

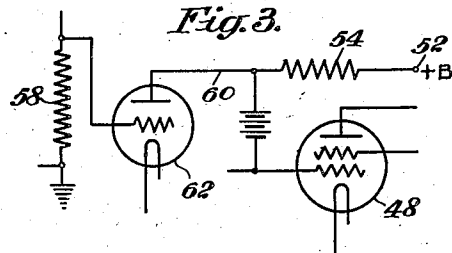
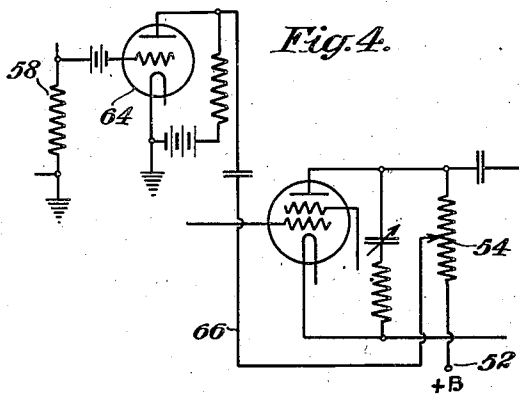
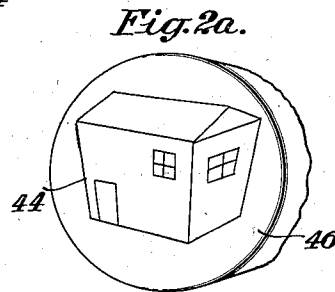
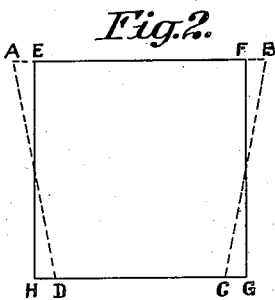
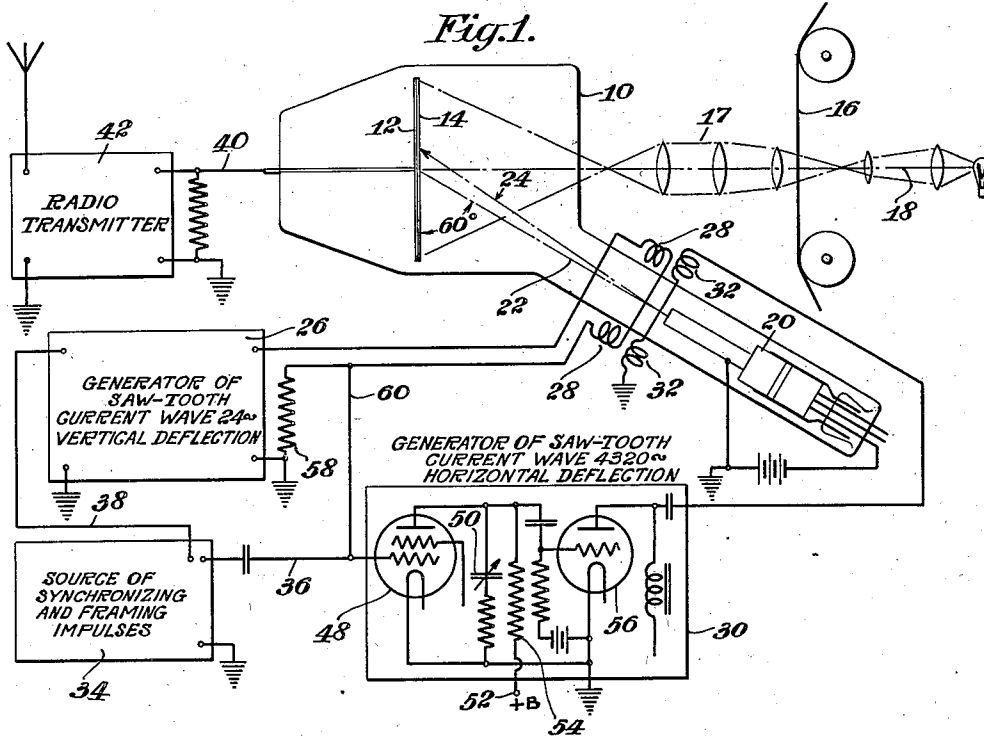
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2,040,813

TELEVISION SYSTEM

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UNITED STATES PATENT OFFICE

2,040,813

TELEVISION SYSTEM

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12 Claims. (Cl. 178—6)

My invention relates to improvements in television systems.

In television systems embodying a cathode ray tube at the transmitting station, and in which the tube comprises a photosensitive mosaic screen on which an image of the object is projected, and which is scanned by a cathode ray, it has been found to be advantageous to project the image on the same side of the screen which is scanned by the ray. When this is done, the axis of the optical system for projecting the image is, as usual, made perpendicular to the screen, but the axis of the so-called gun for developing and directing the ray of electrons is, of necessity, disposed at an acute angle to the screen. On account of this arrangement, the outline of the area scanned by the ray has a keystone shape rather than the desired rectangular shape. This distortion of the scanned pattern is manifested by a substantial and corresponding distortion of the reproduced image at the receiving station, the reproduced image being also the shape of a keystone, with the vertical lines inclined downwardly toward each other.

With the foregoing in mind, it is one of the objects of my invention to provide an improved television system of the character referred to wherein the keystone distortion is corrected.

Other objects and advantages will hereinafter appear.

In accordance with my invention, the cathode ray at the transmitting station is deflected in such manner as to tend to spread out the scanned pattern in a keystone effect opposite to the keystone pattern which would otherwise be scanned, the effect being to substantially entirely compensate or correct for the latter, so that the scanned pattern is rectangular in shape.

More particularly, in accordance with my invention, the cathode ray at the transmitting station is deflected in different directions to scan repeatedly a given area of the photosensitive screen, the amplitude of deflection in one of the directions being substantially uniformly varied during each scanning period to correct for the keystone distortion which would otherwise occur.

My invention resides in the improved method of operation and system of the character hereinafter described and claimed.

For the purpose of illustrating my invention, an embodiment thereof is shown in the drawing, wherein

Figure 1 is a diagrammatic view of a television transmitting system embodying my invention;

Figs. 2 and 2a are diagrammatic views illustrative of the principle of operation; and

Figs. 3 and 4 are simplified diagrammatic views showing modifications of the system in Fig. 1.

In Fig. 1, a transmitting tube 10 is provided with an electrode 12, having the usual photosensitive surface 14 comprised of a great number of minute metallic elements, such as silver globules, each insulated from the electrode 12 and from each other, and each provided with a coating of photosensitive material. In operation, an image of the object, shown as being in the form of a moving picture film 16, is projected upon the photosensitive surface by a suitable optical system 17, the axis 18 of the optical system being perpendicular to the surface or screen 14.

A gun 20 of any suitable construction operates to develop and direct a ray 24 of electrons at the photosensitive surface 14, the axis 22 of the gun being disposed at an acute angle, for example 60°, to the photosensitive surface 14.

For the purpose of causing the ray 24 to scan the surface 14, a saw-tooth current wave, at a frequency of 24 cycles, is developed by a suitable generator 26 and is caused to flow through deflecting coils 28. Also, for this purpose, a saw-tooth current wave, at a frequency of 4320 cycles, is developed by a suitable generator 30, and is caused to flow through deflecting coils 32. The coils 28 deflect the ray vertically, and the coils 32 deflect the ray horizontally. The ray 24, therefore, is caused to scan the surface 14 twenty-four times a second, each scanning being along 180 horizontal lines.

The reference numeral 34 designates any suitable system for developing the usual synchronizing impulses which are supplied to the generator 30 by a connection 36, and the usual framing impulses which are supplied to the generator 26 by a connection 38. The system 34 supplies 4320 synchronizing impulses a second to the generator 30, and supplies 24 framing impulses a second to the generator 26.

In operation, the projection of the image on the photosensitive surface 14 causes discrete electrostatic charges to be stored up over the surface, each elemental charge being proportionate to the light intensity at the elemental area. As the ray 24 scans the surface 14, these charges are neutralized to develop picture signals which are supplied by way of a connection 40 to a suitable radio transmitter 42.

In the system just described, the ray 24 would scan the surface 14 over an area ABCD, as shown in Fig. 2. That is, the scanning pattern would

be the shape of a keystone rather than the desired rectangle. This would cause, at the receiving station, the production of a distorted image 44 on the fluorescent screen of the usual cathode ray tube 46, as represented in Fig. 2a, the vertical lines of the reproduced image being so inclined to each other that the entire image has a generally keystone configuration.

For the purpose of compensating or correcting for the keystone distortion referred to, I propose to modify or vary the amplitude of the horizontal deflection during each scanning period in such a way as to cause the ray 24 to scan a rectangular area such as EFGH in Fig. 2. That is, with reference to Fig. 2, the angular amplitude of horizontal deflection of the ray 24 is decreased uniformly as it scans the upper half of the scanned area, and is increased uniformly as the ray scans the lower half of the scanned area, the amount and rate of such decrease and increase of ray deflection being sufficient to compensate for the keystone distortion which would otherwise take place. For such purpose, I utilize the operating action, in the horizontal deflection system 30, whereby the amplitude of the ray deflection can be increased or decreased by changing the grid bias of the usual discharge tube 48, or by changing the charging potential applied across the usual condenser 50 which produces the initial saw-tooth wave.

In the system illustrated, the condenser 50 is continuously charged, linearly, from a high potential supply 52 through a high resistance 54. When the condenser 50 has stored a definite charge, it is discharged by the tube 48. A saw-tooth wave is thereby developed in the plate circuit of the tube 48, which wave is amplified by a suitable tube 56 and supplied to the coils 32.

The low-frequency saw-tooth current wave developed by the generator 26 produces a corresponding variation of voltage drop across the resistance 58. Therefore, by providing a connection 60 as shown, between the resistance 58 and the control grid of the discharge tube 48 of the horizontal deflection system 30, the grid bias of the discharge tube is made to vary along a saw-tooth path at the framing frequency of 24 cycles. The polarity is such that the amplitude of horizontal deflection is decreased as the ray 24 scans the upper half of the scanned area, and is increased as the ray scans the lower half of this area. In this way, the ray is caused to scan the screen 14 over the rectangular area EFGH, the extent of variation of the grid bias of the tube 48 being just sufficient to correct for the keystone distortion which would otherwise occur.

From the foregoing, it will be seen that in my improved system, I correct for the keystone distortion by utilizing a control action on the horizontal deflection system 30 from the low-frequency vertical deflection system 26.

In the particular embodiment of my invention disclosed in Fig. 1, this is done by impressing the low-frequency voltage wave, developed by the generator 26, on the control grid of the discharge tube 48 in the high-frequency generator 30.

Instead of making the direct connection 60 to the control grid of the tube 48, as in Fig. 1, an intermediate stage of amplification can be introduced, as shown in Fig. 3, wherein the reference numeral 62 designates a suitable amplifier tube for this purpose.

Fig. 4 illustrates a modification wherein the charging voltage on the condenser 50 is modified or varied in accordance with the low-frequency

wave developed by the generator 26. For this purpose, a suitable amplifier tube 64 operates to amplify the voltage wave across the resistor 58, and the amplified wave is applied, by a connection 66, to an intermediate point on the resistance 54.

If required, in some systems, the methods for keystone correction in Figs. 1 and 4 may be used together. In such case, the grid bias of the discharge tube 48 and the charging potential applied across the condenser 50 are both varied in accordance with the low-frequency saw-tooth wave developed by the generator 26.

It will be understood that other modifications are possible without departing from the spirit of my invention or the scope of the claims.

I claim as my invention:

1. In combination, a cathode ray tube including means for generating a beam of electrons, a screen structure positioned in said tube at an acute angle to the axis of said beam generating means, and means acting on the beam for so deflecting said beam that it scans said screen over an area having boundaries which enclose a rectangle.

2. The method of scanning an inclined screen by a cathode ray which comprises producing a relatively low frequency saw-tooth wave, producing a relatively high frequency saw-tooth wave, deflecting the cathode ray in one direction across the screen under the control of said low frequency wave and simultaneously deflecting the cathode ray in a direction substantially at right angles to said one direction under the control of both said high frequency waves and said low frequency waves, over a rectangular area the control of said high frequency waves predominating over the control of said low frequency waves in said last mentioned direction.

3. The method of operating a television system including a cathode ray tube having an electron gun and a light-sensitive screen positioned at an acute angle to the axis of said gun, and including a saw-tooth wave generator comprising a condenser and a source of charging voltage therefor for producing a relatively high frequency saw-tooth wave, which method comprises producing a relatively low frequency saw-tooth wave, deflecting the cathode ray in one direction under the control of said low frequency wave and simultaneously deflecting the cathode ray in another direction mainly under the control of said high frequency wave, and varying said charging voltage in accordance with the instantaneous amplitude of said low frequency wave.

4. In a television system, a cathode ray tube provided with screen structure and means for developing a ray of electrons and directing the same at one side of said structure, the axis of said ray-developing means being disposed at an acute angle to said structure, an optical system disposed exteriorly of said tube and on said side of said structure with its axis substantially perpendicular thereto, and means for causing the ray to scan a keystone area over a plane perpendicular to the axis of said ray-developing means whereby the ray scans the surface of said screen structure over a substantially rectangular area.

5. In a television system, a cathode ray tube provided with screen structure and with means for developing a ray of electrons and directing the same at said structure, the axis of said ray-developing means being inclined at an acute angle to said structure, means for causing the ray to scan said structure comprising a generator of a

relatively low-frequency electrical wave and a generator of a relatively high-frequency electrical wave, an electron tube provided with a control grid and forming part of said second-named generator, and means for applying the low-frequency wave to said grid.

6. In a television system, a cathode ray tube provided with screen structure and with means for developing a ray of electrons and directing the same at said structure, the axis of said ray-developing means being inclined at an acute angle to said structure, means for causing the ray to scan said structure comprising a generator of a relatively low-frequency electrical wave and a generator of a relatively high-frequency electrical wave, a condenser and a source of charging voltage therefor forming part of said second-named generator, and connecting means between said generators for causing the charging voltage to vary in accordance with the low-frequency wave.

7. The method of operating a cathode ray tube which comprises developing a ray of electrons and directing the ray at a screen along an axis at an acute angle to the screen surface, applying a relatively low-frequency wave to deflecting elements to deflect the ray in one direction, applying a relatively high-frequency wave to deflecting elements to deflect the ray in a direction at right angles to the first-named direction; and applying the low-frequency wave to the second-named elements in such manner that the ray is caused to scan a keystone area in a plane perpendicular to said axis.

8. The method of operating a cathode ray device which comprises generating and directing a cathode stream at an inclined screen, generating a low-frequency impulse to cause the stream to scan the screen in one direction, generating a high-frequency impulse to cause the stream to scan the screen at right angles to the first direction, and controlling the high-frequency impulse by the low-frequency impulse to cause the stream to trace a rectangular path on the screen.

9. A cathode ray tube deflecting circuit comprising a tube, means for producing a saw-tooth wave occurring at a relatively low frequency, a condenser, means for charging and discharging said condenser at a relatively high frequency to produce a saw-tooth wave occurring at said high frequency, and means for varying said discharge in accordance with the instantaneous amplitude of said low frequency saw-tooth wave.

10. A cathode ray tube deflecting circuit comprising a tube, means for producing a saw-tooth wave occurring at a relatively low frequency, a condenser, means for charging and discharging said condenser at a relatively high frequency to produce a saw-tooth wave occurring at said high frequency, and means for varying said charge in accordance with the instantaneous amplitude of said low frequency saw-tooth wave.

11. The method of scanning a screen positioned at an acute angle to the axis of an electron gun which includes the steps of projecting an electron beam from said gun against said screen, so deflecting said beam that it scans said screen in a series of parallel paths of scanning, and varying the velocity of each scanning traversal in proportion to the distance of the elemental section of the screen scanned from said electron gun.

12. The method of scanning a screen positioned at an acute angle to the axis of an electron gun which includes the steps of projecting an electron beam from said gun against said screen, deflecting said beam a comparatively large number of times per second in a plane at right angles to the plane of said acute angle, deflecting said beam a comparatively small number of times per second in the plane of said acute angle whereby said beam scans said screen, and varying the velocity of each scanning traversal in said first plane in proportion to the distance of the elemental section of the screen scanned from said electron gun.

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