June 11, 1935. A. V. BEDFORD 2,004,099

CATHODE RAY APPARATUS

Filed Oct. 15, 1932

Fig.1.

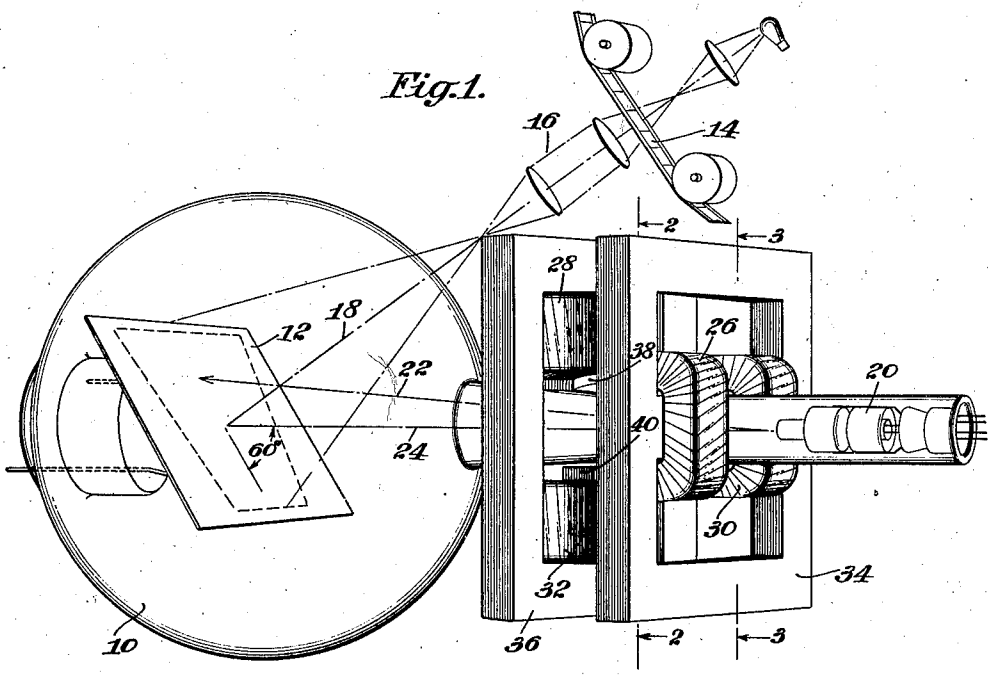


Fig.2.

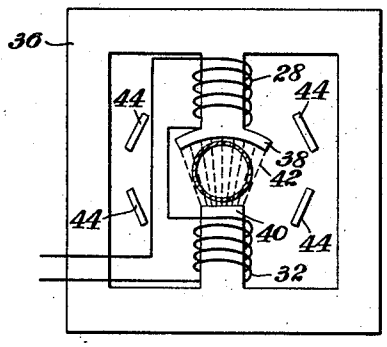


Fig.3.

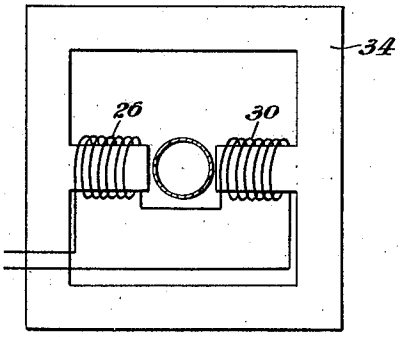


Fig.4.

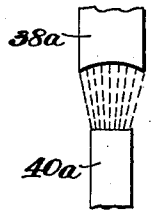
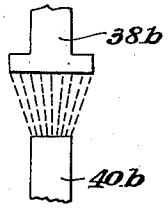


Fig.5.



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CATHODE RAY APPARATUS

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Application October 15, 1932, Serial No. 637,879

9 Claims. (Cl. 250—27.5)

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 photo-sensitive mosaic screen on which an image of the object is projected, it has been found to be advantageous to scan, by the cathode ray, the same side of the screen on which the image is projected. When this is done, the axis of the optical system for projecting the image is 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. The 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 to 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 is deflected horizontally by electromagnetic coils provided with pole pieces shaped to cause the lines of flux to spread outwardly or diverge from one pole piece to the other in planes perpendicular to the axis of the electron gun. In this manner, the horizontal deflecting field, at any instant, is made to have a uniformly varying strength or density from the upper edge of the scanned area to the lower edge thereof, the density increasing in the downward direction. The resulting action is to cause the ray to so scan a keystone area in a plane perpendicular to the axis of the electron gun, that when the ray strikes the surface of the inclined screen, it is caused to scan the surface thereof over a substantially rectangular area.

My invention resides in the improved apparatus 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 perspective view, partly diagrammatic, of television transmitting apparatus embodying my invention;

Figs. 2 and 3 are simplified, sectional views, the sections being taken, respectively, on the lines 2—2 and 3—3 in Fig. 1; and

Figs. 4 and 5 are simplified, fragmentary views, showing several modifications.

With reference to Fig. 1, the reference numeral 10 designates a cathode ray tube provided with some suitable form of mosaic photosensitive screen structure 12 upon which an image of the object is projected. The screen structure 12 comprises, generally, a supporting plate provided on the front surface thereof with a great number of minute metallic elements (not shown) insulated from each other and from the plate, and each provided with a coating of photosensitive material.

An image of the object, shown as being in the form of a moving picture film 14, is projected upon the photosensitive surface by a suitable optical system 16, the axis 18 of which is perpendicular to the screen structure 12.

An electron gun 20, of any suitable construction, operates to develop a ray 22 of electrons, and to direct the ray at the photosensitive surface of the screen 12, the axis 24 of the tube being inclined at an acute angle of about 60° to the plane of the screen 12.

For the purpose of causing the ray 22 to scan the photosensitive surface of the screen 12, saw-tooth current waves at different frequencies are caused to flow through the coils 26, 28, 30 and 32. The coils 26 and 30 operate to deflect the ray vertically, while the coils 28 and 32 operate to deflect the ray horizontally.

As shown, the vertical and horizontal deflecting coils are placed on separate yokes 34 and 36, the yoke carrying the vertical deflecting coils 26 and 30 being disposed next to the electron gun 20 so that the ray 22 passes first through the vertical deflecting field before it passes through the horizontal deflecting field. The yokes 34 and 36 are spaced a sufficient distance from each other to insure against detrimental flux inter-leakage.

As more clearly shown in Fig. 2, the pole pieces 38 and 40 have different shapes, the pole piece 38 being larger and curved so that the lines of flux 42 converge downwardly. In this way, the flux density is made to increase uniformly from the pole piece 38 to the pole piece 40. Therefore, when the saw-tooth current wave is caused to pass through the coils 28 and 32, the action is such as to cause the ray 22 to scan a keystone area in a plane perpendicular to the axis 24, so that when the ray strikes the surface

of the screen 12, it is caused to scan the same over a substantially rectangular area. Without this action, to correct for the keystone distortion, the ray would scan the screen 12 over a keystone area, as indicated in Fig. 1.

Other possible variations of the pole pieces 38 and 40 are shown in Figs. 4 and 5. In Fig. 4, the upper pole piece 38*a* is greater in cross sectional area than the lower pole piece section 40*a*, and has a concave face. In Fig. 5, the upper pole piece 38*b* is T-shaped, the upper face thereof being flat and greater in area than the complementary face of the lower pole piece 40*b*.

In some cases, there might remain some slight distortion at the corners of the area over which the ray 22 scans the screen 12. To correct for this, it is proposed to place permanent magnets 44 in suitable positions to shape the magnetic field in such manner as to eliminate the relatively slight remaining distortion.

It will be understood that various modifications within the conception of those skilled in the art are possible without departing from the spirit of my invention or the scope of the claims.

I claim as my invention:

1. Cathode ray apparatus comprising screen structure and an electron gun for developing a ray of electrons and directing the same at said structure, the axis of said gun being disposed at an acute angle to said structure, and means for deflecting said ray to cause the same to scan a keystone area over a plane perpendicular to said axis whereby the ray is caused to scan said structure over a substantially rectangular area, said ray-deflecting means including magnetic pole pieces disposed respectively on opposite sides of said axis and shaped and arranged to cause the magnetic lines of force to diverge substantially uniformly from one edge of the area traversed by the ray to the opposite edge of such area.

2. Cathode ray apparatus comprising screen structure and an electron gun for developing a ray of electrons and directing the same at said structure, the axis of said gun being disposed at an acute angle to said structure, and means for deflecting said ray to cause the same to scan a keystone area over a plane perpendicular to said axis whereby the ray is caused to scan said structure over a substantially rectangular area, said ray-deflecting means including magnetic pole pieces disposed respectively cn opposite sides of said axis, the dimension of the face of one of said pole pieces measured transversely of said axis being substantially greater than such dimension of the face of the opposite pole piece.

3. Cathode ray apparatus comprising screen structure and an electron gun for developing a ray of electrons and directing the same at said structure, the axis of said gun being disposed at an acute angle to said structure, and means for deflecting said ray to cause the same to scan a keystone area over a plane perpendicular to said axis whereby the ray is caused to scan said structure over a substantially rectangular area; said ray-deflecting means including a magnetic core disposed about said axis and adjacent said ray-developing means and provided with pole pieces, coils carried by said pole pieces for deflecting said ray at a relatively low frequency, and a second magnetic core disposed about said axis between said screen structure and said first-named core and spaced from the latter, said second core being provided with pole pieces, and coils carried by said second-named pole pieces for deflecting said ray at a relatively high frequency.

4. Cathode ray apparatus comprising screen structure and an electron gun for developing a ray of electrons and directing the same at said structure, the axis of said gun being disposed at an acute angle to said structure, and means for deflecting said ray horizontally and vertically to cause the same to scan a keystone area over a plane perpendicular to said axis whereby the ray is caused to scan said structure over a substantially rectangular area; said ray-deflecting means including a magnetic core disposed about said axis and adjacent said ray-developing means and provided with pole pieces, coils carried by said pole pieces for deflecting said ray vertically, and a second magnetic core disposed about said axis between said screen structure and said first-named core and spaced from the latter, said second core being provided with pole pieces, and coils carried by said second-named pole pieces for deflecting said ray horizontally.

5. Cathode ray apparatus comprising screen structure and an electron gun for developing a ray of electrons and directing the same at said structure, the axis of said gun being disposed at an acute angle to said structure, and means for deflecting said ray to cause the same to scan a keystone area over a plane perpendicular to said axis whereby the ray is caused to scan said structure over a substantially rectangular area, said ray-deflecting means including a plurality of magnetizable and complementary poles having dissimilar opposed ends and arranged to cause the magnetic lines of force to diverge substantially uniformly from one edge of the area traversed by the ray to the opposite edge of such area.

6. The invention set forth in claim 5 characterized in that one of the pole-faces has a greater area than the other pole-face.

7. The invention set forth in claim 5 characterized in that one of the pole-faces is curved from one edge thereof to the opposite edge on substantially an arc of a circle.

8. The invention set forth in claim 5 characterized in that one of the poles is T-shaped and has its face curved from one edge thereof to the opposite edge on substantially an arc of a circle.

9. The invention set forth in claim 5 characterized in that one of the poles is T-shaped and has a substantially flat face.

ALDA V. BEDFORD.