Dec. 31, 1940. A. N. GOLDSMITH 2,227,080

TELEVISION SCANNING DEVICE

Filed Aug. 6, 1938

Fig. 2

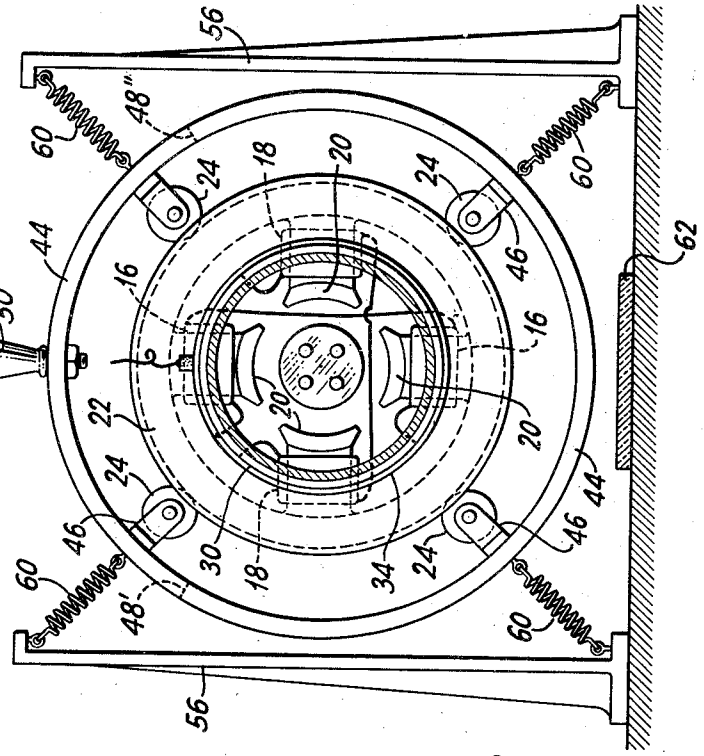
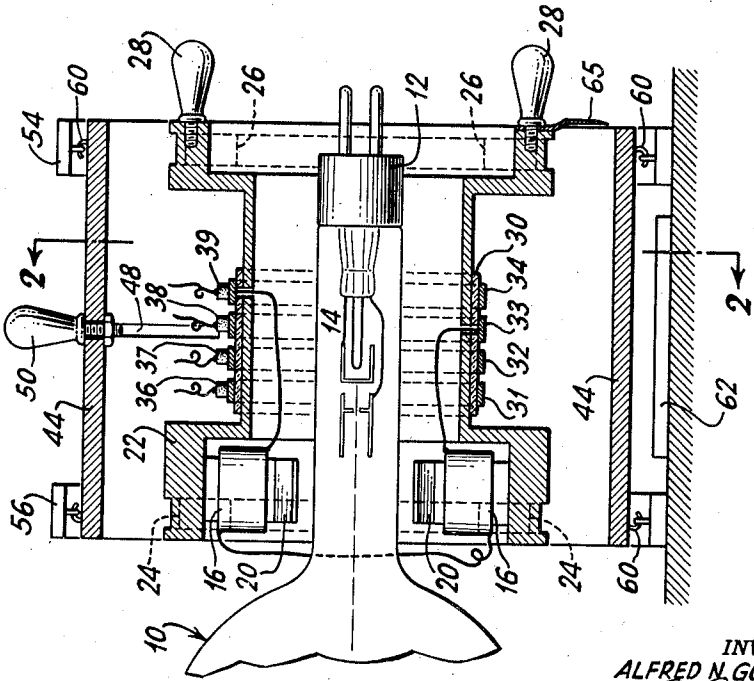


Fig. 1



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TELEVISION SCANNING DEVICE

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9 Claims. (Cl. 250—157)

This invention relates to a new and improved technique in the method of and means for scanning optical images to produce a series of television signals which are subsequently used to produce a picture image of the subject scanned.

More specifically, the invention relates to a new manner of varying or controlling the mode of scanning and an improvement in the apparatus used in conjunction with the scanning of the television transmitter.

In present television scanning apparatus, an optical image of the subject to be transmitted is focused upon a light sensitive mosaic which is positioned inside the television transmitting tube to cause the production of an electrical image of the subject, which electrical image is systematically scanned in two directions by a systematically deflected beam of electrons in order to produce by such scanning a series of signals representative of the electrical image which has been created on the photosensitive mosaic as a result of the projection of the light image thereon. Normally, the scanning is carried out by causing the electron beam to be deflected horizontally at a rapid rate while at the same time the electron beam is moved in a vertical direction at a much slower rate in order that the entire area of the picture may be broken up into a series of electrical signals. These signals, when transmitted and received at a television receiver, operate upon the electron beam in the receiver cathode ray tube to modulate the beam and to produce a visible reproduction of the subject televised. The movement of the cathode ray beam in the receiver must, of course, be maintained in synchronism with and in phase with the movement of the scanning beam in the television transmitting apparatus, and its intensity varied corresponding to the lights and shades of the original picture.

In the commercial presentation of television programs it may become necessary to produce certain desired optical effects which cannot conveniently or practically be actually carried out in the studio. Such optical effects might include a relatively slow movement of the subject either in a circular or in an oscillatory manner, or in a vertical or horizontal plane, or any combinations of these motions in order to simulate a certain desired effect. In conventional television systems this is not possible without actually moving the subject per se, so that the corresponding movement of the image created at the television receiver may result.

It is therefore one purpose of the present invention to provide a new and improved scanning means whereby the image of the subject to be televised may be so scanned that an apparent added movement in any one or more of a plurality of directions may result at the television receiver.

It is a further purpose of the present invention to provide means whereby the image at the television receiver may be caused to appear to rotate in either direction about substantially the geometric center of the image.

It is still another purpose of the present invention to provide means whereby the image at the receiver may be caused to oscillate through any desired angle.

It is still another purpose of the present invention to provide means whereby the television image may be caused to move vertically or horizontally by slight amounts or in any other direction in a plane parallel to the plane of the image.

A still further purpose of the present invention resides in the provision of means whereby the image as produced at the television receiver may be caused to appear to approach and recede from the observer by slight amounts in order to simulate certain desired optical effects, and in order to produce an apparent enlargement and diminution in the linear dimensions of the picture.

It is still a further purpose of the present invention to provide means whereby any of the above mentioned purposes may be carried out simultaneously or in any desired combination.

Other purposes and advantages of the present invention will become more apparent to those skilled in the art from a reading of the following specification and claims, particularly when considered in connection with the drawing, wherein like reference characters represent like parts and wherein:

Figure 1 represents a sectional view of one form of an apparatus constructed in accordance with the present invention, and

Figure 2 shows another view of the same apparatus taken along section lines 2–2 of Figure 1.

A television transmitting device of the cathode ray type includes a vacuum tube in which a cathode ray beam is generated, and in which a photosensitive mosaic is provided, upon which is projected by an appropriate optical system an image of the subject to be televised. Through appropriate cathode ray beam deflecting means the cathode beam is caused to scan the mosaic in order to produce a series of electrical signals therefrom in accordance with the light intensity of the image projected on the mosaic. In Figure 1 is shown a portion of a cathode ray tube 10

having a base 12 and a cathode ray beam generating means 14. The complete cathode ray tube 10 is not shown and the mosaic is not shown, but it is to be understood that the cathode ray tube and the system for scanning in general are preferably of the type described and disclosed by V. K. Zworykin in the Journal of the Institute of Electrical Engineers (British) vol. 73, No. 442 for October, 1933, on page 440 et seq., as well as the Proceedings of the Institute of Radio Engineers for January 1934, and further illustrated by his Patent #2,021,907, assigned to Radio Corporation of America or the pending application of V. K. Zworykin Serial No. 732,750 (RCV Docket 3780). The mosaic which is included within the tube and which is not shown, may, for example, be prepared as disclosed in S. F. Essig Patents #2,020,-305 of November 12, 1935 and #2,065,570 of December 29, 1936.

In present television systems, a cathode ray beam is deflected for scanning the photosensitive mosaic by providing electro-magnets which are energized by a voltage having a wave form which will produce the desired beam deflections. These electro-magnets are spaced on a magnetic yoke and are positioned about the neck of a cathode ray beam between the cathode ray gun or beam producing means and the photosensitive mosaic. In the drawing are shown a pair of deflecting coils 16 for producing horizontal deflections of the cathode ray beam, and positioned at right angles to the axis of these coils are another pair of deflecting coils 18 for producing vertical deflections of the cathode ray beam. All of these deflecting coils are positioned about magnetic pole pieces 20, and all four of the pole pieces 20 are secured to an annular member 22. The annular member 22 is preferably made of magnetic material in order to decrease the reluctance of the magnetic path for the deflecting coil. This annular member is rotatably supported about the neck portion of the cathode ray tube and in order that the annular support may be rotated a plurality of rollers 24 are provided which lie substantially in the plane of the magnetic deflection yoke. For positioning the other end of the annular support member, other rollers 26 are provided, and for rotating the annular member 22 within the rollers a pair of handles 28 are attached to this end of the annular member.

Since the current or voltage source for energizing the beam deflecting coils must be derived from a relatively remote source, and since the coils, together with the yoke and pole pieces, are to be rotated with respect to the stationary cathode ray tube, some provision must be made for completing the electric circuit to the deflecting coils. Accordingly, about the annular member 22 is positioned an insulating band 30 upon which is positioned a plurality of slip rings 31, 32, 33 and 34. Cooperating with these slip rings are a like number of contact brushes 36, 37, 38 and 39. Since the field coils 16 cause horizontal deflection of the cathode ray beam these coils are normally connected in series as is shown in Figure 2 of the drawing, and the unconnected terminal of each coil is connected to the slip rings 33 and 34. Likewise, deflecting coils 18 are connected in series and are in turn connected to slip rings 31 and 32. The deflecting voltages for the coils are then applied to the conductors, which extend from the stationary brushes 36, 37, 38 and 39 which cooperate with the slip rings 31, 32, 33 and 34 respectively. Any appropriate means may be employed for supporting the contact brushes.

For maintaining the rollers 24 and 26 in position about the annular member 22 a second annular support member 44 is provided. This support member completely surrounds the first annular member 22 and the rollers 24 and 26 are attached to the annular member 44 by any appropriate means such as forked supports 46. The annular member 44 is provided with a circumferential opening 48 which extends from the point marked 48' to the point marked 48'' on Figure 2 of the drawing. Cooperating with this circumferential opening 48 is a handle member 50, which may be positioned at any desirable place along the opening for reasons which will become more apparent later. It is necessary, in order to bring about the desired results, to elastically support the annular member 44 with respect to a stationary support member and this is preferably accomplished by means of coil springs. A pair of stationary supports 54 (one of which is shown in Figure 1) is provided at one end of the annular member 44, whereas a second pair of support members 56 are provided at the other end of the annular member 44. To these supports are attached a plurality of springs 60, which are maintained under a certain degree of tension and which are also attached to the annular member 44.

Inasmuch as a certain clearance is provided between the pole pieces and the neck of the cathode ray tube, it is therefore obvious, in view of the spring mounting of the annular member 44 and the deflecting mechanism supported thereby, that the deflecting mechanism, including the pole pieces and deflecting coils, may be moved relative to the cathode ray tube in a direction normal to the axis of the tube. It is also apparent that, because of the fact that the annular member 22 may be rotated with respect to the annular member 44 by reason of the rollers 24, the deflecting mechanism may be rotated about the axis of the stationary cathode ray tube, and the electron beam generated therein. In order that the relative positions of the annular members 22 and 24 may be observed, and in order that they may be returned to a zero or normal operating position, an indicator 65 is provided, the indicator being attached to the rotatable annular member 22 and cooperating with indices (not shown) on the end portion of the relatively non-rotatable annular member 44.

Since the deflection of a cathode ray beam in a magnetic field is in a direction normal to the direction of the field, it is, therefore, apparent that by rotating the deflecting field the direction of deflection of the cathode ray beam may be rotatably varied. Accordingly, when the cathode ray television transmitting tube 10 is in operation, and appropriate deflecting voltages are applied to the deflecting coils 16 and 18, a rotation of the annular member 22 with respect to the tube will cause a rotation of the deflecting field and accordingly, a rotation in the direction of deflection of the cathode ray beam. If under these circumstances an image is brought to focus upon the mosaic of the tube, the direction of scanning of the image may be rotatably varied with respect to the geometric axis of the image and the picture signals derived therefrom will accordingly be altered. Inasmuch as the cathode ray tube at the receiving set is maintained stationary, the signals received during rotation of the annular member 22 will cause a rotation of the image on the fluorescent or luminescent screen of the receiving tube at the receiving set. Inasmuch as this rotation is brought about by merely rotating the deflecting

field of the television transmitting tube, no rotation of the set in the studio or of the actors is necessary in order to produce an apparent rotation of the subject at the television receiver. The rotation of the image at the receiver is, of course, in a direction opposite to the direction in which the deflecting coils are rotated, but the degree of rotation and the rate of rotation are directly proportional to the degree and rate of rotation of the deflecting coils with respect to the cathode ray tube 10. Therefore, the image at the television receiver may be caused to spin around if one of the handles 28 is grasped by an operator and rotated rapidly with respect to the cathode ray tube. An oscillation of the image may also be produced by oscillating the support 22 with respect to the transmitter tube.

Other movements of the image at the television receiver may be brought about by different movements of the deflecting coils with respect to the cathode ray tube. If it is desired to cause the image to be moved slightly vertically it is only necessary to grasp the handle 50 which is attached to the annular member 44 and move it in a vertical direction. When this is done the distortion of the field created by the deflection coils 18 with respect to the electron beam is sufficient to disturb the vertical deflection of the cathode ray beam so that a vertical movement of the image created at the television receiver may result. If it is desired to cause the image to be moved horizontally, then the annular member 44 is accordingly moved slightly back and forth in a horizontal direction normal to the tube axis to cause a corresponding change in the horizontal deflection of the cathode ray beam. The annular member 44, in view of its spring mounting, may of course be moved in any direction in a plane perpendicular to the axis of the cathode ray tube, and in order that forces may be applied in any direction, the handle 50 may be loosened and swung about the periphery of the annular member 44 in the circumferential opening 48 in order that movement in the desired direction may be more readily accomplished.

Furthermore, in view of the spring mounting of the deflecting unit, a certain elastic movement in a direction parallel to the axis of the cathode ray tube is possible, and when the deflecting unit is moved in this direction, the degree of deflection of the cathode ray beam with respect to the mosaic is changed. Moving the deflecting unit toward the base of the tube, that is, away from the mosaic, causes greater deflections of the cathode ray beam and accordingly a reduction in the area of the image field created at the television receiver. By the same token, movement of the deflecting unit toward the mosaic and parallel to the axis of the tube will cause smaller deflections of the cathode ray beam in the transmitter tube so that less of the image projected upon the mosaic is traversed by the cathode ray beam, with the result that the area of the image field created at the television receiver appears enlarged.

To prevent any possibility of the pole pieces 20 striking the transmitting tube, which might result in breakage of the latter, stop means are provided to limit the movement of the deflecting unit in a direction normal to the axis of the tube. One of these stops is shown at 62 and then may, for example, be made of soft rubber, although any other appropriate stop means to adequately perform the function could as well be used. No stop means are necessary to limit the axial movement of the deflecting unit although they may be provided, if desired.

From the above, it may, therefore, be seen that the normal deflections of the cathode ray beam in a television transmitting tube may be so controlled that the signals derived from the signal plate of the transmitter tube may be altered to produce peculiar and astonishing results at the television receiver. These results may be conveniently utilized in the presentation of a television program to produce either comic or dramatic effects. For example, if a comic effect is desired, one scene might show an impressive gentleman slowly walking down a flight of steps, then slipping, and starting to fall. At this point of the action the handle 28 is rotated with increasing rapidity in a certain direction. While the deflecting unit is being rotated, the scene is shifted and the deflecting unit is slowly brought to rest showing a scene of a man in bed bandaged and holding his head. The dissolve from one scene to the other may, of course, be accomplished merely by changing the object projected upon the mosaic, or in fact two cameras may be used, one of the cameras being removed from service and the other placed in service during the rapid rotation of the deflecting coils of each of the cameras.

Furthermore, certain dramatic effects may be accomplished to simulate the spinning fall of an airplane to earth, or in fact a great variety of revolving optical effects may be accomplished during the use of the apparatus.

The movement of the annular support member 22 in a direction normal to the axis of the cathode ray tube to cause a slight movement of the image at the receiver in a particular desired direction may be utilized to simulate the effect of a jolting automobile, for example. Under this condition, the actors may be situated in the television studio and the jolting action of the automobile may be accomplished by slight movements of the supporting rings 22 and 44 in a vertical direction. This will cause a corresponding movement of the image at the receiver, even though the actors are actually not moving in the studio. The background may be injected in the picture through the use of another camera in order to produce a composite picture of an automobile positioned in an appropriate surrounding. The two scenes, that is, of the automobile and its occupants, may be combined, for example, in a manner shown and described in my application Serial No. 152,740, filed July 9, 1937, (RCA Docket 13,839) and in the Goldsmith-Goldsborough Patent No. 2,073,370 of March 9, 1937.

Various other movements of the deflecting unit in a direction normal to the axis of the cathode ray tube may be utilized to produce many other obvious effects on the screen of the television receiver tube.

The movement of the deflecting unit by slight amounts in a direction parallel to the cathode may be utilized, for example, to simulate the effect of a galloping horse, in which instance the movement of the deflecting unit causes a rythmical expansion and contraction in the area scanned on the mosaic and accordingly a slight enlargement and diminution in the image created at the television receiving tube. This movement of the deflecting unit with respect to the cathode ray tube may, of course, be used in any respect where a slight change in the apparent proximity of the subject is desired.

From the foregoing it may be seen, therefore, that through the use of the device described and

illustrated in one form, the deflections of the cathode ray beam in the television transmitting tube may be so controlled as to produce various desired results at the television receiver without the necessity of actually moving the subject being scanned in the television studio.

In the drawing, electromagnetic deflecting means are shown but it is entirely possible to employ electrostatic deflecting means in which case the plates, between which the static field is created, would be located outside the tube and would occupy a position similar to that occupied by the pole pieces 39 shown in the drawing.

Although a more or less specific mechanical design is shown and described herein, it is to be understood that various other mechanical designs may be utilized to bring about the same results, and it is to be understood that any and all such modifications in the mechanical design are to be considered as within the purview of the present invention except as limited by the hereinafter appended claims.

I claim:

1. A deflecting yoke for a cathode ray tube wherein a cathode ray beam is adapted to be produced, comprising means for creating separate electromagnetic deflecting fields including a support of ferromagnetic material for said means whereby the cathode ray beam may be deflected in mutually perpendicular directions to cause the beam to scan a predetermined area, and elastic mounting means whereby said support and first named means may be moved by a slight amount in a direction normal to the axis of the cathode ray tube, said elastic means operating to return the first named means to a normal position.

2. A deflecting yoke for a cathode ray tube wherein a cathode ray beam is adapted to be produced, comprising means for creating separate electromagnetic deflecting fields including a support of ferromagnetic material for said means whereby the cathode ray beam may be deflected in mutually perpendicular directions to cause the beam to scan a predetermined area, and means whereby said support and said first named means may be moved parallel to the axis of the cathode ray tube, said last named means including a plurality of resilient members for returning said support to its normal position relative to the axis of the tube.

3. A deflecting yoke for a cathode ray tube wherein a cathode ray beam is adapted to be produced, comprising unitary means for creating separate deflecting fields for deflecting the cathode ray beam in mutually perpendicular directions to repeatedly and systemmatically scan a predetermined pattern on a target electrode, and means for normally positioning said unitary deflecting means in a predetermined position with respect to the cathode ray tube, said last named means including an elastic support whereby the position of the unitary deflecting means may be altered in three mutually perpendicular directions with respect to the cathode ray tube during the operation of the tube, said elastic support means operating to return the deflecting means to its normal position.

4. A deflecting yoke for a cathode ray tube wherein a cathode ray beam is adapted to be produced, comprising a deflecting unit, means for maintaining said unit in a predetermined normal position with respect to the tube, and means including said unit adapted to create separate electromagnetic deflecting fields for deflecting the cathode ray beam in substantially mutually perpendicular directions whereby the beam may be caused to repeatedly and systemmatically scan a predetermined area on a target electrode, means for altering the position of said deflecting unit in mutually perpendicular directions from its normal position with respect to the cathode ray tube during the operation of the tube to alter the position or size of the scanned area on the target electrode, and elastic means to return the deflecting unit to its normal position.

5. A deflecting yoke for a cathode ray tube wherein a cathode ray beam is adapted to be produced, comprising electromagnetic means for creating two separate deflecting fields to deflect the cathode ray beam in substantially mutually perpendicular directions to scan a predetermined area, means for supporting said deflecting means independently of and surrounding the cathode ray tube, and means including a plurality of rollers whereby the deflecting means may be continuously rotated in either direction about the axis of the cathode ray tube during the operation of the tube to thereby cause a continuous rotation of the two separate deflecting fields and accordingly a continuous rotation of the scanned area.

6. In a cathode ray tube wherein a cathode ray beam is adapted to be produced, a deflecting yoke including a plurality of electromagnetic beam deflecting field generating means for deflecting the cathode ray beam in substantially mutually perpendicular directions to scan a predetermined area, frame means for maintaining said unit in a predetermined normal position with respect to the tube, means whereby the field generating means may be oscillated a slight amount in a direction normal to the axis of the cathode ray beam to alter the position of the predetermined scanned area, and elastic means for returning the field generating means to its normal position.

7. A deflecting yoke for a cathode ray tube wherein a cathode ray beam is adapted to be produced, comprising means for creating separate electromagnetic beam deflecting fields including an electromagnetic field structure for causing the beam to scan a predetermined area, a support means including a plurality of resilient members for supporting said field structure in a predetermined normal position with respect to the cathode ray tube, said resilient members permitting the position of the field structure to be altered in at least two mutually perpendicular directions with respect to the cathode ray tube to alter the position and size of the scanned area, said resilient members operating to bias the field structure in a direction to return the field structure to the predetermined normal position.

8. A deflecting yoke for a cathode ray television transmitting tube wherein a cathode ray beam is adapted to be produced, comprising means for creating separate electromagnetic deflecting fields including an electromagnetic field structure, whereby the beam may be caused to scan a predetermined area to produce picture signals, means including a plurality of resilient members and a plurality of rollers for supporting said field structure for oscillatory and rotary motion from a normal position in order that the position of the field with respect to the cathode ray tube may be altered to alter the position, size, or orientation of the scanned area during the operation of the tube whereby the received image may be caused to appear to change its position, said resilient

means operating to return the field structure to its normal position.

9. A deflecting yoke for a cathode ray tube wherein a cathode ray beam is adapted to be produced, comprising means for creating two separate electromagnetic deflecting fields including a support of ferromagnetic material for said means whereby the cathode ray beam may be deflected in substantially mutually perpendicular directions to cause the beam to scan a predetermined pattern, means including a plurality of rollers for positioning said support in a predetermined position with respect to the cathode ray tube, and means whereby said support may be continuously rotated in either direction about the axis of the cathode ray tube to thereby rotate the scanning pattern of the cathode ray beam.

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