DIRECTION FINDING IN NAVIGATION.

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It is of great importance to *aircraft* to know exactly the direction in which they are travelling, and hence direction-finding equipment has been elaborated. This not only takes up much of the limited space available but is often also difficult to operate. The Air Ministry has recently developed a new method of direction finding in its design establishment at Biggin Hill. This was described on Jan. 4 to the *Institution of Electrical Engineers* by Messrs. T. H. GILL and N. F. S. HECHT.

The chief object of the method is to replace the direction-finding equipment on the aircraft by something very much smaller and easier to operate. A loop aerial is employed at the station, the energy radiated from the loop being a maximum in one direction and a minimum in another. The loop rotates about a vertical axis at a speed of one revolution per minute and sends out a continuous signal. This signal is interrupted when the line of minimum radiation is in the true north direction and a special MORSE signal is transmitted at that moment. This enables the observer to start a chronograph. He can then find the interval between the north signal and the instant at which he is receiving minimum radiation. He thus obtains his bearing.

From the results obtained it was found that bearings could be determined with an accuracy at least equal to that obtained by any other radio method of direction finding. For the accuracy necessary for aerial navigation, this method gives a range of 200 miles.

The Air Ministry having found the "rotating beacon" method of great use for aircraft, the *Radio Research Board* has made a series of experiments to find out if it would be equally useful for navigation. The results of these experiments were communicated to the *Institution of Electrical Engineers* by Messrs. R. L. SMITH-ROSE and S. R. CHAPMAN at the same meeting.

The rotating-loop beacon was installed near Gosport and a calibration was carried out at fixed points in various directions up to a distance of 60 miles. It was found that the observed bearings were subject to a permanent deviation due to land effects. This permanent deviation was not greater than one or two degrees. At distances exceeding 60 miles, radio bearings got by this method were found to be subject to night effects similar to those obtained in radio direction finding. The errors were not serious, however, until the range exceeded 90 miles oversea. Even at great distances a fair accuracy can be obtained by taking the average value of a series of readings made in about ten or fifteen minutes. It was concluded that, up to 50 miles, the rotating beacon method gives accurate readings.

Compared with the ordinary direction-finder as used on board ship, this method has several advantages. It is independent of the steadiness of the ship, and also of the accuracy with which the ship's head is given by the compass reading at the instant of observation. No correction or compensation corresponding to the quadrantal error associated with the ship's direction-finder is necessary. It was proved, however, both theoretically and experimentally, that the limitation of the accuracy by night effects applies equally to both methods.