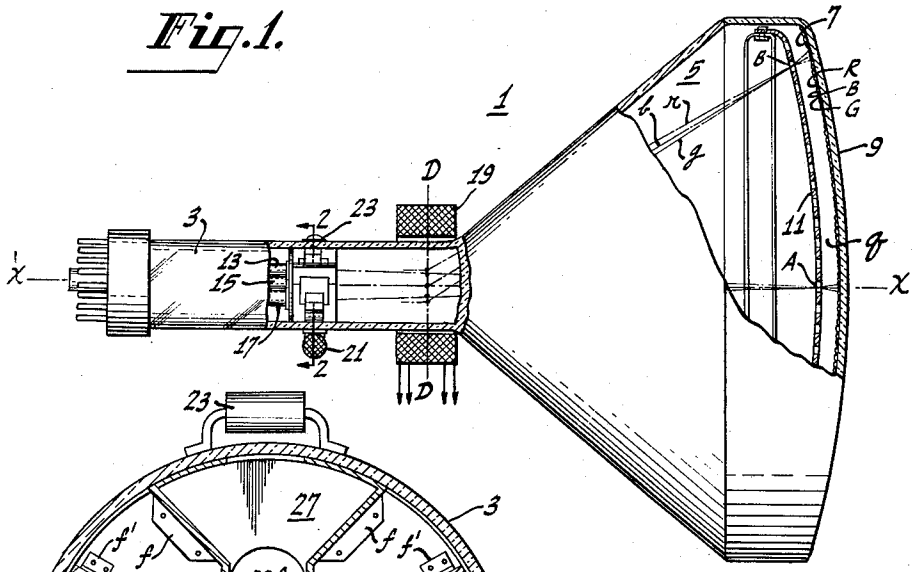
July 4, 1961 R. H. HUGHES 2,991,381

SHIELDED MAGNET-ASSEMBLY FOR COLOR-KINESCOPES ETC.

Filed Jan. 7, 1959

Fig. 1.



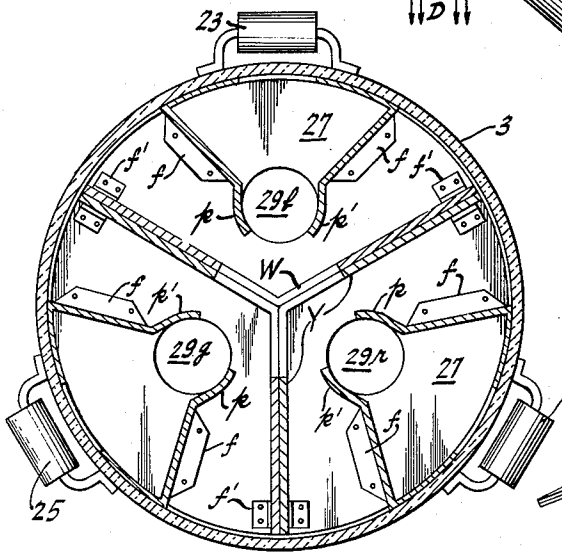


Fig. 2.

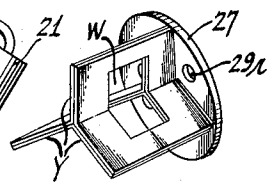


Fig. 3.

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SHIELDED MAGNET-ASSEMBLY FOR COLOR-KINESCOPES, ETC.

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5 Claims. (Cl. 313—84)

My invention relates to improvements in 3-beam tri-color kinescopes and other plural beam cathode-ray tubes of any kind wherein it is necessary or desirable to apply vernier magnetic-deflecting forces to the separate electron-beams within a region adjacent to their area of origin.

I have traced certain image-defects in tubes of the subject variety to the beam-shielding contrivances presently employed therein and my invention may be said to reside, principally, in the provision of a shielded magnet assembly that obviates or at least minimizes such image-defects. The defects with which my invention is especially concerned are manifest as a unidirectional loss of resolution in the images or pictures reproduced on the phosphor screens of such tubes. I attribute said image-defects to the fact that in the beam-shielding contrivances of the prior art the shielding metal spans the space in front of the pole pieces of each magnet and acts as a shunt path for its flux. This distorts the magnetic field between the pole-pieces in such a way that the normally circular cross-section of the beam is rendered elliptical.

My invention may be said to be predicated upon my discovery that by providing a window or windows in the shielding metal, between the magnets paired pole-pieces, I can cure the above-described beam and image defects without (*a*) subjecting any one of the beams to the disturbing influence of the magnetic fields which are allotted to the other beams and (*b*) without rendering the shield susceptible to microphonic vibrations.

The invention is described in greater detail in connection with the accompanying single sheet of drawings wherein:

FIG. 1 is a partly broken away plan view of a 3-gun tri-color kinescope of the masked target variety equipped with small electromagnets for dynamically maintaining the three electron-beams converged at the mask throughout their scanning movements and containing the novel means of the invention for magnetically isolating each beam from the magnetic fields which are allotted to the other two beams;

FIG. 2 is a greatly enlarged sectional view, taken on the line 2—2 of FIG. 1, showing the beam-shielding contrivance of the invention and

FIG. 3 is a view in perspective, on a reduced scale, of the magnetic shield of the invention, the pole-pieces of the magnet assembly being removed to show the open-work construction of the shield.

In the drawing the invention is shown as applied to a color-kinescope comprising an evacuated glass envelope **1** having a longitudinal axis *x*—*x* which extends through the neck **3** and main chamber **5** of the envelope. This kinescope is of the "masked-target dot screen" variety wherein the red (R), blue (B) and green (G) phosphor dots are arranged in a hexagonal pattern on the concave target surface **7** of a glass screen plate **9** which, in the instant case, comprises the front-end or window of the envelope. The apertured mask **11** for the mosaic target surface of the color-screen **7** preferably comprises a thin metal plate having a convex surface presented across an intervening space *q* to the concave surface of the screen and with each mask-hole centered on a "triad" (i.e., cluster of three) phosphor dots, R, B and G.

The glass neck **3** of the envelope **1** contains a battery of three electron guns **13, 15, 17** each of which is allotted to a particular screen color. The guns are arranged delta (Δ) fashion (as in Schroeder 2,595,548) and may be inclined toward the central axis *x*—*x* of the tube so that their three beams *r, b* and *g* converge at the mask when the beams are undeflected. Here, as in the Schroeder patent, the rquired horizontal and vertical scanning movements are applied to all three beams by a common deflecting yoke **19**. As is now more or less standard practice three small electromagnets **21, 23, 25** on the outer surface of the neck operate dynamically to maintain the three beams converged, at the mask, throughout their scanning movements, as is indicated at the points of convergence A and B marked in FIG. 1.

As shown more clearly in FIG. 2 each of the three electromagnets is provided with a pair of internal pole-pieces *p* and *p'* between which the beams pass preferably prior to entering the tube's plane of deflection D—D. These three pairs of pole pieces *p*—*p'* are shown supported, as by integral flanges *f*, upon a non-magnetic end-plate **27** at the leading end of the battery of three guns. This end plate **27** contains three apertures **29***r*, **29***b*, **29***g*, one for each of the three beams, and the terminals of the pole pieces are arranged on opposite sides of the respective apertures. Thus, each beam is subject to radial movement as determined by the instantaneous intensity of the magnetic flux in the gap between the pole pieces which are allotted to that beam.

It is important that the deflecting effect of each magnetic field be confined to the particular beam which it is designed to serve and, to this end, it has previously been proposed to isolate said magnetic fields (and hence each beam) from each other as by means of a Y-shaped ferromagnetic sheet-metal structure wherein the open-ends of the paired pole pieces are presented, across an intervening space, to the metal which lies adjacent to the intersection of the several arms of the Y. As previously mentioned, electron-image tubes employing such magnetic shields frequently exhibit a unidirectional loss of resolution which I attribute to elliptical distortion of the beam resulting from the presence of "shielding" metal in the region circumscribing the space between the ends of each pair of pole pieces. It would appear that to eliminate the shielding metal, of which the disturbing "shunt path" is comprised, would involve giving up a proportionate amount of the shielding effect of the metal, but I have found that this is not necessarily so.

Accordingly, referring now particularly to FIGS. 2 and 3, my invention provides a magnetic shield comprising a three-dimensional sheet metal member, indicated generally at Y, of open-work construction which is dimensioned to be received within the tube neck **3** and having radially extending arms between adjacent ones of which the pairs of pole-pieces are respectively accommodated, with the gap between the pieces of each pair presented to an open area or "window" W of said sheet metal structure. Where, as here, the open areas or "windows" W in the shield Y circumscribe the space between the ends of each pair of pole pieces *p*—*p'* there is no metallic shunt in the path of the magnetic field, between the pole-pieces of each pair and the beam-distorting effect of such a shunt is eliminated. In one practical embodiment of the invention wherein the internal diameter of the neck was 1.8" and the shield extended about .610 along the axis (*x*—*x*) of the tube, the pole-pieces extended to within about 0.25" of said axis, the gap between the paired pieces was approximately 0.20" and the "windows" W in each radially extending arm of this three-dimensional Y-shaped shield were approximately 0.330 long (as measured along said axis) and 0.25" wide (as measured in the radial direction).

To obviate setting-up microphonic vibrations in this

relatively light-weight shielding structure it was supported, as by flanges *f'* upon the same rigid end-plate **27** as the pole-pieces *p—p'*.

What I claim is:

1. In a multi-beam cathode ray tube wherein the several electron beams are subjected, respectively, to vernier deflection forces in their transit between the spaced apart elements of a plurality of pairs of pole-pieces disposed in the neck of said tube and wherein a magnetic shield is mounted between said pairs of pole-pieces to limit the deflection force of one pair to the beam which passes between the spaced apart pole-pieces of that pair, the improvement which comprises: the provision of a window in said magnetic shield adjacent to the terminals of each of said pairs of pole-pieces to avoid a beam-distorting shunt in the path of the magnetic flux between said spaced apart pole-pieces.

2. A magnetic shield for use in the neck of a multi-beam cathode ray tube of the kind employing separate pairs of magnet pole-pieces for imparting vernier deflecting forces to the several electron-beams, said shield comprising a three-dimensional sheet-metal member of open-work construction dimensioned to be received within said tube-neck and having radially extending arms between adjacent ones of which said pairs of pole pieces are adapted to be accommodated, respectively, with the gap between the pieces of each pair presented to an open area of said sheet metal structure.

3. An electron-beam tube comprising a target, a battery of electron-guns for producing a plurality of electron-beams directed toward said target, a pair of magnetic pole-pieces individual to each beam and between which said beam passes in its transit to said target, means including said pole-pieces for independently subjecting each beam to a magnetic field to control the direction of said beam with respect to the other of said beams, and means for magnetically isolating each of said electron beams from the magnetic fields individual to the other of said electron-beams, said last mentioned means comprising a sheet metal structure of open-work construction disposed with an open area thereof circumscribing the space between the ends of each pair of pole pieces whereby to avoid a beam-distorting shunt in the path of the magnetic field between the pole-pieces of each pair.

4. The invention as set forth in claim 3 and wherein said battery of electron guns terminates in a rigid end-plate containing a plurality of apertures through which said beams respectively pass, and wherein said sheet-metal structure is supported upon said rigid end-plate.

5. The invention as set forth in claim 4 and wherein said pairs of magnetic pole-pieces are mounted upon said rigid end-plate.

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