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DIRECTIONAL ANTENNA SYSTEM

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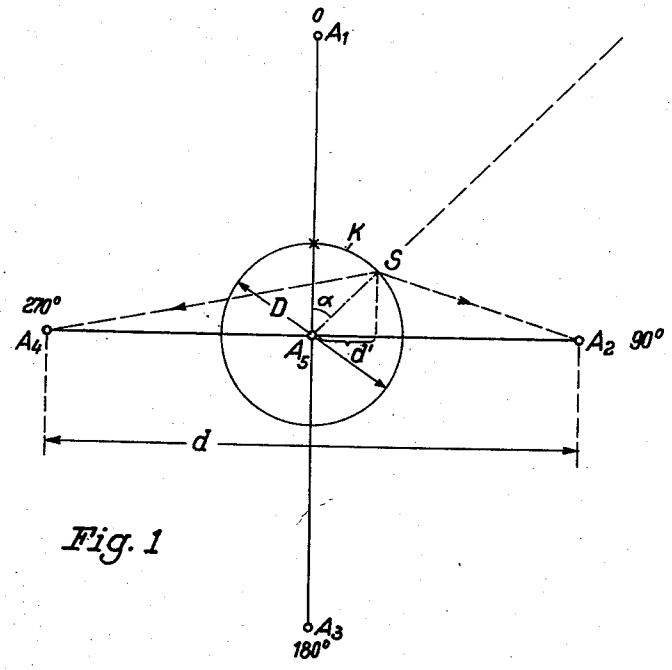


Fig. 1

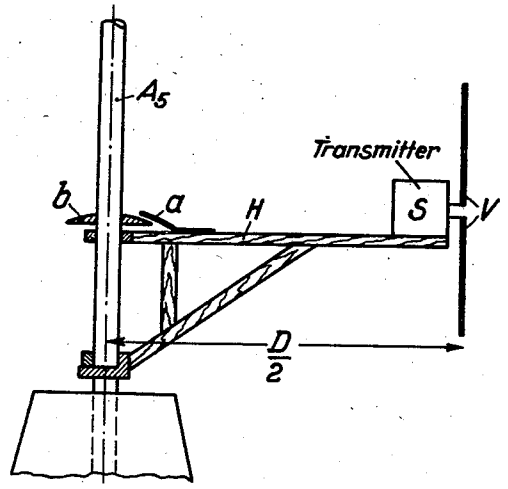


Fig. 2

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DIRECTIONAL ANTENNA SYSTEM

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3 Claims. (Cl. 250—33)

This invention briefly relates to directional antenna systems, and more particularly to means for calibrating such systems.

Several types of directional antenna systems are known in the art. One of these types, known as Adcock antenna, comprises four individual antennas, each of which is located in a corner of a square. In a condition of equalization or balance, that is, when the feeder lines interconnecting the individual antennas and the transmitter neither pick up nor radiate electromagnetic energy, the antenna system operates with suppressed horizontal polarization. A fifth antenna located in the centre of the square or point of intersection between the diagonals connecting oppositely positioned antennas with one another, completes the antenna system for the purpose of effecting lateral direction determination and for more sharply defining the minimum effect of radiation action.

It is a necessary requirement in directional antenna systems, from time to time, to check or calibrate the efficiency thereof in respect to eventually occurring unbalances and errors in its directional action. In the past such calibration has been effected from an airplane cruising around the antenna system or by a movable transmitter brought around the system on a vehicle, for example. The first mentioned method of calibration is very expensive and necessitates skilled operators since not only electrical direction finding measurements but even optical determinations must be accomplished in order to ascertain errors introduced in the action of direction finding. The second method is wearisome and considerably restricted by fields and impassable roads in the vicinity of the antenna system. A suitable and simple instrument for accomplishing such calibration has not yet been rendered available.

It is an object of this invention to overcome this lack and to provide a simple and relevant device for calibrating and checking directional antenna systems. I make use of an auxiliary or calibration transmitter which is carried on a bracket member rotatably mounted on the central antenna of the directional antenna system. It is thus possible to move this transmitter along the circumference of a circle traced in the central portion of and having its mid point coincident with the central antenna of the system. The rotatable bracket member and the fixed pivot are provided with a scale and pointer, respectively, in order to simplify comparison between the auxiliary transmitter and the efficiency of the antenna system.

The arrangement according to my invention is beneficially applicable to the above mentioned Adcock antennas in which direction finding errors may immediately be ascertained. It is thus possible in the simplest manner to determine the operating characteristic of the antenna system.

My invention will be fully understood from the following description taken in conjunction with the accompanying drawing, in which:

Fig. 1 is a plan view of an Adcock antenna system explanatory of the invention, while Fig. 2 is a partial cross section through an arrangement according to this invention.

With reference to Fig. 1, there is shown a directional antenna system comprising four individual antennas A1, A2, A3 and A4 each disposed in one corner of a square. The antennas A1 and A3 and the antennas A2 and A4, respectively, are spaced apart at a distance=d. A fifth antenna A5 is located in the centre of the square, in the four corners of which the antennas A1 to A4 are placed. Now, as taught by this invention an auxiliary transmitter S is provided. This auxiliary transmitter is movable along the circumference of a circle K of the diameter D in the central portion of the antenna system, that is, around the mid-antenna A5. The auxiliary transmitter S is provided with a dipole or Marconi antenna V. In cases when the transmitter is positioned at 0° or at 180°, transit time difference with respect to the antenna system A1 and A3 is a maximum value which is constant and equal to D, while under the same condition the transit time difference is zero for the antenna system A2 and A4. On moving the transmitter S along the circumference of the circle K in a direction toward the antenna A2, the distance $2d'$ represents the transit time of the currents in the antennas A2 and A4, and $2d'=D \sin \alpha$. The phase is given by the expression:

$$\psi=\frac{2\pi.D.\sin\alpha}{\lambda}$$

In cases when the transmitter would be moved outwardly along the azimuth, the action of direction finding remains constant since the phase change is proportionate for both antenna systems.

The Fig. 2 embodies a suitable design of the calibration or checking device according to this invention. The central antenna mast A5 carries a wooden bracket H which serves as a support for a small size transmitter S having a vertical antenna or dipole V. This bracket and a pointer

a attached thereto is rotatable around the central antenna over a full 360 degrees scale *b* which gives the geographic orientation of the directional antenna system. When it is desirable to check the efficiency of the antenna system, the transmitter S may be moved from 0 to 10 degrees so as to determine the minimum effect in the goniometer of the directional system; this minimum being precisely defined in the known manner by means of the auxiliary or central antenna A5. Since each change in condition occurring in a directional antenna system causes a direction finding error, the possibility of arbitrarily repeating the test and the fact that such test only requires a very short time is of beneficial advantage. It is likewise possible to determine polarization errors by inclining the transmitter dipole V relative to its vertical or normal position. If this dipole is moved into a horizontal position, no reception takes place in the antenna system.

Because of the fact that the calibration or checking transmitter is fixed to the central portion of the antenna system, the efficiency thereof with respect to the surrounding terrain cannot be determined with this device. This, however, is no essential drawback since eventual changes in this respect are insignificant while the slightest mechanical unbalance of the antenna system per se might give rise to considerable errors in the direction finding efficiency.

What is claimed is:

1. An arrangement for calibrating directional antenna systems consisting of a number of individual antennas comprising a calibration transmitter, a dipole antenna directly connected to the said transmitter, a supporting bracket therefor pivotally mounted on an axis at a central position of the said directional antenna system and movable along the circumference of a circle formed by the said bracket as the radius thereof.

2. An antenna arrangement according to claim 1 in which the said axis at a central position of the said directional antenna system is an antenna mast forming part thereof.

3. An arrangement according to claim 1 in which a scale is provided on the said axis and a pointer is provided on the said bracket for ascertaining the position of the said calibration transmitter relative to the geographical orientation of the said antenna system.

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