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MAGNETIC DISTORTION CORRECTING MEANS FOR CATHODE RAY TUBES

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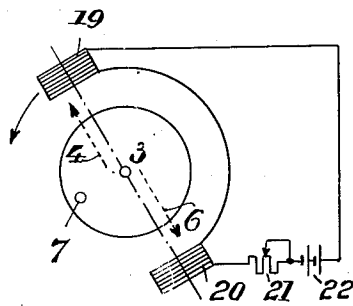
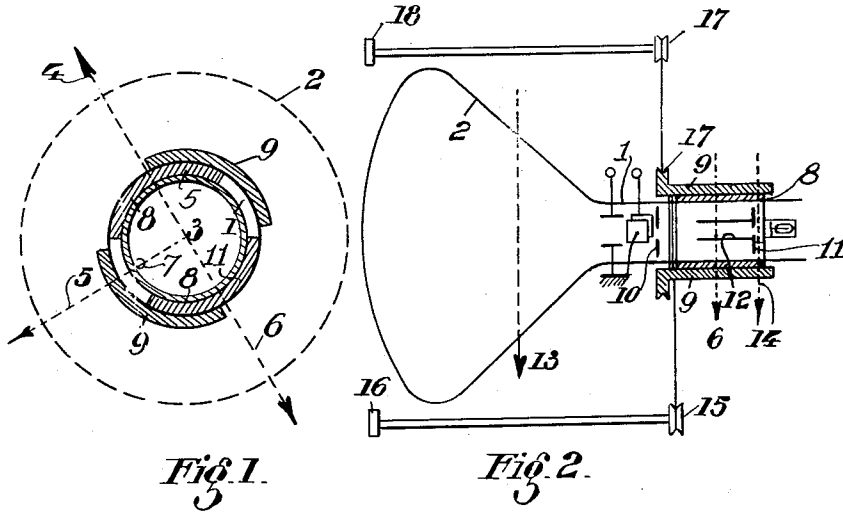


Fig. 3.

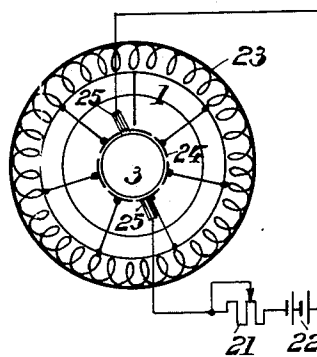


Fig. 4.

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MAGNETIC DISTORTION CORRECTING
MEANS FOR CATHODE RAY TUBES

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mesne assignments, to Loewe Radio, Inc., a cor-
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5 Claims. (Cl. 250—157)

In the practical operation of cathode ray tubes for oscillographic or television purposes the deflection of the rays by the earth's magnetic field make itself apparent in very disturbing fashion. The lower the anode potentials which are employed in the cathode ray tube and the more exact the passage of the ray is required to be within the tube, or the greater the length of the tube respectively, the greater are the errors which occur in the practical operation of tubes of this character if the same are subjected to the earth's magnetic field without special precautions.

The subject matter of the invention is a method and also means which enable this error to be avoided. It has been found that an effective screening of the magnetostatic fields is incapable of being performed in practice. For this purpose much too thick and heavy iron masses would be required. A deflection of the magnetic field lines by magnetic refraction cannot be relied upon to be effective in all cases. According, therefore, to the invention there is provided a compensation apparatus, which is readily operable preferably by grips accessible from the outside and which produces in the plane of the ray in the tube a magnetic counter-field, the intensity and direction of which may be adjusted from the outside as desired.

The invention will be more fully understood from the following detailed description, if taken in connection with the accompanying drawing,

Figs. 1 and 2 whereof illustrate one form of embodiment of the invention,

Fig. 1 showing a cross section through the tubular portion of a cathode ray tube, whereas

Fig. 2 shows a longitudinal section through the tube with slightly altered dimensions.

Figs. 3 and 4 show diagrammatic cross sections of the tubular portion of the cathode ray tube as incorporated in two further embodiments of the invention; these figures also contain certain details of the circuits concerned with this invention.

Referring now to Fig. 1 is the tubular portion and 2 the screen of the cathode ray tube. The desired position of the ray is the tube axis 3. Owing to an earth field 4 effective at the point of disposal the cathode ray is deflected in the direction 5, which is vertical to the direction of the ray and the field. There is required, therefore, in accordance with the invention a magnetostatic counter-field 6 of the same size as but in an opposite direction to 4, having the object of returning the ray from the position of deflection 7, which it assumes in practice, into the central position 3. For this purpose there is employed according to the invention an arrangement comprising two slotted concentric cylinders 8 and 9 which, as shown in Fig. 2, merely require to be slipped over the neck of the tube. It is

advisable to apply the field approximately at the centre of the electron-optical system but behind that electrode limiting the cross-section of the cathode beam—if any such electrode is provided—which has the smallest aperture for the passage of the ray. In the case of the modern high-vacuum tube system illustrated diagrammatically in Fig. 2, wherein the bulb is again designated 2 and the neck 1, the electrons between the main anode 10 and the diaphragm 11 have a relatively low speed within the long tubular portion 12. It is, therefore, most convenient to apply the plane of action of the counter-field 6 according to the invention above this tube, whilst application of the field behind the anode 10, i. e., approximately in the plane of the cross-section 13, would not be desirable, as the ray has already been deflected in its course within the electronic lens, and has already lost in intensity by selection at the diaphragm provided. Application in a plane 14, which is situated in front of the diaphragm 11, would also be open to objection in practice, as exactly at this point it is important that as far as possible all electrons pass through the narrow aperture of 11, and because the same at this point possess their lowest speed and are, therefore, most susceptible to magnetic fields.

According to the invention, a steel tube 8, for example, which fits about the neck of the tube, is divided by cutting out two quadrants into two remaining quadrants, which may be supplemented mechanically by non-magnetic material to form a whole. The two tube portions 8 are permanently magnetised or given remanent magnetism in an opposite sense (north-south). The coercive force and remanent magnetism of the steel is selected to be such that the magnetisation suffices for every case occurring in practice, i. e., that it at least reaches the total intensity of the earth magnetic field. The steel tube 8 is arranged to be readily rotatable about the neck of the tube, and this rotation may be performed from the outside, possibly by means of a cord drive 15, which may be operated externally by a rotary button 16.

Over the metallic tube 8 there may be rotated a soft iron member 9, which is also produced by cutting open a complete tube to form 2 pieces, which are somewhat larger than a quadrant. This tube fits as far as possible over the steel tube 8 without an air gap, and by means of a second cord drive may be rotated about the inner tube independently thereof to a total extent of approximately 90°. In the position illustrated in Fig. 1 this tube practically wholly short circuits the magnetomotive force of the steel tube 8, so that the field traversing the tube is considerably weakened. If on the other hand the quadrants 8 and 9 are superimposed, the maximum field is effective within the television tube. It is pos-

sible, therefore, to regulate by actuation of the first cord drive 15, 16 the direction of the compensation field, and by actuation of the second cord drive 17, 18 the intensity of the field.

5 The final object as described may naturally also be obtained in accordance with the invention with other means than those set forth. The same object of sounding, for example, might also be accomplished by means of a pair of magnet coils 10 19 and 20, shown in Fig. 3, which are connected magnetically in series and may be rotated about the axis of the tube, whilst the amplitude condition of the field might be fulfilled by the series resistance 21 of a battery 22.

15 The rotation of the coil support 19, 20 may also be replaced by the use of a Gramme ring according to Fig. 4 by a collector rotation. For this purpose a coil toroid 23 should be connected with a few bars of a commutator 24, and the direction 20 of the magnetic compensation field might be adjusted by the rotation of a brush holder 25, whilst in turn the strength of the field may also be adjusted by means of a series resistance 21 and battery 22. The expanse of this Gramme ring 25 may be adapted in an axial direction to practical requirements, i. e., made approximately the same length as the tube or of the parts along the path of the electrons in the television tube which are acted upon in disturbing fashion by the interfering field.

I claim:

1. A device for compensating for the effects of disturbing magnetic fields in a cathode ray tube, effected by an interfering magnetic field, 35 comprising a cathode ray tube, two co-axial cylinders of ferro-magnetic material mounted about said cathode ray tube and adapted to be rotated in relation to said cathode ray tube and in relation to each other, each of said cylinders having 40 two longitudinal slots filled with non-magnetic material, one of said cylinders consisting of permanent magnet steel having remanent magnetism.

2. In combination, a cathode ray tube having 45 included therein means to develop an electron beam, a target area upon which the beam is adapted to impinge, means symmetrically disposed relative to the electron beam axis for developing a magnetic field of substantially constant intensity in a direction substantially transverse to the beam axis, means mechanically coupled with the symmetrically disposed means for orientating the substantially constant intensity magnetic field relative to and about the beam 50 axis for neutralizing the effects upon the beam of interfering magnetic fields tending to deflect the electron beam from a desired normal axial path, and adjustable high magnetic permeability shunt means adjacent to and orientatable relative to and within the substantially constant intensity magnetic field producing means for shunting the effect of the substantially constant intensity magnetic field upon the developed electron beam whereby compensating adjustment for 60 varying intensities of disturbing fields may be made.

3. In combination, a cathode ray tube having 70 included therein means to develop an electron beam, a target area upon which the beam is adapted to impinge, means symmetrically and

concentrically disposed relative to the electron beam axis for developing a magnetic field of substantially constant intensity in a direction substantially transverse to the beam axis, means mechanically coupled with the symmetrically 5 disposed means for orientating the substantially constant intensity magnetic field relative to and about the beam axis for neutralizing the effects upon the beam of interfering magnetic fields tending to deflect the electron beam from a desired normal axial path, and adjustable high magnetic permeability shunt means adjacent to and orientatable relative to and about the substantially constant intensity magnetic field producing means for shunting the 10 effect of the substantially constant intensity magnetic field upon the developed electron beam whereby compensating adjustments for varying intensities of disturbing fields may be made.

4. In combination, a cathode ray tube having 20 included therein an electron gun means to develop an electric beam and a target area upon which the beam is adapted to impinge, concentrically and symmetrically disposed means symmetrically positioned relative to the electron beam axis and located substantially within the longitudinal limits of and surrounding the electron gun for developing a magnetic field of substantially constant intensity, means mechanically 25 coupled with the symmetrically disposed means for orientating the substantially constant intensity magnetic field relative to and about the beam axis for neutralizing the effects upon the developed beam of interfering magnetic fields tending to deflect the electron beam from a desired normal axial path, high magnetic permeability shunt means also positioned within the longitudinal limits of and surrounding the electron gun for decreasing the effect of the substantially constant intensity magnetic field upon the 30 developed electron beam, and means mechanically coupled with the high permeability shunt means for orientating said means relative to the substantially constant intensity magnetic field whereby compensating adjustments for varying intensities of the disturbing fields may be made.

5. In combination, a cathode ray tube having 50 included therein an electron gun means to develop an electron beam, a target surface upon which the beam is adapted to impinge, means symmetrically disposed relative to the electron beam axis for developing a magnetic field of substantially constant intensity in a direction substantially transverse to the beam axis, adjustable high magnetic permeability shunt means adjacent to and orientatable relative to and about the substantially constant intensity magnetic field producing means for shunting the effect of the substantially constant intensity magnetic field upon the developed electron beam, and means 60 mechanically coupled with the symmetrically disposed and high permeability shunt means for independently orientating the substantially constant intensity magnetic field and the high permeability means relative to each other and relative to and about the beam axis for neutralizing the effects upon the developed beam of interfering magnetic fields tending to deflect the electron beam from a desired normal axial path.

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