

May 9, 1939.

I. G. MALOFF

2,157,182

CATHODE RAY DEFLECTING DEVICE

Filed Dec. 31, 1935

2 Sheets-Sheet 1

*Fig. 1.*

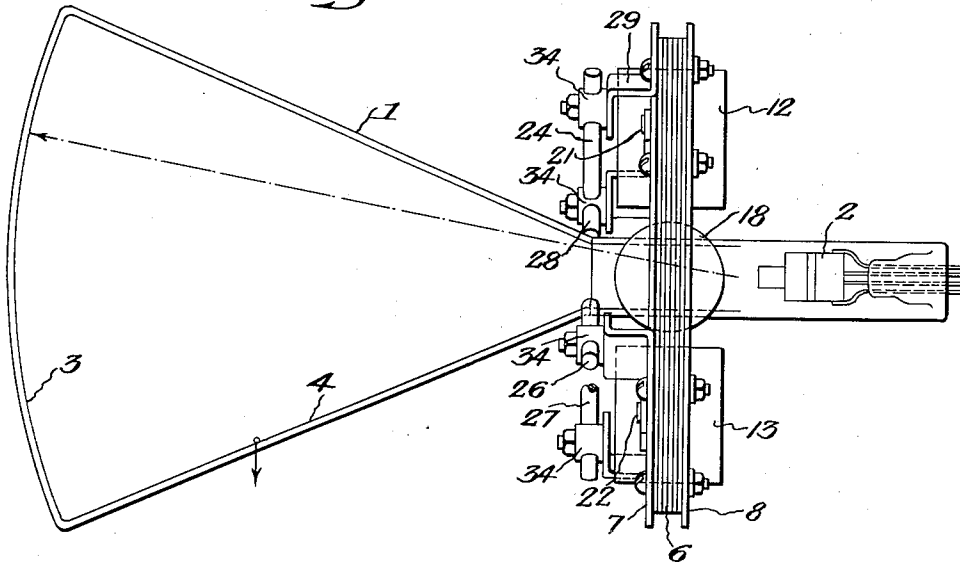
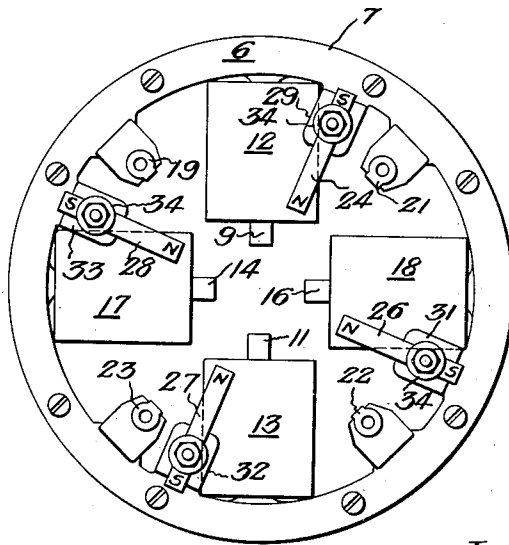


*Fig. 2.*



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2 Sheets-Sheet 2

Fig. 3<sup>a</sup>

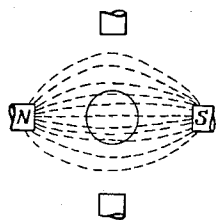


Fig. 3<sup>b</sup>

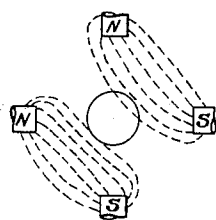


Fig. 3<sup>c</sup>

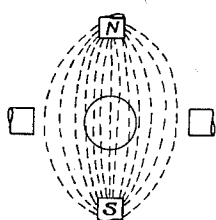


Fig. 3<sup>d</sup>

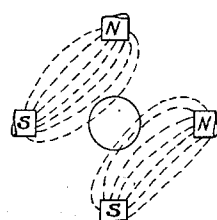


Fig. 3<sup>e</sup>

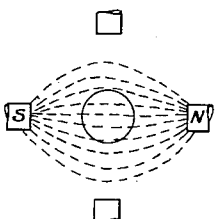


Fig. 3<sup>f</sup>

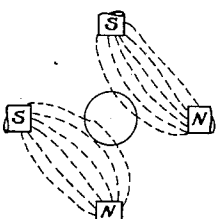


Fig. 3<sup>g</sup>

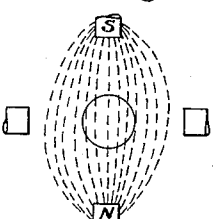


Fig. 3<sup>h</sup>

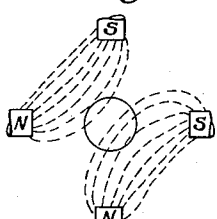


Fig. 4<sup>a</sup>

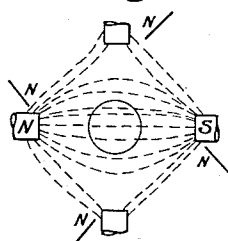


Fig. 4<sup>b</sup>

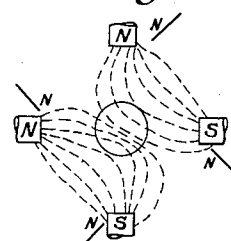


Fig. 4<sup>c</sup>

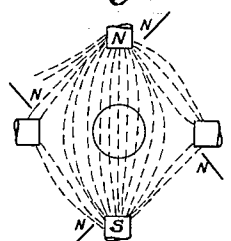


Fig. 4<sup>d</sup>

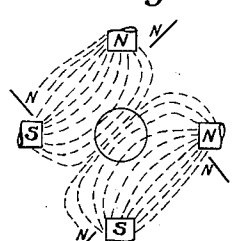


Fig. 4<sup>e</sup>

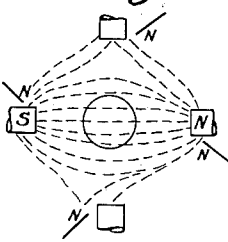


Fig. 4<sup>f</sup>

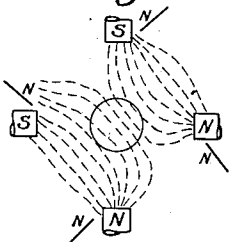


Fig. 4<sup>g</sup>

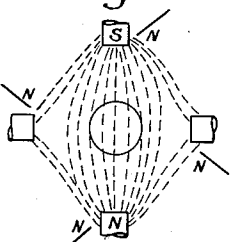
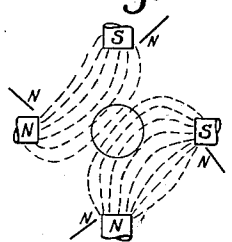


Fig. 4<sup>h</sup>



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## UNITED STATES PATENT OFFICE

2,157,182

## CATHODE RAY DEFLECTING DEVICE

Ioury G. Maloff, Philadelphia, Pa., assignor to  
Radio Corporation of America, a corporation  
of Delaware

Application December 31, 1935, Serial No. 56,846

3 Claims. (Cl. 250-157)

My invention relates to cathode ray tube deflecting devices and particularly to deflecting devices of the electromagnetic type.

In the past, deflecting devices of the above-mentioned type have not been very satisfactory for cathode ray tubes when employed for certain purposes, such as for television, because of defocusing of the cathode ray during deflection. In a cathode ray tube employed in a television receiver, in particular, it is desirable to deflect the cathode ray through a rather large angle. The deflection in one standard size television receiver tube provided with electromagnetic deflection is sufficient to produce a picture seven or eight inches square. Because of defocusing of the cathode ray, however, the outer edges of the picture are not sharply defined unless special precautions are taken for reducing defocusing.

A further difficulty encountered in utilizing electromagnetic deflection is that, when the cathode ray is caused to scan a fluorescent screen (as by means of vertical deflecting and horizontal deflecting saw-tooth waves), the pattern on the screen is likely to be distorted. The greater the angle of deflection, the greater is this distortion. The pattern distortion may be of such a character as to reproduce a circle as a square with rounded corners.

It is an object of my invention to provide an improved electromagnetic deflecting device for cathode ray tubes.

It is a further object of my invention to provide a method of and means for reducing defocusing of a cathode ray.

It is a still further object of my invention to provide a method of and means for reducing distortion in the scanning pattern of a cathode ray tube.

In practicing my invention, I provide a deflecting field which has a more uniform flux distribution in the plane perpendicular to the undeflected electron beam than deflecting fields previously produced by deflecting coils. In one embodiment of the invention, this increase in flux uniformity is obtained by properly positioning permanent magnets adjacent to the deflecting coils.

Other objects, features and advantages of my invention will appear from the following description taken in connection with the accompanying drawings in which

Figure 1 is a side view of a cathode ray tube having a deflecting yoke mounted thereon which is constructed in accordance with one embodiment of my invention;

Fig. 2 is an end view of the deflecting yoke shown in Fig. 1;

Figs. 3a to 3h are diagrams showing the flux distribution produced by a deflecting yoke of the conventional type, and

Figs. 4a to 4h are diagrams showing the flux distribution produced by the deflecting yoke shown in Figs. 1 and 2.

Referring to Fig. 1, my deflecting yoke is shown mounted on a cathode ray tube of a conventional type. The cathode ray tube comprises an evacuated envelope 1 having therein an electron gun 2 and a fluorescent screen 3. A metallic coating 4 on the inner surface of the envelope functions as the second anode and also provides an electrostatic field next to the electron gun 2 for focusing the cathode ray.

Referring to Figs. 1 and 2, the deflecting yoke comprises a magnetic core or ring 6, this core preferably being built up of soft iron laminations which are clamped between two iron rings 7 and 8. Two diametrically opposed pole pieces 9 and 11 of magnetic material extend from the inner periphery of the core 6, these pole pieces having a pair of horizontal deflecting coils 12 and 13 mounted thereon.

At right angles to the pole pieces 9 and 11, two other diametrically opposed pole pieces 14 and 16 extend from the core 6, these pole pieces having the vertical deflecting coils 17 and 18 mounted thereon. Terminal lugs 19, 21, 22 and 23 for the deflecting coils are mounted on brackets extending from the ring 7.

The deflecting yoke so far described is one which is well known in the art, each pair of coils being connected in series-aiding relation. For the reasons previously mentioned, it is not very satisfactory if the cathode ray tube is to be employed in a television system. The shapes of the magnetic fields produced by this yoke under several different conditions of deflection as indicated by iron filings are shown in Figs. 3a to 3h. In these figures the letters N and S indicate the polarity of the deflecting coils for the several conditions of deflection.

In accordance with my invention, I change the shape of the magnetic field to make it more uniform in the region through which the cathode ray is deflected and in a plane at right angles to the axis of the electron gun or undeflected cathode ray. I have found that this can be accomplished by employing magnets such as permanent magnets properly positioned with respect to the ends of the pole pieces.

In Figs. 1 and 2, four permanent magnets 24,

26, 27 and 28 are shown, one magnet being provided for each pole piece. The permanent magnets are supported by brackets 29, 31, 32 and 33 extending from the iron ring 7, these brackets as well as the clamping members 34 being of magnetic material whereby a good magnetic circuit is provided from the magnets through the core 6.

In the specific embodiment illustrated, each permanent magnet is mounted with its north end adjacent to the end of its corresponding pole piece and with its axis at an angle of approximately 22° to the axis of the said pole piece.

The shapes of the magnetic fields produced by this improved structure for different conditions of deflection are shown in Figs. 4a to 4h. In these figures the circle indicates approximately the area through which the cathode ray is deflected. It will be noted that the improved deflecting yoke provides a magnetic field in which the variation in flux density from point to point in the area through which the cathode ray is deflected is less than in the case of the old type of yoke. As a result, in the plane of the pole pieces, that is in the plane of the paper in Figs. 4a to 4h, the flux density of the magnetic field is comparatively uniform throughout the region traversed by the cathode ray during deflection. Consequently, there is a reduction in defocusing of the cathode ray and in distortion of the deflection pattern on the fluorescent screen.

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

I claim as my invention:

1. In combination with a cathode ray tube having an electron gun, means including deflecting coils for producing a magnetic deflecting field, and additional means for making said field substantially uniform from point to point in a plane at right angles to the axis of said gun, said additional means comprising a plurality of permanent magnets adjacent said deflecting coils and developing a magnetic field correcting non-uniformity in said deflecting field.

2. A deflecting device for cathode ray tubes in which a cathode ray is produced, a pair of oppositely disposed deflecting coils having a magnetic circuit which is closed except for an air gap in which a cathode ray tube may be located, a second pair of oppositely disposed deflecting coils located at right angles to said first coils and having a magnetic circuit a portion of which is common to said first magnetic circuit, a plurality of magnets adjacent said deflecting coils each having a north pole and a south, one of said magnets being so positioned adjacent to each of said coils that the deflecting field produced thereby is made substantially uniform from point to point in a plane at right angles to the undeflected cathode ray.

3. A deflecting device for cathode ray tubes, said device comprising a magnetic core having oppositely disposed pole pieces, there being an air gap between said pole pieces in which a cathode ray tube may be placed, a pair of deflecting coils mounted on said pole pieces and connected to produce a deflecting field in said air gap, and a plurality of auxiliary magnets adjacent said deflecting coils, at least one magnet being so positioned adjacent to each of said pole pieces that the said deflecting field is made substantially uniform.

IOURY G. MALOFF.