INSTRUMENT FOR THE MEASUREMENT OF THE FORE AND AFT TILT OF OTTERBOARDS

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A portable self contained instrument has been designed and developed for the measurement of the Fore and Aft tilt of otter boards within the range —22° to + 22° with an accuracy of ± 1°. An underwater transducer fitted on the otterboard converts its tilt into corresponding electrical resistance which is measured in an ohmmeter on board, both being connected by electric cable.

Introduction

During the course of design and development of otterboards, the measurement of the Fore and Aft tilt of the otterboard has been very much felt. For the proper working of the otterboard, this angle should never go to the negative side during bottom trawling, in which case the otter board will plough into the ground and will cause high resistance to motion and also sometimes the breaking of the rope. Too much tilt to the positive side also upsets its normal function. The study of the Fore and Aft tilt with respect to the maximum efficiency has become very important and can be carried out only with a light, but rugged and sensitive instrument.

The instrument already available aboard called 'clinometer' is too heavy and bulky for small otterboards. Its duration of operation is limited and the measurements can be taken only after hauling out the otterboards. The research workers and the technicians in the field require a simple, rugged and sensitive instrument for the instantaneous measurement of the Fore and Aft tilt of otterboards.

The instrument consists of an ohmmeter calibrated in terms of angle from —22° to + 22° and a transducer fitted at either one side of the otterboard which converts angle within the range into electrical resistance, both being connected through water resistant electrical wires. —and + angles denote correspondingly the downward and upward tilt of otterboard from its horizontal position.

As shown in Fig. I A, the underwater unit consists of a bent polythene tube of

3 mm bore, the two ends of which are connected to a bulb containing mercury. The uniformly curved portion A B of the polythene tube was divided into 22 equal portions and 23 numbers of platinum terminals were connected. The projected lengths of the platinum terminals into the tube were adjusted to be about 1 mm. so that they make electrical contact with the mercury column inside the tube and also do not make much resistance for the easy movement of the mercury inside the tube. 22 numbers of resistors ranging from 100 to 47000 ohms were connected to the terminals as shown in the figure so that they are in series to themselves and parallel to the consecutive platinum terminals. The platinum terminals and the holes through which they were connected to the tube were thickly coated with araldite. The system is partially filled with mercury to bring the level of mercury just above the 12th platinum terminal from below, when the system is in exactly horizontal position. The system is completely sealed against any external pressure variations. The whole system including the 22 numbers of 0.5 watt carbon resistors were enclosed in a rectangular brass box and the empty space is filled with a proper synthetic electrically non-conducting adhesive so as to enable it to withstand high hydro-static pressure to which it is subjected during operation.

As shown in figure I B, the indicating part is an ohmmeter in principle, which measures the electrical resistance of the unit under water connected by means of water proof electrical wires. It consists of a galvanometer, a 1.5 volts battery, a variable wire wound resistance and an electrolytic condenser.

When the underwater unit is tilted in the vertical plane, the mercury limb in the tube changes its position from point A to point B as shown in fig. IA, corresponding to the tilt from —22° to + 22°. While moving through the tube, the mercury short circuits the carbon resistors through the platinum terminals varying the effective electrical resistance of the unit from 0 to 96000 ohms corresponding to the variation from —22° to + 22°. For every 2° variations in tilt, the mercury column changes its position from one platinum terminal to the next one making the accuracy of measurement $\pm$ 1°. The values of the carbon resistors were selected in such a way as to give almost a linear deflection in the meter for a variation in position of the mercury limb from one end to the other end of the platinum terminals.

Before the underwater unit is connected to the indicator, the two leads of the indicating unit are short circuited and the meter is made to read —22° by adjusting the variable resistance R. Then the meter is ready for measurements.

When the mercury column moves much abruptly through the tube due to any shake in the otterboard, short circuiting more numbers of resistors, giving high kick of current variations, the high value capacitor C charges and discharges, thus smoothening the abrupt changes.

Calibration was carried out subjecting the unit for various tilts from —22° to + 22°. The instrument was tested in sea and the working was found satisfactory.

The following are the features of the instrument developed already for trials

1. Range —22° to + 22°
2. Accuracy $\pm$ 1°
3. Weight in air of the underwater unit: 550 gms.
4. Weight in water of the under water unit: 375 gms.

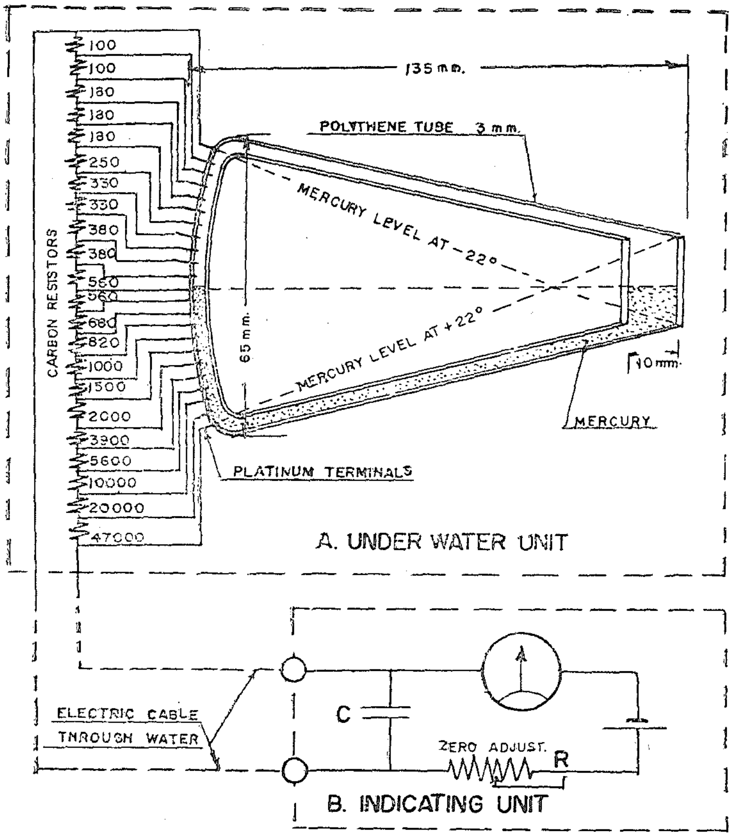

Fig. 1 ELECTRIC CIRCUIT OF THE INSTRUMENT

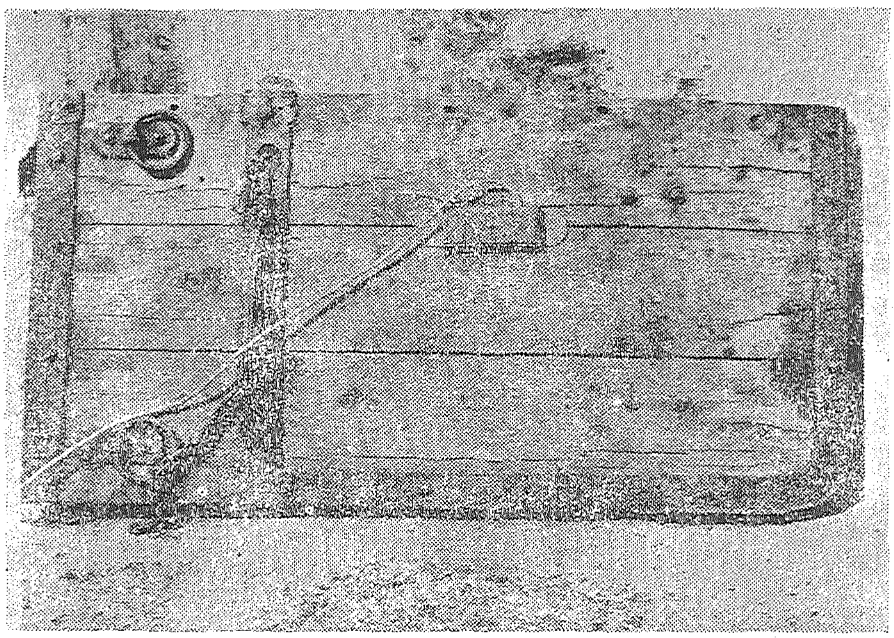

Fig. 2 The photograph shows the underwater tilt transducer fitted on otter board.

5. Capacity to stand pressure: 10 Kg / cm^2
6. Cable length: 100 meters.

The underwater unit will be fitted at the outer or inner side of the otter board and connected to the boat by means of a two-core electric cable. The instrument was designed for the rough conditions in sea. The total cost of it is estimated to be approximately Rs. 400/ and the materials are fully indigenous except the platinum wire which costs approximately Rs: 30/-.

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REFERENCE

de BOER. P. A., "Modern Fishing Gear of the World" 1959, Vol. I, 22-233.