

Jan. 10, 1956

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2,730,642

DEVICE COMPRISING A CATHODE-RAY TUBE

Filed Jan. 4, 1952

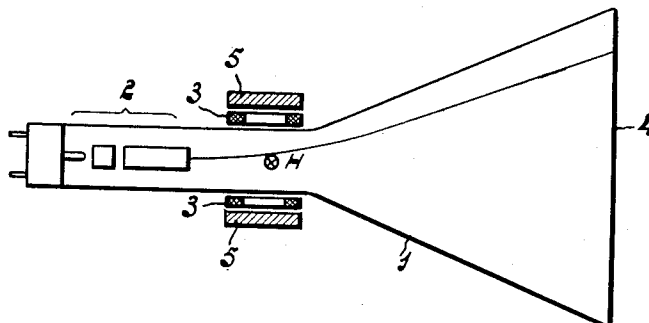


Fig. 1

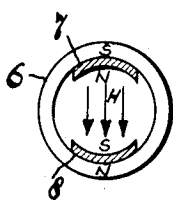


Fig. 2

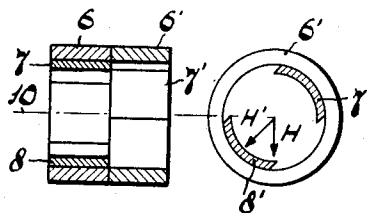


Fig. 3

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DEVICE COMPRISING A CATHODE-RAY TUBE

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Application January 4, 1952, Serial No. 264,985

Claims priority, application Netherlands April 23, 1951

4 Claims. (Cl. 313—76)

This invention relates to devices comprising a cathode-ray tube, more particularly of the kind used for plan position indication P. P. I. in radar systems and its object is to provide means for adjusting the image.

A cathode-ray tube for plan position indication generally comprises a set of revolving magnetic deflection coils, to which sawtooth deflection currents are supplied. In this case, image-focussing may be effected with the use of a stationary coil system by means of which a focussing magnetic field is produced. Both the rotary and the stationary coil systems are generally arranged as close to the cone of the cathode-ray tube and hence as close to one another as possible in order to avoid the deflected electrons striking the neck of the cone.

According to the invention, a device comprising a cathode-ray tube and one or more deflection coils for the magnetic deflection of the electron beam, is characterized in that one or more substantially non-conductive permanent magnets are arranged adjacent the deflection coil for providing an additional magnetic field, the ratio between the remanent induction B_r and the coercive field strength BH_c of the material of the permanent magnet being at the most 4.

In order that the invention may be more clearly understood and readily carried into effect, it will now be described more fully with reference to the accompanying diagrammatic drawing, given by way of example in which Fig. 1 discloses the application of the invention to a cathode ray tube; Fig. 2 is a side view and Fig. 3 a side view and cross-section of modifications.

Referring now to Fig. 1, a cathode-ray tube 1 comprises an electron-accelerating and density modulating system 2 and deflecting coils 3 arranged adjacent the beginning of the cone of the tube 1 and rotated with the use of a motor (not shown). In order that the plan position indication thus formed on the screen 4 of the cathode ray tube 1 may be additionally deflected, provision is made of a magnetic system 5 which produces a diametrically directed additional magnetic field H and which is preferably constituted, as shown in the side elevation of Fig. 2, by a ring 6 of ferromagnetic material having a high permeability and on which are arranged two magnets 7 and 8 magnetized in the direction N-S of their smallest dimension. Magnetisation of the bodies 7 and 8 is thus considerably more simple than if the system 5 were made entirely from permanent magnetic material.

This material of the magnets 7 and 8 is substantially not conductive and the ratio between its remanent induction and its coercive field strength is at the most 4 and with the construction shown in Fig. 2, the ring 6 may be made of ferrite or laminated sheet iron and hence constitute a high impedance for eddy currents due to the field produced by the coils 3.

A permanent magnetic material which satisfies these requirements is, for example, cobalt ferrous ferrite, which has a specific resistance of 225 ohm/cms. and a ratio

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$B_r:BH_c::1.8:1$. A particularly favourable material for the said purpose is that described in British Patent No. 708,127, which is constituted substantially by non-cubic crystals of polyoxides of iron and at least one of the metals barium, strontium and lead and, if desired, calcium and hence can be manufactured from comparatively plentiful raw materials. This material may have a ratio $B_r:BH_c$ from 1.2 to 1.5 and a specific resistance exceeding 10^5 ohm/cms. In addition, a comparatively high maximum value of $(B \cdot H)$ is found, with the result that the required volume of permanent magnetic material for producing a given field may remain comparatively small.

If image-deflection were to be performed with a permanent magnet of conductive material arranged adjacent the deflection coils 3, the field of these coils 3 would bring about eddy currents in the magnet, with the result that the deflection field would be distorted and, more particularly, the flyback time of the sawtooth increased. This disadvantage is obviated by the use of substantially non-conductive permanent magnetic material.

However, it is not sufficient that the permanent magnetic material is substantially non-conductive but it is also necessary for the ratio between the remanent induction and the coercive field strength of the permanent magnetic material to be smaller than 4. With the usual permanent magnetic materials (which generally have also a high conductivity) the ratio between the remanent induction B_r and the coercive field strength BH_c is, for example, equal to 12, so that the hysteresis loop which is described with a given field strength and induction of the material, has a slope which is appreciably smaller than the ratio $B_r:BH_c$, with the result that the said hysteresis loop may have a comparatively large area. However, the smaller this ratio, the smaller will the said area be, since the slope of the hysteresis loop approaches more and more closely to the said ratio. With a ratio less than 4 the hysteresis losses are generally found to be substantially negligible, it being found that the additional advantage is obtained that the reluctance to which the field of the coils 3 is subjected is substantially identical in any position of the said coils.

In order to provide variation of the magnetic field it is possible to arrange in succession two magnetic systems as is shown in Fig. 3 comprising two permeable rings 6 and 6' respectively, and permanent magnets 7, 8 and 7', 8', respectively as shown in Fig. 3, said magnets being adapted to be rotated relatively to one another about the axis 10. The deflection to which the electron beam is then subjected is determined approximately by the vector composition of the magnetic fields H and H', respectively, developed by the bodies 7, 8 and 7', 8', respectively, and is therefore adapted to be varied within wide limits.

The invention may also be employed, for example, for image-adjustment or image correction with a cathode-ray tube for television purposes but in this case it is of less importance to arrange the deflecting coils and the permanent magnets adjacent one another.

What I claim is:

1. A device for plan position indication comprising a cathode ray tube including an envelope having a conical portion and a neck portion, deflection coils rotatably mounted on said neck portion adjacent said conical portion, and a magnetic system surrounding said deflection coils, said magnetic system including a pair of arcuate substantially non-conductive permanent magnet segments positioned opposite one another and concentric with the coils and oriented to produce a diametrically directed magnetic field, each of said permanent magnets exhibiting a ratio of remanent induction B_r and coercive field strength BH_c of less than four.

2. A device as claimed in claim 1 in which an annular

ring of soft ferromagnetic material embraces the permanent magnets.

3. A device as claimed in claim 1 in which the permanent magnets each consist of hexagonal crystals composed of polyoxides of iron and a metal selected from the group consisting of barium, strontium and lead.

4. A device for plan position indication comprising a cathode ray tube including an envelope having a conical portion and a neck portion, deflection coils rotatably-mounted on said neck portion adjacent said conical portion, and an adjustable magnetic system surrounding said coils, said system including a pair of relatively rotatably-mounted permeable rings surrounding said coils, each of said rings embracing a pair of arcuate substantially non-

conductive permanent magnet segments positioned opposite one another and concentric with the coils and oriented to produce a diametrically directed magnetic field, each of said permanent magnets exhibiting a ratio of remanent inductance B_r and coercive field strength H_c of less than four.

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