

REPORT ON CURRENT MEASUREMENTS AT STATION N^o 369 OF THE GERMAN SURVEYING VESSEL "METEOR"

(19th April 1937 in Lat. 19°36'9 N., Long. 18°03'9 W.)

by

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(Taken from the *Bericht über die erste Teilfahrt der Deutschen Nordatlantischen Expedition des Forschungs- und Vermessungsschiffes Meteor Februar bis Mai 1937* - Supplement to September number of the *Annalen der Hydr. u. Maritim. Meteorologie*, Berlin 1937, p. 14).

Translated from the German.

In order to complete our concept of the structure of the ocean as furnished by the measurements of temperature, salinity and density, it was planned to continue the experimental research of the German North Atlantic Expedition of 1925-1927 by deep sea current measurements undertaken by the German North Atlantic Expedition of 1937. Because of the extremely short space of time available for the investigation of the upwelling of the waters, and taking into consideration the weather conditions (the Trade Winds reach their maximum intensity in the Spring), the framework of this special investigation could not be very greatly extended. Therefore we rather welcomed the fact that at least on profile N^o XVI, at station 369 (see Fig. 1), where there was a depth of water of 2140 metres, there was a possibility of putting out a sea anchor in order to undertake current measurements from 19.IV.1130 to 21.IV.1400.

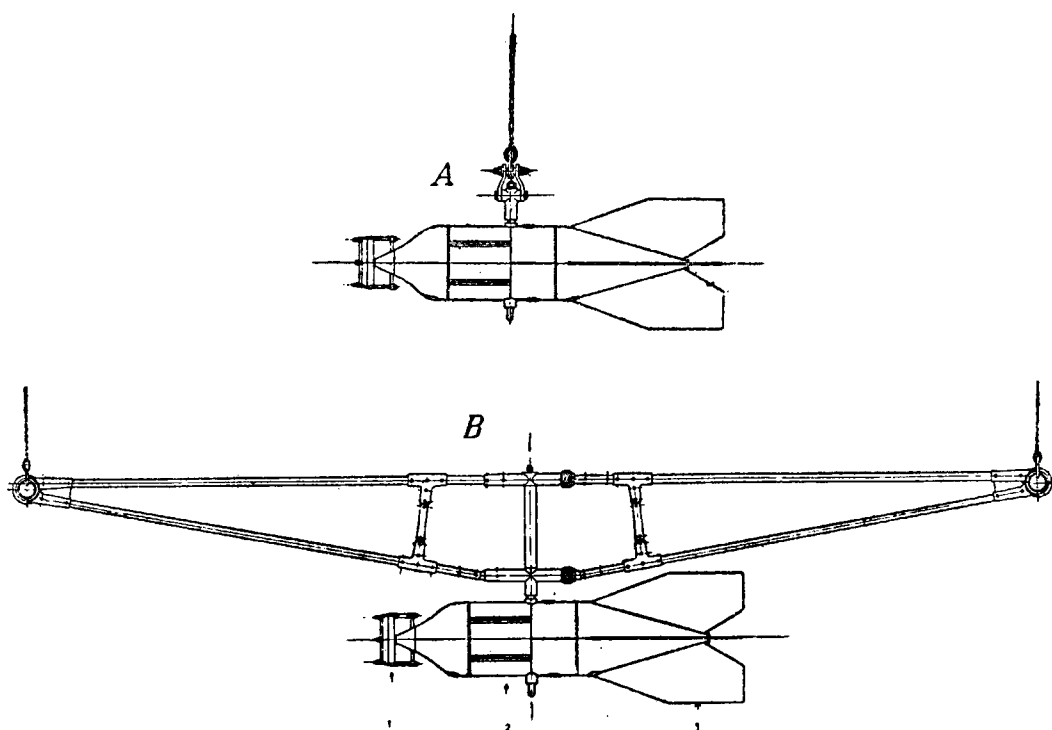


FIG. 1.

(1) H. THORADE: *Methoden zum Studium der Meeresströmungen*, Handbuch der biolog. Arbeitsmethoden, Abt. II, Teil 3, Berlin 1933.

G. THIEL: *Strommessungen des V. S. "Meteor" unter Island*, Ann. d. Hydr., Bd. 62, Berlin 1934.

A. DEFANT und O. V. SCHUBERT: *Strommessungen und ozeanographische Serienbeobachtungen der 4. Länderunternehmung im Kattegat*, Veröffentl. d. Instituts f. Meereskunde, Neue Folge, Reihe A, Heft 25, Berlin 1934.

For the purpose of these current measurements we employed a type of recording current meter developed by the author and built by the Askania-Werke, Berlin. The first model of this instrument was built with the assistance of the German Navy and the *Deutsche Forschungsgemeinschaft*, and was utilized on several occasions for measurements in shallow water (1).

The underlying idea in the construction of this instrument was to supply an apparatus which would be capable of use from vessels at sea and which could operate and register as a mechanical device. Electric distance recording devices were avoided because they gave rise to great difficulties in insulating the electric conduits at great depths. Packing which would have withstood the great pressures with certainty, would have made the device too heavy and unwieldy. For this reason the entire apparatus, with the exception of the clockwork mechanism, which operates in a small, closed, oil-filled case, is open to the sea and completely surrounded by sea-water, including the recording device.

The fish-shaped body (See Fig. 2) carries a propeller at its forward end while at the rear end are the guide vanes for adjusting the direction. It contains the rustless and non-magnetic driving vanes made of beryllium bronze which transmit their impulse to a drive-and-hammer-work, as well as the recording elements of the registering device. In shallow water *i. e.* at short distances from the ship, the current meter is suspended from the vessel by means of two (bifilar) suspension wires of 4 metres' length, and the deviation of the current meter from this suspension (framework) is recorded. The frame is suspended parallel to the keel of the ship. Its direction is therefore given by the ship's heading. Thus the ship's heading and the recorded deviations of the device from the ship's heading, give the direction of the current, which is independent of the magnetic field of the ship itself. In greater depths the device is suspended by a single wire and is equipped with a compass which indicates the orientation. The connection between the current direction obtained from the simultaneously recording framework and compass devices, gives at once the possibility of determining the deviation of the current measuring compass, which is used in all cases where the device is suspended by a single wire.

The indicators for the revolutions of the propellers (See Fig. 2), direction of the frame and compass devices, consist of horizontally placed plates which contain appropriate numerals on their outer edges (similar to those on a typewriting machine). The mechanism then pulls a strip of tinfoil past the figures, which can be so arranged that the hammer strikes a blow every 2, 5 or 10 minutes as desired. As a result of these blows of the hammer, which is contained in a small box, the numerals on the plate corresponding to the number of turns of the propeller, during the above-mentioned intervals, as well as the numerals representing the orientations of the frame and the compass, are impressed upon the tinfoil strip. The number of the blows, or of the blows recorded, is a measure of the time. An example of the registration is shown in Fig. 3. The detailed description of the apparatus must be reserved for the final report.

To test the current meter and to effect the measurements, two instruments were available for the Expedition. One of these devices -- on the port side -- was suspended by two wires near the frame; it was manipulated by hand winches and was used for depths between the surface and 50 metres. The second current meter was hung over the starboard side by a single wire and was handled by an electric winch. This served for the measurements between 100 and 800 metres.

The measurements themselves were so arranged that at depths of 5, 15, 30 and 50 metres each, there was a registration of 15 minutes' duration in every hour. For depths of 100, 300, 500 and 800 metres, owing to the time required for heaving up and slacking off, it was only possible to obtain records of 15 minutes' duration every two hours. In these tables the horizontal lines indicate the times and the duration of the measurements, the numerals above the lines, the velocities in cm/sec., while the numerals below the line indicate the mean direction in degrees during the average time of the measurements. The occasional blanks in the record are due to changing the recording strips, which had to be undertaken on the average of about once each watch of four hours. This relatively frequent change was effected at first as a precautionary measure, but in future it will be superfluous since the current meter can now run for 12 hours with a 5-minute recording interval, and for 10 hours with a 2-minute recording interval.



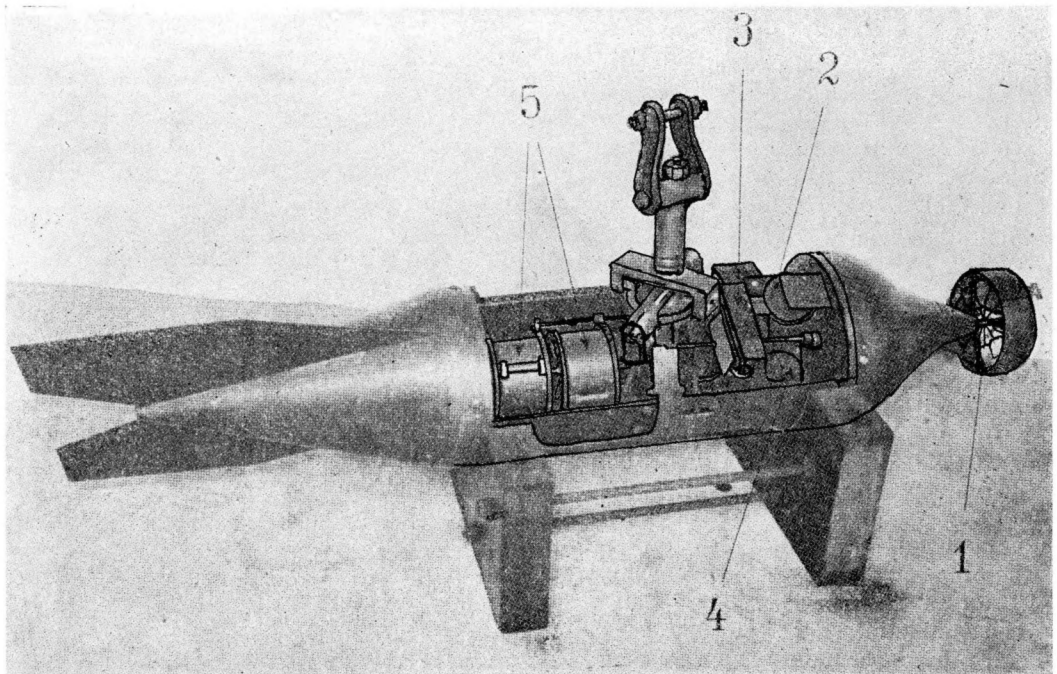


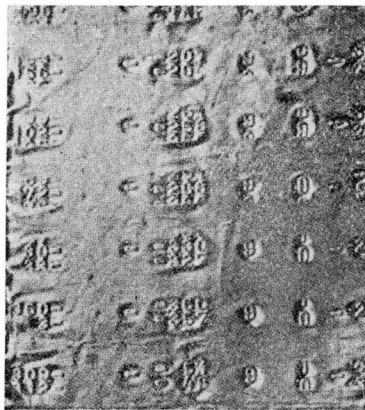
FIG. 2.

Appareil de mesure de courants Böhnecke (tôles de protection extérieures enlevées)

1. Moulinet. 2. Disques d'orientation et de vitesse. 3. Coffret avec bande d'enregistrement.
4. Carter pour mouvement d'horlogerie et mécanisme moteur. 5. Ressorts moteurs dans leur logement.

Böhnecke Current Meter (external sheathing removed).

1. Propeller. 2. Direction and Velocity Disks. 3. Compartment for the registering strips.
4. Case for clockwork and motor mechanism. 5. Driving Springs encased.



3 2 1

FIG. 3.

Bande d'enregistrement (réduite aux 2/3 environ).

1. Révolutions du moulinet. 2. Direction du cadre. 3. Direction du compas.

Registering strip (reduced to about 2/3).

1. Revolutions of propeller. 2. Direction of frame. 3. Compass Direction.