

THE AUTOMATIC RADIO COMPASS

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In the October number of the quarterly journal entitled *Electrical Communication* published by the International Standard Electric Corporation, there is a paper by H. BUSIGNIES describing the automatic radio compass and its applications to aerial navigation.

Ten years ago, attempts were made to develop a compass system, called the "Hertzian compass", in which the angles indicating the position of a radio transmitter appeared automatically on a graduated scale, similar to the scale of an ordinary magnetic compass. Rough models were made and the essential principles established. Exhaustive trials were made with the collaboration of the French Air Ministry, and commercial production was commenced. It gives an automatic and unbroken visual indication of the direction of a radio station by showing the angle between the direction of this station and the aeroplane's axis. Le Matériel Téléphonique, Paris, constructs a radio compass (R.C. 5 Radio Compass), which indicates the direction of a transmitter on a dial graduated in degrees completely round the circle.

The radio compass may be described as an automatic radio goniometer. It indicates the direction of chosen transmitters which may be situated at any points round the aeroplane. The apparatus is based on the following principle. When a receiving loop aerial turns regularly round a vertical axis, maximum reception occurs every time that the plane of the loop passes in the direction of the transmitter. If the loop turns at a constant speed, a certain number of maxima and minima receptions per second can be observed in a receiver turned on to a transmitter. A rotating speed of five revolutions per second has been chosen as the standard, maxima and minima of receptions taking place at ten per second. The phase of these maxima and minima, that is, the moment at which they occur in connexion with a given origin, depends on the direction of the transmitter in relation to the axis taken as origin. If the location of the transmitter changes in relation to the radio compass, the minima and maxima phases also change, and it is the changing of the phases which is utilized in the apparatus to obtain the automatic indication.

A two-phase current generator the phase of which is constant in relation to the revolutions of the rotating loop is placed on its rotating axis. The two-phase current creates a rotating field in a magnetic stator which may be compared to the stator of a synchronous motor. This field rotates at a speed double that of the loop. The variable current from the receiver actuates an armature carrying a pointer associated with a dial. In this armature, therefore, an alternating current is produced by the rotation of the receiving loop, and in the stator a fixed phase rotating field by the two-phase machine. Thus the magnetic reactions of one flux on the other give a definite position to the armature, which sets itself perpendicularly to the flux. The radio compass does not itself indicate the "sense" of direction, but this 180° ambiguity can be eliminated in several ways. Little if any trouble arises from interference of transmitting stations. The total weight of the apparatus is about 50 lb., depending on the size and type of the aeroplane. The guaranteed accuracy of the apparatus is $\pm 2^\circ$ for a distance of 300 miles from a 300-watt transmitter.

Guided by the radio compass, the aeroplane always flies in the direction of the station and, if there is no wind, it flies in this direction along a great circle. When there is wind, the pilot determines the drift angle when starting by noticing the course which gives a constant reading of the magnetic compass with a constant indication of the radio compass. Thus, when the correct drift angle has been determined the compass readings can be corrected. In France, both civil and military aviation authorities have submitted the compass to exhaustive trials, and many aeroplanes are already equipped with them.
