Jan. 7, 1941. J. GÜNTHER 2,227,711

DEFLECTING DEVICE FOR CATHODE RAY TUBES

Filed Feb. 16, 1938

Fig. 1.

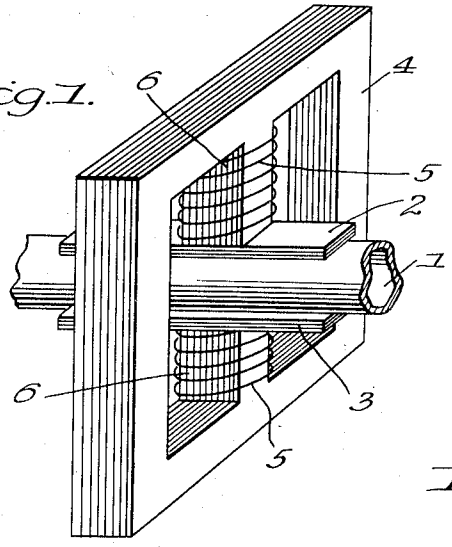


Fig. 2.

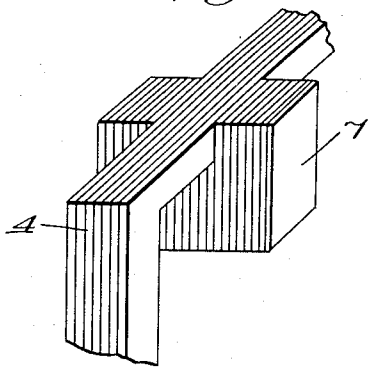
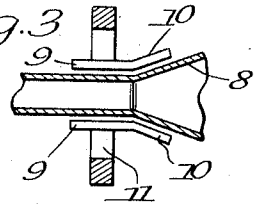


Fig. 3



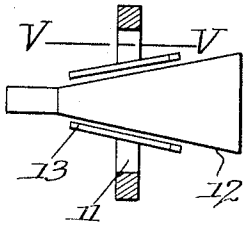


Fig. 4.

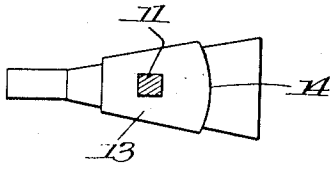


Fig. 5.

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DEFLECTING DEVICE FOR CATHODE RAY TUBES

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5 Claims. (Cl. 250—157)

In magnetic deflection of cathode ray beams, it is known to provide deflecting coils with iron cores, or with yokes, which may or may not possess an air gap. Measurements have shown that an open or closed yoke needs only 70% of the ampere turns necessary for coils without iron. It is, furthermore, known that a particular field distribution can be obtained by widening one pole in the direction perpendicular to that of the beam in order to compensate for so-called keystone effect when scanning a surface oblique to the axis of the scanning beam.

It is the object of the invention to decrease the number of ampere turns necessary for deflection by giving the pole pieces a particular shape. For this purpose, pole pieces are provided which elongate the magnetic field in the direction of the cathode ray beam as far as possible, which is accomplished by making the length of the pole pieces, in the direction of the axis of the electron beam, greater than the length of the yoke.

Preferably, these pole pieces are disposed at a region of the neck of the tube having the smallest cross section. If an extremely small length of tube is desirable, it may be necessary to place the pole pieces at a point where the conical part of the tube begins. In this case, the pole pieces have a portion which broadens corresponding to the walls of the tube, or pole pieces are used, the top view of which is a trapezoid, and which are not placed parallel, but have a distance between them which increases in the direction of the cathode ray beam. If the cathode ray beam is deflected through a large angle, it is furthermore preferable not to end the pole pieces in a straight line but to make this edge curved so that the center of curvature may lie approximately at the point of deflection of the beam.

In the accompanying drawing, Fig. 1 is a perspective view of a deflecting yoke having extended pole pieces showing the position of the yoke with respect to the neck portion of a cathode ray tube; Fig. 2 shows a modified type of pole pieces; Fig. 3 is a cross-sectional view through a section of a cathode ray tube and a scanning yoke having pole pieces representing an embodiment of the present invention; and Figs. 4 and 5 show a side view and a plan view, respectively, partly in cross section, of a preferred embodiment.

Fig. 1 shows a schematic view of the deflection system, which consists of individual laminations. The neck of the tube 1 lies between the plates 2 and 3, which serve as pole pieces. The plates consist of individual laminations and extend over a greater distance in the direction of the cathode ray beam than the yoke proper does. The yoke 4 also consists of laminations and carries the winding 5 on the portion 6. In place of the coil cores 6 with the attached pole pieces 2 and 3, a coil core 7 according to Fig. 2 may also be used which, in its entirety, possesses larger dimensions in the direction of the electron beam than the yoke does. The coil core 7 of Fig. 2 again consists of laminations. The pole pieces as well as the iron yoke may also consist of a material as is used for solid cores for high-frequency coils.

In order to obtain a homogeneous magnetic field over the entire space through which the cathode ray beam is deflected, it is preferable to make the pole pieces at least as wide as the neck of the tube.

In cathode ray tubes for television purposes, the frame deflection as well as line deflection may be accomplished with such a system. The systems can either be combined into a closed yoke possessing four poles, or two two-pole yokes may be placed in close proximity to each other. It is also possible to arrange the yokes adjacent each other in such a manner that the pole pieces of one yoke reach into the free spaces between the pole pieces of the other system. It is also possible to use a deflecting system according to the invention for the deflection in one direction of a cathode ray beam, and to use for the deflection in the other direction a system of air coils or deflecting plates placed in the vacuum.

If the permissible length of the tube is limited, it may seem preferable to extend the pole pieces over the conical portion 8 of the tube as shown in Fig. 3. Pole pieces 9 then have extensions 10 which are no longer parallel, whereby the spacing increases with increasing diameter of tube. It is preferable also to widen the pole pieces at this point. Yoke 11 must not necessarily be placed symmetrically to the pole pieces.

Figs. 4 and 5 show another embodiment in which pole pieces 13 are matched over their entire length to the conical portion 12 of the tube. They are disposed obliquely with respect to each other and possess approximately trapezoidal shape in the cross section VV in Fig. 4, as is shown in Fig. 5. The edge 14 of the pole pieces facing the fluorescent screen is not straight, but preferably curved, so that the beam travels through equal lengths of magnetic field for all angles of deflection. Furthermore, it may be preferable to provide the pole pieces with a curvature conforming to that of the tube, as is

known in the art, in order to obtain a homogeneous field in the interior of the vacuum receptacle.

Extension of pole pieces in the direction of the cathode ray beam is also possible if the deflecting field is not intended to be homogeneous, but if its intensity distribution shall be so influenced by the use of pole pieces of different sizes that the deflected beam shall cover a rectangular area upon a screen disposed in a plane oblique to the main axis of the cathode ray beam. This is known in the art as compensation of the so-called keystone effect. The arrangement described is also applicable to pole pieces disposed in the interior of the vacuum receptacle of a cathode ray tube.

I claim:

1. A cathode ray device having a scanning system including a magnetic core having pole pieces disposed one on either side of the cathode ray, each pole piece increasing in width in the direction of travel of said cathode ray and said pole pieces being symmetrically disposed with respect to the undeflected position of said cathode ray, and each of said pole pieces having a length parallel with said undeflected position, greater than the thickness of said magnetic core in the same direction.

2. A cathode ray device having a scanning system including a magnetic core having pole pieces disposed one on either side of the cathode ray, said pole pieces being symmetrically disposed with respect to the undeflected position of said cathode ray and each having a length parallel with said undeflected position greater than the thickness of said magnetic core in the same direction, said pole pieces increasing in separation in the direction of travel of said cathode ray.

3. A cathode ray device having a scanning system including a magnetic core having pole pieces disposed one on either side of the cathode ray with uniform separation between first portions of said pole pieces and increasing separation between second portions in the direction of travel of said cathode ray, said pole pieces being symmetrically disposed with respect to the undeflected position of said cathode ray and each having a length parallel with the undeflected position of said cathode ray greater than the thickness of said magnetic core in the same direction.

4. A cathode ray device having a scanning system including a magnetic core having pole pieces disposed one on either side of the cathode ray with uniform separation between first portions of said pole pieces and increasing separation between second portions in the direction of travel of said cathode ray, said pole pieces being symmetrically disposed with respect to the undeflected position of said cathode ray and each pole piece increasing in width in the direction of travel of said cathode ray.

5. A cathode ray device having a screen and a deflecting system including a magnetic core having pole pieces disposed one on either side of the cathode ray, said pole pieces being symmetrically disposed with respect to the undeflected position of said cathode ray and increasing in separation in the direction of travel of said cathode ray, each pole piece increasing in width in the direction of travel of said cathode ray and having its edge nearest said screen arcuately shaped about a center substantially coinciding with the point of deflection of said cathode ray.

JOHANNES GÜNTHER.