AN AUTOMATIC RECORDER OF SIGNALS FROM A ROTATING BEACON TRANSMITTER

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The present article describes an automatic recording apparatus whereby the signals received from the rotating beacon may be printed on a sheet of paper, thus relieving the need for continuous attention on the part of the operator and avoiding the use of a watch for timing the signals. The instrument is intended to be connected at the output end of the ordinary ship's receiver, and when once it is set in operation the bearing of the distant beacon may be observed immediately, or it may be read off the paper sheet after this is removed from the recorder drum.

The rotating beacon transmitter employs a frame coil about 10 ft. square, rotating about a vertical axis at a uniform speed of one revolution per minute. The coil forms the inductance of a tuned circuit in which the oscillations are generated by the transmitting valve and the intensity of the radiated field at points distant from the transmitter varies as the cosine of the angle between the plane of the coil and the direction of transmission.

As the coil rotates, a characteristic signal is emitted to indicate when the plane of the coil is perpendicular to the geographical meridian. If an observer at a distant receiving station starts a watch or chronograph on hearing this signal, and then observes the time interval which elapses before the signal passes through its minimum intensity, the bearing of the receiver from the transmitter can be calculated from the known speed of rotation of the beacon (6° per second). To avoid having to make this calculation, it is convenient to provide the watch or chronograph with a special dial graduated in degrees (0-360) and also marked with the points of the compass.

Description of the Apparatus. — As the beacon transmitter rotates at its normal speed of one revolution per minute, the pen magnet is energised for almost the whole of the minute, but during the two minima and the space of the characteristic N. signal emitted by the beacon it is not so energised. The pen in turn is continuously tracing a line on a rotating drum except for these periods when it lifts from the paper.

The drum itself has a circumference of 36 inches, and a ruled piece of paper is fixed to it by a simple clamping device. The ruled lateral marks are 1/10th inch apart, corresponding to degrees. This drum is rotated synchronously with the beacon by means of a phonic motor and gearing, the motor being driven by a standard tuning fork electrically maintained. The pen is mounted on a travelling carriage, which also supports the pen armature and energising magnet. This pen carriage traverses the paper by means of a lead screw geared to the drum, the pitch of the thread being such that the pen moves 1/10th inch per complete revolution of the drum. By this means, the trace obtained is a spiral with a 1/10th inch pitch. To facilitate the final reading of the bearing a movable protractor is fitted, by means of which the bearing can be rapidly read from the trace left on the paper.

In operation, therefore, the drum is rotating continuously, and the pen causes an ink line to be traced upon the paper whenever the strength of the incoming signal is greater than a certain minimum to which the receiver can be adjusted.

When left in operation, the apparatus will continue to record the received signals from the beacon over a period of half an hour or longer, this period being dependent only upon the pitch of the spiral and axial length of the drum. At any time, the received bearings may be read directly off the drum by setting the circular protractor scale so that the 0° reading coincides with the N. signal mark, and then noting the reading of the protractor at the mid-points of the gaps in the record which indicate the occurrence of minimum intensity of the received signal.

The pen is lifted from the paper for about 0.5 second corresponding to about 3°, but the mid-point of the minimum space can naturally be measured to within a fraetion of this arc.

Accuracy of Bearings obtained with the Apparatus. — To obtain a knowledge of the accuracy of operation of the recorder under practical conditions, a number of tests were carried out at the National Physical Laboratory, Teddington, on the transmissions from the Orfordness beacon.

Since observations on the rotating beacon are normally obtained by an aural observer listening to the incoming signals in a pair of head telephones, it was considered desirable to compare the accuracy of the bearings obtained in this manner by two different aural observers with those given by the automatic recorder.

These results show that the two aural observers are in practically complete agreement in their mean bearings. The mean bearing given by the recorder is seen to be about 0.5° higher than that obtained by the aural observers.

All the above results were obtained at a distance of 93 miles overland from the Orfordness beacon in the presence of severe local interference, and it is likely that when used on board ship under more favourable conditions its operation would be equally reliable up to at least twice this range. It is considered that the recorder could easily be developed along lines which would make it suitable for installation in any part of a ship preferably equipped with a receiver specially tuned in to receive signals from a rotating beacon. If the present alternate five minutes' interval in the transmissions from Orfordness were occupied by those from a second beacon on the same wave-length, then bearings from the two beacons could be recorded on the same instrument at any time.