and said deflecting coils is connected to an intermediate point on said potentiometer resistor and further characterized

in that the other end of said series combination is connected to said potentiometer resistor through a variable tap.

5. The invention according to claim 3 characterized in that said potentiometer resistor is connected between the negative terminal of said direct current source and ground.

6. In combination, a pair of cathode ray tube deflecting coils, a source of periodic deflecting current, said source including an output tube having a plate electrode, an auto-transformer having a primary and a secondary, a direct current source comprising a voltage divider having voltage supply taps thereon and a comparatively low resistance potentiometer resistor connected in series with said resistor at the positive potential side of said direct current source, said primary being connected between said plate and a point on said resistor, and said coils being connected across said secondary through at least a portion of said resistor.

7. The invention according to claim 1 characterized in that the junction point of said voltage divider and said potentiometer resistor is connected to ground.

RALPH S. HOLMES.