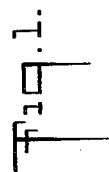
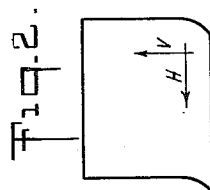
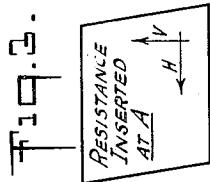
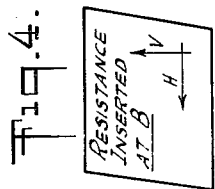


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O. H. SCHADE
ELECTRON TUBE CIRCUIT

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INVENTOR.

OTTO H. SCHADE.

BY

H. J. Grove
ATTORNEY

UNITED STATES PATENT OFFICE

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ELECTRON TUBE CIRCUIT

Otto H. Schade, West Caldwell, N. J., assignor to
Radio Corporation of America, a corporation of
Delaware

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This invention relates to cathode ray beam deflection circuits, and more particularly to a circuit arrangement for deflecting the cathode ray beam in a television image pickup or scanning tube such as that known as the "Iconoscope" type, for example.

As is well known to those skilled in the art, a cathode ray beam may be deflected by subjecting the cathode ray beam to an electromagnetic or an electrostatic field. The direction of deflection is a function of the direction of the deflecting field. In an electronic television system a cathode ray beam is used in both the television image pickup or scanning tube and in the television picture reproducing tube. When the cathode ray beam is deflected by an electromagnetic field, a deflection yoke normally is positioned around the cathode ray tube in such a manner that the electromagnetic field produced by the yoke when an electric current is passed through the winding of the yoke will cause the cathode ray beam to be deflected in a desired direction.

For television purposes, it is desirable to deflect the cathode ray beam in mutually perpendicular directions at different rates, and in order to accomplish this purpose the deflection yoke generally includes a plurality of windings which, when energized by current or voltage variations of proper frequency and having proper wave form, will cause a substantially rectangular pattern to be traversed on the target electrode by the cathode ray beam. In picture reproducing tubes where symmetrical construction is, in general, used, no particular difficulties arise; however, when deflecting the cathode ray beam in a television image pickup or scanning tube of the "Iconoscope" type, several special provisions must be made in order to assure that a substantially rectangular pattern will be scanned on the light sensitive mosaic or charge storage target electrode in the pickup tube.

In the usual "Iconoscope" construction, the target electrode is light responsive, and for illustrative purposes may be considered as being of the general character disclosed by Essig Patent No. 2,065,570 of December 29, 1936. In image transmission an optical image is projected and focused upon one side of the target electrode. This optical image causes the emission of photoelectrons from the target electrode, with the result that an electrostatic charge image is produced across the dielectric element between the light sensitive particles or elements and the signal plate with the magnitude of the charge upon the mosaic or target electrode representing the

light intensities of the optical image. In the "Iconoscope" the light sensitive particles of the mosaic or target electrode is then scanned by a cathode ray beam in order to produce picture signals by discharging the previously produced electrostatic charge image at each elemental area of the mosaic impacted by the scanning cathode ray beam.

Inasmuch as the optical image and the cathode ray beam are both projected against the same side of the target electrode, and since the optical image is preferably projected onto the target electrode along a path substantially normal to the surface thereof, the axis of symmetry of the electron gun structure which produces the cathode ray beam cannot conveniently be positioned normal to the plane of the target electrode, and accordingly it is generally positioned at an angle with respect thereto.

Due to the angular displacement of the target electrode with respect to the axis of symmetry of the electron gun structure, several problems arise insofar as the deflection of the cathode ray beam is concerned. The principal effect due to the displacement of the electron gun structure with respect to the target electrode is that of "keystoning" in which a "keystone" or trapezoidal shaped pattern is scanned on the target electrode when the cathode ray beam is deflected in mutually perpendicular directions and the amplitude and wave form of the electrical energy wave produced by the deflection is maintained substantially uniform. In order to compensate for this keystone pattern, the horizontal deflection of the cathode ray beam is gradually decreased during each field or vertical scanning cycle as the cathode ray beam scans from the bottom to the top of the target electrode, so that a substantially rectangular pattern will be scanned on the target electrode. This effect can best be accomplished by modulating the amplitude of deflection of the cathode ray beam in the horizontal direction by a component of the vertical deflection potential.

Furthermore, due to the angular displacement of the target electrode with respect to the gun structure, the rate of deflection of the cathode ray beam in the vertical or field direction should preferably not be uniform, but should decrease during each field scanning cycle.

Various circuits have been devised for modulating the horizontal deflection of the cathode ray beam to compensate for keystoning, but in general most of such circuits involve a considerable number of tubes and circuit elements. The

present provides means whereby keystoneing may be compensated for by amplitude modulation of the horizontal deflection of the cathode ray beam during each field scanning cycle by means of a simple and convenient method. Furthermore, in the present invention the wave form of the vertical deflection voltage variations is so chosen that the vertical displacement of the cathode ray beam along the target electrode will be substantially uniform in point of time.

Even though the above provisions may be made in a deflection circuit for a television image pickup tube of the "Iconoscope" type, a truly rectangular pattern will still not be scanned on the target electrode because of the inherent asymmetric modulation of the horizontal deflection potentials, and the distortion introduced by the tube supplying the horizontal deflection potentials. Furthermore, various other factors may prevent the cathode ray beam from scanning a perfectly rectangular pattern, including misalignment of the electron gun structure and the presence of a small component of vertical deflection frequency arising from the keystone modulation.

The asymmetric modulation of the horizontal deflection voltage may be compensated according to the present invention by applying a correction voltage of vertical deflection frequency to the control electrode of the tube supplying the horizontal deflection potentials. The cancellation of the small component of vertical deflection frequency is accomplished according to the present invention by the inclusion of means for feeding or supplying a relatively small current component of vertical deflection frequency to the horizontal deflection coils of the yoke together with the inclusion of a compensating resistance when necessary in a portion of the horizontal deflection circuit.

It is, therefore, one purpose of the present invention to provide a deflection circuit for a cathode ray television image pickup tube of the "Iconoscope" type by means of which the cathode ray beam in the tube may be caused to scan a substantially truly rectangular area on the target electrode.

Another purpose of the present invention resides in the provision of a deflection circuit for a television image pickup tube in which the horizontal deflection voltage is amplitude modulated at the vertical deflection frequency rate in order substantially to compensate for opposite effects due to keystoneing.

Another purpose of the present invention resides in the provision of means in a deflection circuit for a television image pickup tube whereby a relatively small voltage component of vertical deflection frequency is applied to the horizontal deflection tube in order to compensate for asymmetric modulation of the amplitude of the horizontal deflection potentials.

A still further purpose of the present invention resides in the provision of means in a deflection circuit for a television image pickup tube whereby an undesired component of vertical deflection frequency in the horizontal deflection circuit may be compensated for by applying a relatively low intensity potential of corresponding frequency to the deflection circuit or by including an impedance in the horizontal deflection circuit.

Various other purposes and advantages will become more apparent to those skilled in the art from the following detailed description, particu-

larly when considered in connection with the drawing wherein,

Figure 1 shows a preferred form of the present invention; and

Figures 2, 3 and 4 show patterns that would be scanned on the target electrode in the absence of the provisions of the present invention.

Referring now to Figure 1, there is shown an electron discharge tube 10 having a cathode, a control electrode and an anode. The cathode is preferably directly connected to ground, and the control electrode is connected to ground through a grid resistance 12. Input signals are then applied between the control electrode and the cathode of tube 10 by way of condenser 14. A pair of input terminals 16 are provided, and to these input terminals is applied a voltage variation having a wave form such as indicated at 18. This voltage variation comprises a series of horizontal impulses occurring at a rate corresponding to the horizontal deflection rate of the cathode ray beam, the impulses of the series extending in a positive direction.

The anode of the tube 10 is connected to a positive terminal 20 by way of a load resistance 22, a portion of potentiometer resistance 24 and a portion of potentiometer resistance 26. The anode of tube 10 is also connected to ground by way of condenser 28 and adjustable peaking resistance 30.

When impulses such as indicated by the curve 18 are applied to the control electrode of tube 10, voltage variations of sawtooth wave form are produced at the anode of tube 10 due to discharge of the charge stored in condenser 28. The average intensity of these voltage variations is determined by the potential applied to the anode of tube 10 which may be controlled by the position of the slidable contact along the potentiometer resistance 24. Furthermore, a negative pulse may be added to the produced sawtooth wave having an intensity controlled by an adjustment of the variable peaking resistance 30 for controlling the current in deflection tube 42 during the retrace interval. In the absence of any further circuit arrangement, and with a constant applied anode potential to the tube 10, the amplitude of the voltage variations present at the anode of tube 10 will remain substantially constant.

In order to compensate for keystoneing, the amplitude of the voltage variations present at the anode of tube 10 should be varied cyclically in accordance with the vertical deflections of the cathode ray beam. This is accomplished by applying a voltage variation having a wave form such as indicated by the curve 32 to terminals 34, one of which is connected by means of condenser 36 to one end of the potentiometer resistance 26. As stated above, the opposite end of the potentiometer resistance 26 is connected to a source of positive potential.

Accordingly, the position of the movable contact along the resistance 26 determines the amplitude of the keystone modulating potential effective for modulating the amplitude of the voltage variations present at the anode of tube 10. By adjusting the position of the movable contact along the resistance 26, it is possible therefore to vary the degree of modulation of the voltage variations produced at the anode of tube 10, and by adjusting the movable contact along the potentiometer resistance 24, the average intensity of these voltage variations may be controlled. The voltage variations produced at the anode of

the tube 10 are then similar to the wave form shown at 40.

A horizontal deflection power tube 42 is also included in the circuit, and this tube includes at least a cathode, a control electrode and an anode. The cathode of tube 42 is connected to ground by means of a cathode resistance 44, in parallel with which is connected a series combination of a resistance 46 and a decoupling condenser 48. Inasmuch as complete decoupling is not desired, the resistance 46 is included in series with the condenser 48.

The control electrode of tube 42 is connected to ground by way of grid resistance 50 and a portion of the potentiometer resistance 52. The potentiometer resistance has a condenser 54 connected in parallel therewith, and the ungrounded end of the potentiometer resistance 52 is connected to the movable contact of the potentiometer 24 by means of resistance 56 and condenser 58. Voltage variations of a wave form such as shown at 40 are then applied to the control electrode by way of coupling condenser 60.

The anode of tube 42 is maintained positive with respect to its cathode by connecting the anode to positive terminal 64 by way of the primary 66 of output transformer 68 and by way of a small choke 70. The choke 70 and the primary 66 of the output transformer 68 are, therefore, connected in series. The junction of these two elements is connected to ground by way of filter condenser 72.

The output transformer 68 also includes a secondary winding 74, and voltage variations for deflecting the cathode ray beam in a horizontal direction are present at the terminals of this secondary winding. An inverted suppressor tube or damping tube 76 is included in the circuit, the tube incorporating at least a cathode and an anode. The anode of tube 76 is connected to conductor 78 and to one terminal of the secondary 74 of the output transformer 68. An inductance 92 and condenser 82 are connected in series between conductors 78 and 80, the latter conductor being connected to the opposite terminal of the secondary winding 74 of the output transformer 68. The cathode of tube 76 is then connected to the junction of inductance 92 and condenser 82 by a variable resistance 94 for controlling horizontal distribution.

As shown in the drawing, the one end of the secondary winding 74 (i. e., conductor 78) is connected directly to terminal 84, whereas the other end of the secondary 74 (i. e., conductor 80) is connected to terminal 86 by way of a beam centering potentiometer 88. The resistance element of the centering potentiometer is connected between terminal 90 (to which a source of potential is applied) and ground, with a point along the resistance element 88 connected to the conductor 80. The movable contact associated with the potentiometer resistance element 88 is connected directly to terminal 86. The horizontal electron beam deflection coils which are contained within the deflection yoke are then connected between terminals 84 and 86.

It has been found that when applying keystone modulation to the horizontal deflection generator, the modulation of the horizontal deflection potentials is not uniform on each side of the alternating current axis thereof throughout the entire field cycle. As a result, a pattern may be scanned on the target electrode such as that shown in Figure 2, where the lower portion of the pattern will be shifted slightly in the horizontal

scanning direction. This shifting during the initial part of the field scanning cycle, as stated above, is a result of asymmetric modulation of the horizontal deflection potentials and incomplete elimination of the modulation frequency (vertical deflection frequency) in the deflecting coils 96 because of the frequency characteristics of transformer 68. By an inspection of the voltage variation curve shown at 40, it may also be seen that the horizontal deflection potentials at the beginning of a frame deflection cycle are not symmetrical with respect to the alternating current axis of the voltage variations. In order to compensate for these undesired effects, a small component of the keystone modulation voltage variation represented by curve 32 but modified in wave form by condenser 54, is applied to the control electrode of the horizontal deflection output tube 42. This application of the keystone modulation potential to the control electrode of the tube 42 is derived from the voltage variation applied to the terminals 34, and after the keystone modulation potentiometer 26 has been adjusted, further control of the potentials applied to the control electrode of tube 42 are determined by an adjustment of the keystone correction potentiometer 52. These voltage variations are applied to the keystone correction potentiometer 52 by way of condenser 58 and resistance 56. When such potentials are applied directly to the control electrode of tube 42, the current variations present in the deflecting coils 96 are affected in such a manner that the modulation becomes symmetrical with respect to the alternating current axis, and the current variations may then have a wave form such as indicated by the curve shown at 41.

Unless this provision is made, the area traversed on the target or mosaic electrode of the television pickup tube will be similar to that shown in Figure 2, wherein the first portion of the scanned area is shifted out of alignment due to the non-symmetrical wave form condition resulting from asymmetric modulation of the horizontal voltage variations. In Figure 2 (as in Figures 3 and 4) the area represents the area scanned on the mosaic or target electrode of the television pickup tube, and the direction of both horizontal and vertical scanning is indicated by arrows in the figure. Both of these scanning directions are opposite to the directions of scanning in a television receiving tube, since in the television transmitting tube the optical image is not only inverted but is reversed from left to right. Accordingly, the scanning operation begins at the lower right hand corner and finishes at the upper left hand corner, as indicated by the arrows.

When a keystone correction potential is applied to the control electrode of tube 42, as described above, the non-symmetrical condition of the horizontal deflection voltage variations is compensated so that the modulations of the horizontal deflection current variations can be made symmetrical with respect to its alternating current axis. With a proper adjustment of the movable contact along the potentiometer resistance 52, the sides of the scanned area should then be perfectly straight and parallel. It is supposed, of course, that the movable contact along the potentiometer resistance 26 is properly adjusted in order to afford the desired modulation to compensate for the keystone effect. The amplitude of the deflection current variations (i. e., the width of scanned area on the target electrode) may be controlled by an adjustment of the mov-

able contact along the potentiometer resistance 24.

In spite of the provisions above referred to, it is still possible that the scanned area of the mosaic may not be truly rectangular. As a result, the area traversed by the cathode ray beam on the target or mosaic electrode may be tilted to the left or to the right as indicated respectively in Figures 3 and 4. The present invention also includes an arrangement to compensate for this tilt or inclination.

As described above, the horizontal deflection circuit as shown in Figure 1 includes a damping tube 76, and it has been found desirable to supply to the horizontal deflecting coils a small component of vertical deflection frequency to balance out a vertical modulation component introduced by the damping tube circuit and by the coupling transformer, since complete filtering of the vertical deflection component may not be accomplished by the transformer 68. For this purpose the choke coil or inductance 92 is provided, the coil being connected between the anode of the damping tube 76 and the cathode of that tube by way of an adjustable resistance 94. The inductance 92 may be made similar to that of the secondary 74, and in most cases has an inductance of the order of a fraction of a Henry. The horizontal deflection damping circuit connected across the deflecting coils 96 comprises diode 76, resistance 94 and condenser 82. The resistance component of the circuit may be varied to control the horizontal deflection linearity by an adjustment of resistance 94.

The inductance 92 is included as shown in Figure 1, and operates to cancel a small vertical deflection frequency displacement component that arises from the keystone modulation of the current through the diode 76. This component is not large, but might result in causing the traversed area to be a fraction of an inch out of square on the target of a normal television pickup tube. The effectiveness of the cancellation current that is permitted to flow through the inductance 92 may be controlled by an insertion of a small resistance of the order of a few ohms either at point marked "A" or at point marked "B" in Figure 1. If, for example, the area scanned on the target electrode is tilted to the right, as indicated in Figure 4, then by inserting a small amount of resistance at point A the area may be converted to a true rectangle. If, on the other hand, the area scanned on the target electrode tilts to the left, as indicated in Figure 3, the insertion of a small amount of resistance at point B in the circuit will reduce the tilt so that the scanned area may be made perfectly rectangular.

By inserting an excessive amount of resistance at point A or B the scanned area may be caused to tilt to the left or to the right, respectively, as indicated in Figures 3 and 4. In some instances, the resistance of the particular circuit elements used, together with the resistance of the conductors connecting the circuit elements may be exactly proper for causing the cathode ray beam to scan a rectangular area without the insertion of any small additional resistance at either of the points.

The function of the centering control is more or less obvious, and for its operation a low voltage potential is applied to the terminal 90. When the movable contact is positioned at a point corresponding to the point where conductor 80 is connected to the resistance element of the potentiometer, no direct current will be permitted to flow through the horizontal deflecting coils, but if the movable contact is moved to the right or to

the left of this point, then a direct current component may be caused to flow through the deflecting coils in one direction or another to apply a continuous fixed deflection component for centering or properly locating the scanned area in a horizontal direction.

By means of the apparatus described it may be seen, therefore, that the cathode ray beam in a television pickup tube of the "Iconoscope" type may be caused to scan a substantially exact rectangular area on the target electrode with the result that a minimum of distortion is produced on the screen of the television receiving tube.

Although the present invention is described somewhat in detail, it is conceivable that various alterations and modifications may be made therein without departing from the spirit and scope thereof, and it is desired that any and all such alterations and modifications be considered within the purview of the present invention, except as limited by the hereinafter appended claims.

Having now described my invention, what I claim, as new and desire to have protected by Letters Patent is:

1. A cathode ray beam deflection system for use with a cathode ray television pickup tube wherein the target electrode is positioned at an angle with respect to the tube gun structure comprising means for generating voltage variations of substantially sawtooth wave form corresponding to one deflection rate, means for cyclically amplitude modulating the generated voltage variations at a rate corresponding to another deflection rate, an amplifying tube including a cathode, a control electrode and an anode, means for applying the amplitude modulated voltage variations to the control electrode of said tube, means including a load circuit for maintaining the anode positive with respect to said cathode, and means for applying a relatively low intensity voltage variation of said another deflection rate to the control electrode of said tube to compensate for the inherent lack of symmetry in the amplitude modulation of the voltage variations of said one deflection rate.

2. A cathode ray beam deflection system for use with a cathode ray television pickup tube comprising means for generating voltage variations of a predetermined wave form corresponding to one deflection frequency, means for cyclically amplitude modulating the generated voltage variations at a rate corresponding to another deflection frequency, an amplifying tube including a cathode, a control electrode and an anode, means for applying the amplitude modulated voltage variations to the control electrode of said tube, means including a load circuit for maintaining the anode positive with respect to said cathode, and means for applying a relatively low intensity voltage variation of said another deflection frequency to the control electrode of said tube to compensate for the inherent asymmetry in the amplitude modulation of the voltage variations of said one deflection frequency.

3. A cathode ray beam deflection system for use with a cathode ray television pickup tube wherein the target electrode is positioned at an angle with respect to the tube gun structure comprising means for generating line deflection voltage variations of a predetermined sawtooth wave form, means for cyclically amplitude modulating the generated voltage variations at field deflection frequency, an amplifying tube including a cathode, a control electrode and an anode, means for applying the amplitude modulated voltage varia-

tions to the control electrode of said tube, means including a load circuit for maintaining the anode positive with respect to said cathode, and means for applying a relatively low intensity voltage variation of field deflection frequency to the control electrode of said tube to thereby compensate for any asymmetry in the amplitude modulated voltage variations.

4. A cathode ray beam deflecting circuit for use with a cathode ray television scanning tube wherein the target electrode is positioned at an angle with respect to the tube gun structure comprising means for generating voltage variations of substantially sawtooth wave form corresponding to one deflection frequency, means for cyclically amplitude modulating the generated voltage variations at a rate corresponding to another deflection frequency, an amplifying tube including a cathode, a control electrode and an anode, means including a cathode ray beam deflection load circuit for maintaining the anode positive with respect to the cathode, means for applying the amplitude modulated voltage variations to the control electrode of said tube, and means for applying to the control electrode a relatively low intensity cyclically varying voltage having a frequency equal to the said another deflection frequency to thereby compensate for any asymmetric modulation condition in the applied amplitude modulated voltage variations.

5. A cathode ray beam deflecting circuit for use with a cathode ray television pickup tube comprising means for generating voltage variations of a predetermined wave form corresponding to one deflection frequency, means for cyclically amplitude modulating the generated voltage variations at a rate corresponding to another deflection frequency, an amplifying tube including a cathode, a control electrode and an anode, means for maintaining the anode positive with respect to the cathode, means for applying the amplitude modulated voltage variations to the control electrode of said tube, and means for applying to the control electrode a relatively low intensity cyclically varying voltage having a frequency equal to the said another deflection frequency to thereby compensate for any lack of modulation symmetry in the envelope of the applied amplitude modulated voltage variations.

6. A cathode ray beam deflecting circuit for use with a television cathode ray tube comprising means for generating line deflection voltage variations, means for cyclically amplitude modulating the generated voltage variations at field deflection frequency, an amplifying tube including a cathode, a control electrode and an anode, means for applying the amplitude modulated line deflection voltage variations to the control electrode of said tube, and means for applying to the control electrode a relatively low intensity cyclically varying voltage having a frequency equal to the modulation frequency to thereby compensate for any asymmetric modulation condition in the applied amplitude modulated voltage variations.

7. A cathode ray beam deflecting system for use with a cathode ray television pickup tube wherein the target electrode is positioned at an angle with respect to the tube gun structure comprising means for generating voltage variations of a predetermined wave form corresponding to one deflection rate, means for cyclically amplitude modulating the generated voltage variations at a rate corresponding to another deflection rate, an amplifying tube including a cathode, a control electrode and an anode, means for applying the

amplitude modulated voltage variations to the control electrode of said tube, means including an output circuit for maintaining the anode positive with respect to the cathode, said output circuit including a cathode ray beam deflecting coil, a series connected inductance and capacitance connected in parallel with said deflecting coil, and a uni-directional current conducting path connected in parallel with said inductance, thereby to compensate for the undesired modulation component of said another deflection rate.

8. A cathode ray beam deflecting system for use with a television pickup tube comprising means for generating voltage variations of a predetermined wave form corresponding to one deflection frequency, means for amplitude modulating the generated voltage variations by a voltage variation corresponding to another deflection frequency, an amplifying tube including a cathode, a control electrode and an anode, means for applying the amplitude modulated voltage variations to the control electrode of said tube, means for maintaining the anode positive with respect to the cathode, an output circuit coupled to the anode including a cathode ray beam deflecting coil, a series connected inductance and capacitance connected across said deflecting coil, and a uni-directional current conducting path connected in parallel with said inductance, thereby to compensate for the undesired modulation component of said another deflection frequency.

9. A cathode ray beam deflecting system for use with a television pickup tube comprising means for generating line deflection voltage variations of a predetermined wave form, means for amplitude modulating the generated voltage variations at field deflection frequency, an amplifying tube including a cathode, a control electrode and an anode, means for applying the modulated voltage variations to the control electrode of said tube, means for maintaining the anode positive with respect to the cathode, an output circuit associated with said anode including a cathode ray beam deflecting coil, an inductance and a capacitance connected in series across said deflecting coil, and a uni-directional current conducting path connected in parallel with said inductance, thereby to nullify the undesired modulation component of field deflection frequency present in the output circuit.

10. A cathode ray beam deflecting circuit for use with a television pickup tube comprising means for generating voltage variations of a predetermined wave form corresponding to one deflection frequency, means for amplitude modulating the generated voltage variations at a rate corresponding to another deflection frequency, an amplifying tube including a cathode, a control electrode and an anode, means for applying the amplitude modulated voltage variations to the control electrode of said tube, a cathode ray beam deflection load circuit including a cathode ray beam deflecting coil associated with said anode, a condenser, an inductance and a low resistance connected in series across said deflecting coil, and a uni-directional current conducting path connected in parallel with said inductance, whereby a substantially rectangular area may be traversed on a target electrode by the cathode ray beam.

11. A cathode ray beam deflecting circuit for use with a cathode ray television pickup tube wherein the target electrode is positioned at an angle with respect to the tube gun structure

comprising means for generating voltage variations of a predetermined wave form corresponding to one deflection frequency, means for amplitude modulating the generated voltage variations at a rate corresponding to another deflection frequency, an amplifying tube including a cathode, a control electrode and an anode, means for applying the amplitude modulated voltage variations to the control electrode of said tube, means for maintaining the anode positive with respect to the cathode, a load circuit including a cathode ray beam deflecting coil coupled to said anode, a condenser, an inductance and a low resistance connected in series across said deflecting coil, and a uni-directional current conducting path connected in parallel with said inductance, whereby a substantially rectangular area may be traversed on the target electrode by the cathode ray beam.

12. A cathode ray beam deflecting circuit for use with a cathode ray television pickup tube wherein the target electrode is positioned at an angle with respect to the tube gun structure comprising means for generating line deflection voltage variations of a predetermined wave form, means for amplitude modulating the generated voltage variations at field deflection frequency, an amplifying tube including a cathode, a control electrode and an anode, means for applying the modulated voltage variations to the control electrode of said tube, means including a cathode ray beam deflection load circuit for maintaining the anode positive with respect to the cathode, said cathode ray beam deflection load circuit including a cathode ray beam deflecting coil, a condenser, an inductance and a low resistance connected in series in the order named across said deflecting coil, and a uni-directional current conducting path including a diode connected in parallel with said inductance, whereby a substantially rectangular area may be scanned on the target electrode by the cathode ray beam.

13. A cathode ray beam deflecting circuit for use with a television pickup tube comprising means for generating voltage variations of a predetermined wave form corresponding to one deflection frequency, means for amplitude modulating the generated voltage variations at a rate corresponding to another deflection frequency, an amplifying tube including a cathode, a control electrode and an anode, means for applying the amplitude modulated voltage variations to the control electrode of said tube, a cathode ray beam deflection load circuit including a cathode ray beam deflecting coil, a series connected inductance and capacitance connected in parallel with said deflecting coil, a series connected uni-directional current conducting device and low resistance element connected in parallel with said inductance, and means for supplying energy from the anode of the amplifying tube to the deflecting coil end of the capacitance and to the junction of the uni-directional current conducting device and low resistance element, whereby a desired area may be traversed on the target electrode by the cathode ray beam.

14. A cathode ray beam deflecting circuit for use with a cathode ray television pickup tube wherein the target electrode is positioned at an angle with respect to the tube gun structure comprising means for generating voltage variations of a predetermined wave form corresponding to one deflection frequency, means for amplitude modulating the generated voltage variations at a rate corresponding to another deflection frequency,

an amplifying tube including a cathode, a control electrode and an anode, means for applying the amplitude modulated voltage variations to the control electrode of said tube, means including a load impedance for maintaining the anode positive with respect to the cathode, a load circuit including a cathode ray beam deflecting coil coupled to said anode, an inductance and a capacitance connected in series across said deflecting coil, a uni-directional current conducting device and low resistance element connected in series across said inductance, and means for supplying energy from said load impedance across the capacitance and the uni-directional current conducting device, whereby a desired rectangular area may be scanned on the target electrode by the cathode ray beam.

15. A cathode ray beam deflecting circuit for use with a cathode ray television pickup tube wherein the target electrode is positioned at an angle with respect to the tube gun structure comprising means for generating voltage variations of a predetermined wave form corresponding to one deflection frequency, means for amplitude modulating the generated voltage variations at a rate corresponding to another deflection frequency, an amplifying tube including a cathode, a control electrode and an anode, means for applying the amplitude modulated voltage variations to the control electrode of said tube, a transformer having a primary and a secondary winding, means including the primary winding for maintaining the anode positive with respect to the cathode, a uni-directional current conducting device including a cathode and an anode, means for connecting the anode of the uni-directional current conducting device to one end of the secondary winding, an inductance, a first conductor for connecting one end of the inductance to said one end of the secondary winding, a beam deflecting coil, a second conductor for connecting one end of the deflecting coil to said one end of the inductance, and means including a condenser for connecting the cathode of the uni-directional current conducting device and the other end of the inductance to the other end of the secondary winding and to the other end of the deflecting coil, said first and second conductors having a finite resistance in order that a substantially rectangular pattern will be scanned on the target electrode by the cathode ray beam.

16. A cathode ray beam deflecting circuit for use with a cathode ray television pickup tube wherein the target electrode is positioned at an angle with respect to the tube gun structure comprising means for generating voltage variations of a predetermined wave form corresponding to one deflection frequency, means for amplitude modulating the generated voltage variations at a rate corresponding to another deflection frequency, an amplifying tube including a cathode, a control electrode and an anode, means for applying the amplitude modulated voltage variations to the control electrode of said tube, a transformer having a primary and a secondary winding, means including said primary winding for maintaining the anode positive with respect to the cathode, an inductance and a beam deflecting coil, a first conductor for connecting one end of the inductance to one end of the secondary winding, a second conductor for connecting one end of the deflecting coil to said one end of the inductance, means including a condenser for connecting the other end of the inductance to the

other end of the secondary winding and to the other end of the deflecting coil, and a uni-lateral current conducting device connected between said first conductor and the said other end of the inductance, said conductors including low impedances in order that a substantially rectangular pattern will be scanned on the target electrode by the cathode ray beam.

17. A cathode ray beam deflecting circuit for use with a cathode ray television pickup tube wherein the target electrode is positioned at an angle with respect to the tube gun structure comprising means for generating line deflection voltage variations of a predetermined wave form, means for amplitude modulating the generated voltage variations at field deflection frequency, an amplifying tube including a cathode, a control

electrode and an anode, means for applying the amplitude modulated voltage variations to the control electrode of said tube, means including a cathode ray beam deflection load circuit for maintaining the anode positive with respect to the cathode, said cathode ray beam deflection load circuit including a cathode ray beam deflecting coil, a series connected inductance and capacitance connected in parallel with said deflecting coil, and a series connected uni-directional current conducting path and low resistance element connected in parallel with said inductance whereby a substantially rectangular area may be scanned on the target electrode by the cathode ray beam.

OTTO H. SCHADE.