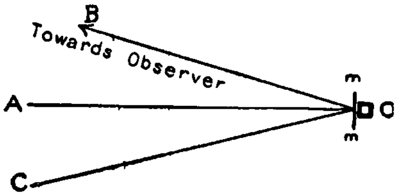


position *A* on the ground where one's own reflection can be seen in the upper mirror is found and marked with a peg. Using a plane-table or compass, the line *OB* towards the observer is then laid out. Now, in order to send light to the observer, using the mirror *mm*, clearly the source of light must be situated somewhere on the line *OC* where the angle *COA* = the angle *AOB*. This line *OC* can be easily marked on the ground and also a point found on it from which the horizon is visible. From this position, or very near it, the observer's station will be visible in *mm*. The procedure adopted was for the observer at the other station to shine a powerful helio in the direction of the mast, at a pre-arranged time. The man at the mast having already found or been shown the approximate position from which he should see the observer's station, soon picked up the observer's light (by the method just described). Having once seen it, there was no further difficulty. He adjusted his ground helio at the same place and kept the light of the sun focussed on the top mirror, as long as required.

HELIO BEACON

by COOKE, TROUGHTON & SIMMS Ltd.,
Engineers & Scientific Instrument Makers,
Broadway Court, Westminster, London, S. W. 1.

The Helio Beacon consists of a dome, on which mirrors are mounted, arranged in a number of series.

The dome is rotated by four wind vanes and the rotation causes the dome to rock so that, with the sun at almost any angle, flashes will be sent periodically to all points about the dome, and thus enable an observer to sight upon it from considerable distances.

The size of the Beacon shown, which is 6" diameter, is intended for shots of 10 miles and over, for which distance the maximum possible error, due to rays being received from mirrors occupying positions to the side of the dome (as viewed from the point of observation) and not in line with the mark over which the beacon has been set up, will be within one second of arc, that is, that permitted in Topographical Survey.

The dome is mounted on ball bearings and is more or less frictionless, so that a very high speed of rotation is imparted to the Beacon with a fairly light wind and flashes are observed in a continuous stream, it being quite an easy matter to take bearings by means of a Theodolite.

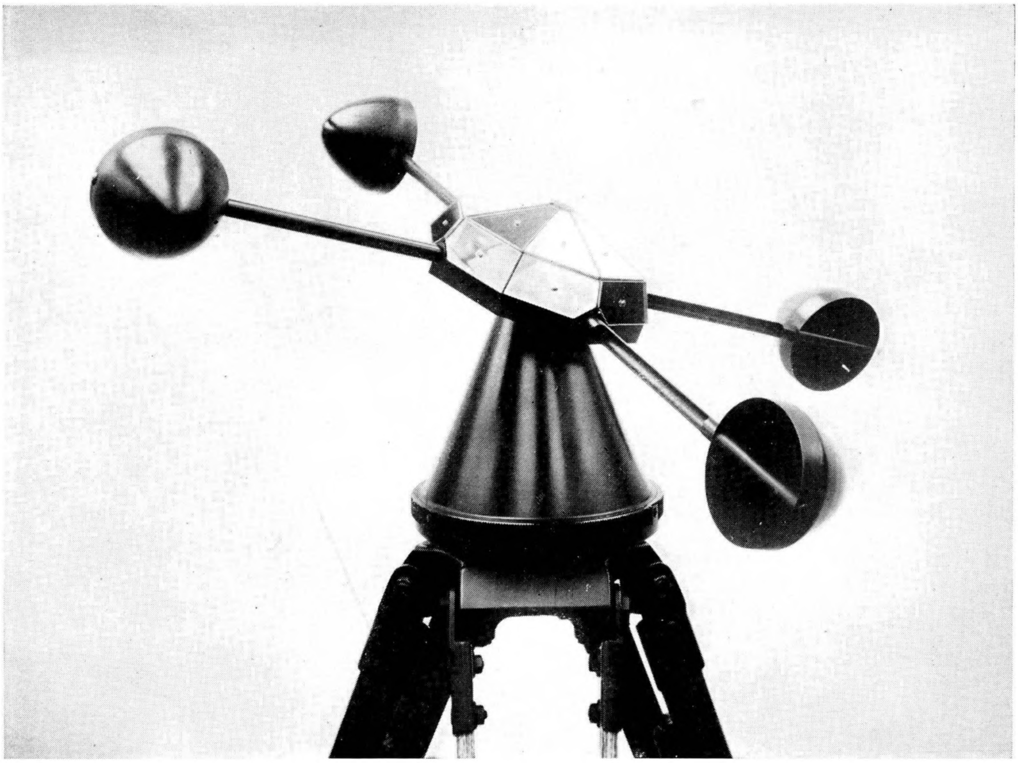
A tripod is supplied with the Beacon, the latter being packed in a mahogany case.

The Beacon is made entirely of rustless materials.

The price of the instrument complete is £ 40. 0. 0.

DETERMINATION OF THE SHIP'S POSITION BY OBSERVATIONS OF TWO POINTS THE BEARINGS OF WHICH INTERSECT AT A SMALL ANGLE.

This problem relates to cases where, on making a land fall, two objects only are visible, the angular distance between them being small and therefore the lines of bearings



Helio Beacon — Balise Héliographique

to them when plotted on the chart would not result in an accurate position of the ship.

Considerably greater accuracy can, however, be obtained by combining the bearing of one object with the angular measurement between them and calculating the distance to the object in the manner about to be described (1).

Let *A* and *B* (Fig. 1) represent the positions of the two objects sighted, and let *M* be the actual position of the ship on the chart relative to them.

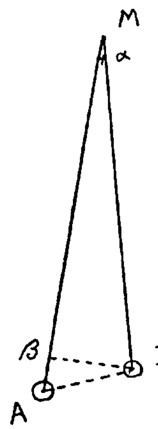


Fig. 1

The compass, owing to its imperfection be it gyroscopic or magnetic, does not permit the lines of bearings *MA*, *MB*, to be observed with a greater accuracy than half a degree.

Consequently, the probable error of the angle α (difference between the two observed compass bearings *MA* and *MB*) may be as much as one degree.

It is quite easy, even by night, when it is a question of lights, and even of flashing lights, to measure with a sextant or a micrometer the value of α within a few minutes of arc, thus obtaining 30 times greater accuracy than by merely taking the difference between the two bearings, with a consequent greater accuracy in the position finally plotted.

In triangle *MAB* (Fig. 1), assume that an accurate bearing *M-A* has been observed: plot the reverse bearing *A-M* on the chart and from *B* drop a perpendicular $B\,\beta$ onto this line.

Obtain the length of the side $B\,\beta$ from the scale of the chart, every possible care being taken as to accuracy, *i. e.* by working with the magnifying glass, repeating the measurement several times and using the largest-scale chart in preference to the track chart on which the land fall has been made. Then compute the distance $\beta\,M$ by means of formula:

$$\overset{\text{miles}}{\beta M} = \overset{\text{miles}}{B\beta}\ \cot\alpha$$

From the point β with radius $\beta\,M$ sweep a chord, and the point *M* where it cuts the line *AM* already plotted will be the position of the ship.

At great distances, when the angle α is small and of the order of some few degrees only, the following relation

$$\cot\alpha = \frac{1}{\alpha}\cot 1^{\circ} = \frac{1}{\alpha^{\circ}} \times 60$$

may be accepted, and the distance βM can readily be obtained from the expression

$$\overset{\text{miles}}{\beta M} = \overset{\text{miles}}{\beta B} \times \frac{60}{\alpha}\ \text{degrees}$$

It is easy to analyse the degree of error involved in this kind of determination, by considering:

1) the error on bearing *MA*;
2) the error in the measurement of α;
3) the error in the estimation of length $B\beta$.

This detailed analysis does not present here much practical interest and it will suffice merely to enunciate the result arrived at, *i. e.* that the error in the final position of the point *M* remains within the limits of one-sixtieth of the distance which separates the ship from the point observed.

H. B.

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(1) Example: *Landfall on the isle of Ushant bearing about* 130°, *either by day or by night.*

The ship at M *takes a compass bearing of Creach' Lighthouse* (A, *fig.* 1). *The Stiff Lighthouse* (B, *fig.* 1), *the only other object visible, is "angularly" too near to permit of a compass bearing of this latter light, combined with that of Creach', to give an accurate position when plotten on the chart.*