June 10, 1941. L. E. Q. WALKER 2,244,748

RADIO DIRECTION FINDING RECEIVER

Filed May 14, 1938

FIG. 1.

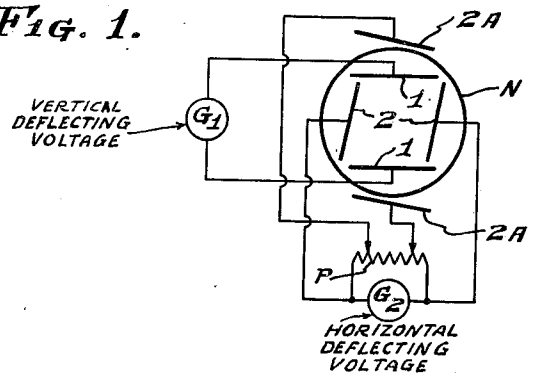


FIG. 2.

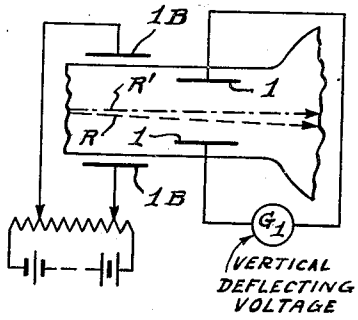
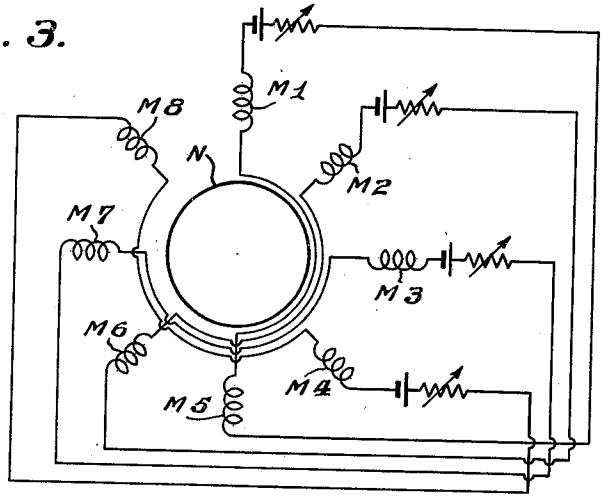


FIG. 3.



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UNITED STATES PATENT OFFICE

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RADIO DIRECTION FINDING RECEIVER

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1 Claim. (Cl. 250—157)

This invention relates to direction finding receivers and more specifically to direction finding receivers of the kind wherein the direction of incoming signals is indicated by means of a cathode ray tube with a fluorescent screen, the incoming signal direction usually being indicated by the direction of the line on the screen.

As is well known, radio direction finders are subject to numerous errors including errors due to pickup by the receiving directional aerial system of subsidiary signals re-radiated from conducting masses near the aerial. Where such re-radiated signals are in phase with the desired incoming signal the resultant error will be of the quadrantal type and where they are out of phase with the desired incoming signal, the result will be equivalent to that set up by a weak interfering field coming from a direction different from that of the main or desired signal field. In addition to errors of the nature just described, there also frequently arise, in radio direction finders of the cathode ray tube indicator type, errors due to manufacturing faults in the cathode ray tube; for example, the configuration and positioning of the electrodes inside the tube may not be exact and correct. The normally provided cathode ray deflecting systems of the tube may not be exactly mutually perpendicular or may be such that the cathode ray, in its undeflected or rest position, is not exactly centrally disposed with reference to the deflecting systems.

The present invention seeks to provide simple and easily adjustable means whereby errors of the types referred to may be minimized or eliminated by trial and error adjustment.

According to this invention, a radio direction finding receiver of the kind referred to is characterized by the provision of means, supplementary to the normally provided electrostatic and/or electro-magnetic ray deflecting means of the tube, for applying subsidary deflection to the ray within the tube. The subsidiary ray deflecting means are preferably adjustable and may be electro-magnetic and/or electrostatic.

The invention may be applied to correct for site errors by providing one or more auxiliary solenoids, pairs of electrostatic plates and/or iron masses so disposed with reference to the main deflecting systems of the tube as substantially to correct for such errors. Similarly, effects of manufacturing errors in the tube itself may be reduced or eliminated by subsidiary magnetic or electrostatic deflecting means.

Where the radio direction finder is of the type employing a radiogoniometer or frame aerial and the incoming signal direction is ascertained by observation of the radiogoniometer or frame aerial scale reading when a predetermined pattern is obtained on the cathode ray tube screen, the subsidiary deflecting means may be arranged to rotate round the cathode ray tube in synchronism with the radiogoniometer or frame aerial (as the case may be) so that errors which vary with rotation of the said radiogoniometer search coil or the frame aerial may be automatically compensated for or reduced for all positions thereof.

The invention is illustrated in the accompanying schematic drawing, in which Fig. 1 illustrates the application of my invention to correct the effect of misaligned deflecting electrodes, Fig. 2 illustrates the application of my invention to a tube in which the cathode beam is not properly centered, and Fig. 3 illustrates a modification employing a plurality of correcting coils.

Referring to Figure 1, this shows one way of applying the invention to correct for error due to the use of a wrongly constructed cathode ray tube employing electrostatic ray deflection by pairs of electrostatic deflector plates. These pairs should be mutually perpendicular, but it is assumed that, by reason of faulty manufacture they are not so. In Fig. 1, which is a view looking into the usual neck N of the tube 1, 1, 2, 2 are the normally provided deflector plates which should be mutually perpendicular. In fact, however, due to faulty manufacture, they are inaccurately positioned (in Fig. 1 this error is for clarity greatly exaggerated as compared to what is likely to be met with in practice) with the result that the lines of force produced by 2, 2 are not perpendicular to those produced by 1, 1. In accordance with this invention external compensating plates 2A, 2A are provided. In use, the plates 2A, 2A are energized from the same source G2 which feeds the plates 2, 2, but means, represented by a potentiometer P, are provided for enabling adjustment of the input amplitude to 2A, 2A, so as to allow of accurate compensation by trial and error. The fields due to 2, 2 and 2A, 2A are so adjusted that the resultant field is at right angles to the field due to 1, 1. G1 represents the source for the plates 1, 1.

Figure 2 illustrates the application of the invention to a case where, due to erroneous manufacture, the cathode ray stream, when in its undeflected position, is not centrally disposed with reference to one pair of deflecting plates. In Fig. 2, which is a schematic side view, the ray from the electron gun (not shown) is represented

by the broken line R as not passing centrally between the plates 1. This defect is met by providing a supplementary constant adjustable magnetic or electrostatic field to bring the cathode ray into the central position indicated by the chain line R' for deflection by potentials on the plates 1. As shown, the supplementary field is provided by additional plates 1B, 1B though clearly coils might have been used in lieu thereof. For simplicity, only one pair of deflector plates proper is shown in Fig. 2.

Site errors, quadrantal and octantal errors can, as is well known, be corrected for by applying experimentally obtained corrections to the readings given upon a normal scale, or, where it is not desired to apply such corrections but rather to read the scale direct, the closeness of the scale may be varied, from part to part thereof, to take into account the errors in any particular system. This, however, involves the use of a specially calibrated or designed scale for each installation. The present invention enables a normal, standardizable scale to be used on the end of the cathode ray tube and yet to give corrected readings direct. This is achieved by compensating for the errors in question by means of a plurality of individually adjustable electrostatic or electro-magnetic deflection systems disposed round the tube.

Figure 3 shows, in a view similar to that of Fig. 1, an arrangement of this nature, there being, in Fig. 3 eight equally spaced coils M1 . . . M8 arranged round the neck N of the cathode ray tube, these coils being individually adjustably excited so that the resultant field therefrom just compensates for the closing up of the cathode ray tube scale which would otherwise occur. In this way, the use of a uniform or even scale is rendered possible. In Fig. 3, the normal deflecting means are, for the sake of simplicity, not shown.

Complex errors due to a combination of causes may, in many cases, be greatly reduced or even entirely eliminated by one and the same supplementary means, but it will be appreciated that the present invention will not eliminate "night effect" errors.

The supplementary deflection required by this invention may be, in some cases, obtained wholly or in part by means including the same plates and/or coils as are employed for the normally provided main deflection by providing means for superimposing on the normally applied potentials or currents for said plates or coils, correcting or compensated supplementary potentials or currents.

I claim as my invention:

A cathode ray indicator comprising means for producing an electron beam, a fluorescent screen adapted to be impinged by said beam, horizontal and vertical deflecting means for deflecting said beam across said screen, means for applying deflecting voltages to said deflecting means to produce horizontal and vertical deflecting fields, respectively, said fields being angularly disposed with respect to each other and perpendicular to the axis of said beam, the orientation of said horizontal deflecting means causing said horizontal deflecting field to be at an angle other than a right angle with respect to said vertical deflecting field, auxiliary deflecting means for producing a third deflecting field which combines with said horizontal deflecting field to produce a resultant horizontal field effectively at right angles to said vertical field so that the resultant horizontal field has no effective vertical component influencing said beam.

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