A NEW PLOTTING METHOD FOR HYDROGRAPHIC SOUNDINGS

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In plotting soundings obtained during hydrographic operations by ultrasonic sounders, the methods followed for many years in plotting lead soundings are still being used. Yet the advent of the ultrasonic machine has not only enabled the ship's speed and consequently the number of soundings to be increased, but has also made it possible to obtain a continuous record of depths.

As a result of the delay in plotting work compared with the actual sounding operations, we considered during our last mission of the coast of Morocco that it was essential to adapt our plotting methods and facilities to our sounding equipment, consisting in Kelvin-Hughes MS 26 instruments using non-shrinkable metallized paper. Our main objective was to speed up analysis of the graphic records, allowing for the tide reduction, without sacrificing accuracy. In addition, we wanted to make the most of the possibilities offered by continuous depth records, and show as clearly and completely as possible the bottom relief on our work sheets.

In order to avoid all the numerical operations required by the insertion of corrections to the sounding figures as read from the graphic records (such corrections are a frequent source of errors difficult to detect), we recommended use of the instrument illustrated by plates 1 and 2. By means of a single reading on a graduated circle, this device enables the depth to be obtained at a specified point, all corrections being done mechanically.

The instrument shown in plate 3 enables the sounding figure thus determined to be plotted in its exact position on the work sheet.

These fairly rudimentary instruments, which were hurriedly built in the Hydrographic Office's workshop, must only be regarded as test models. Their use over a period of a few months indicated a need for several mechanical changes, which will be applied to the new equipment now being developed at the Hydrographic Office.

Analyser

The recording paper wound on two parallel cylinders slides under a transparent graduated circle C, whose radius is equal to the length of the stylus arm of the Kelvin Hughes sounder.

The graduation of circle C and that of the sounder are identical. A transparent graduated circle corresponds to each type of sounder and to each speed of stylus rotation.

The middle of the circle is hollowed out in the shape of a regular nonagon, in which fits a nine-sided brass nut. This device enables the circle to take nine different positions each 40° apart, corresponding to the nine successive scales of the echo sounder. The nut E (see fig. 1) is screwed tightly to the axis, to which it is locked by a check nut (see Pl. 2).

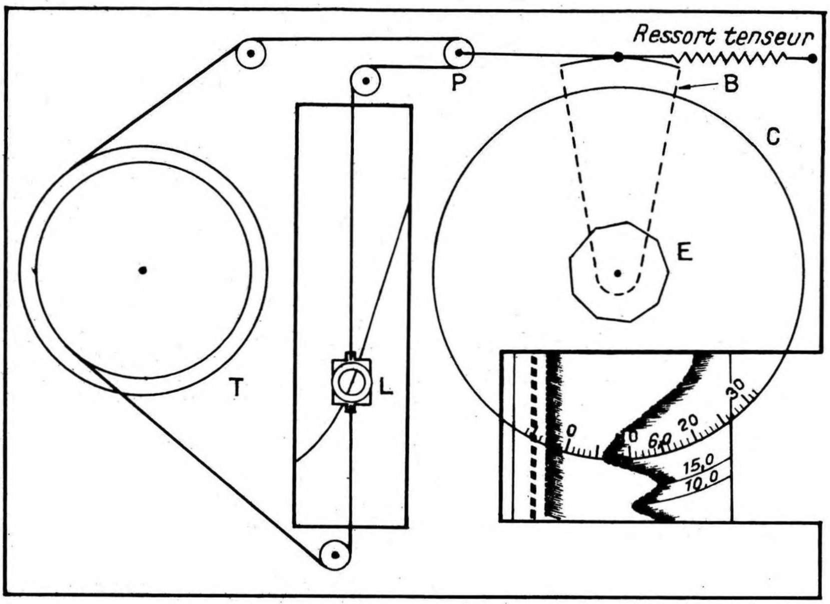

FIG. 1

Calibration correction

This correction is displayed on the instrument by setting the corresponding graduation at the beginning of the transmission signal record.

Echo sounder speed correction

To allow for any possible increase (or decrease) in the speed of rotation of the sounder's stylus arm, we recommended the use of circles C′ graduated for several speeds of rotation $V \pm n\Delta V$, ΔV remaining to be determined according to the sounding accuracy required.

As no such graduated circles were available in our particular case, we were compelled to use correction tables.

Tidal corrections

If there is no tide, the sounding is read directly from the graduated circle C.

To allow for the tide, the circle C-nut E-vertical axis combination is locked to a pulley P by means of an arm B shaped as a circular sector centred on the axis. The motion of the pulley P is linked, by means of a scale-reduction device, to that of a magnifying lens L. The lens is made

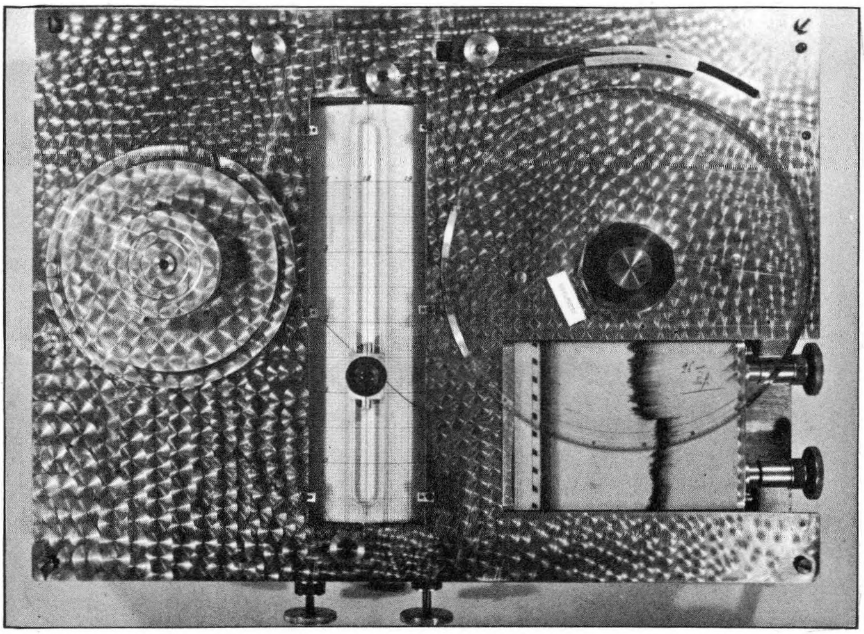

Plate 1

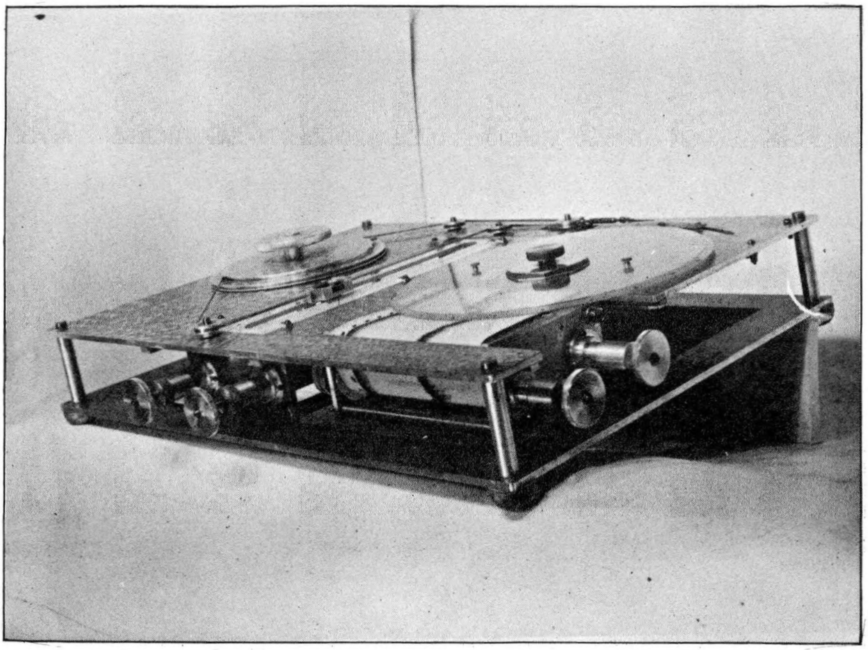

Plate 2

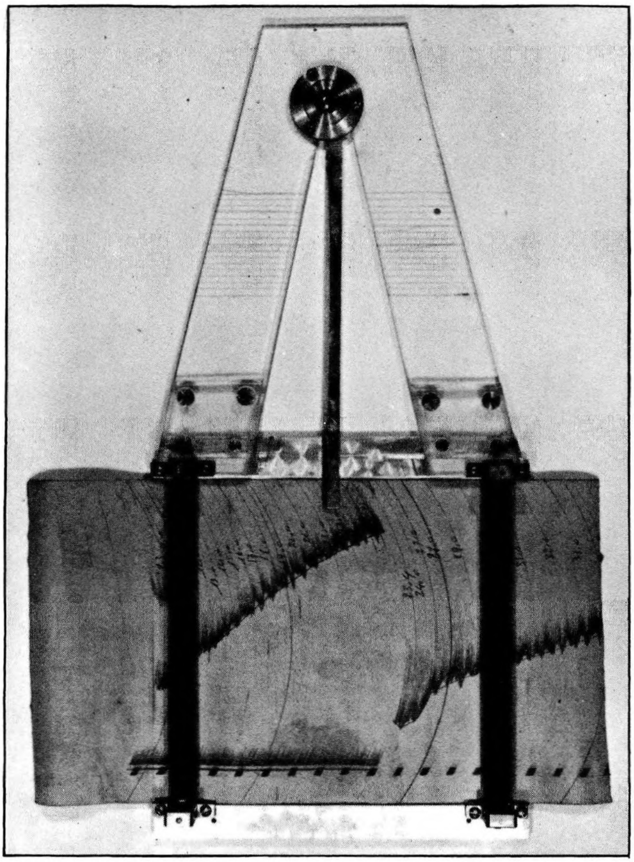

PLATE 3

to follow the tide curve (see fig. 1). Any shift in the position of lens L results in a shift of the pulley P and a rotation leftwards of the graduated circle C.

Subtraction of the tidal height is thus carried out automatically.

Principles of use of analyser

An operator continuously maintains the lens L along the tide curve by rotating the double drum T (see fig. 1) and by shifting the tide sheet in accordance with time *t*.

A second operator slides the sounding record under circle C, and informs the first operator of the station times in order that he can set lens L on the corresponding point of the tide curve. On the right side of the graphic record, along circle C, he draws an arc each time a sounding must be transferred to the work sheet. He enters the sounding along the corresponding arc.

Distribution of soundings

As the sounding vessel is assumed to maintain a constant speed between stations and the paper in the echo sounder also unwinds at constant speed, proportionality is retained between the distance covered and the length of paper unwound.

To locate a sounding in its exact position it therefore suffices to construct two homothetic triangles. The instrument illustrated in plate 3 has been designed for this purpose.

The graphic record slides under two rubber rollers and is kept taut. A mobile arm which swings from the apex of the plexiglass triangle ensures proportionality between the length of paper unwound ABC and the distance covered abc (see fig. 2).

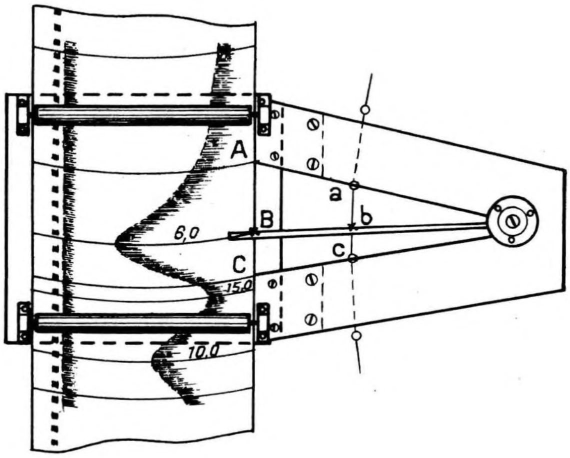

FIG. 2

Sounding work sheets

At the time of our mission off Morocco, we made it a rule to write on the graphic record and transfer to the work sheet :

(a) all maximum and minimum figures of the recorded depth curve;
(b) figures for changes in slope;
(c) soundings in round figures, i.e. those represented by an integer.

In the case of slightly sloping depths, it is recommended that depths showing a difference of 50 or even 20 centimetres also be retained.

Application of these rules ensures better clarity and legibility of the work sheets. The user's attention is immediately drawn to the areas in which the relief is irregular by the density of the soundings entered thereon, whereas regularly spaced sounding figures indicate a constant slope.

Results obtained

Regardless of the imperfections and crude construction of both these instruments, they rendered valuable services. We were able to save a great deal of time in our plotting work at sea, and estimate that it was reduced to about twice the time of the actual sounding operations.

Plotting hence follows closely after sounding, an invaluable asset to continuity of work during hydrographic operations. This is what we were aiming for, and we believe we were successful.

The solution described here is certainly not the simplest or most complete one, and we would be happy to receive any suggestion for its possible improvement. We are moreover at the disposal of any reader who may be interested in our purposely brief account for any desired additional information.