

Operational Depth Telemeter for Use in Fishery Practice

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Manuscript received 3 May 1969

An electronic instrument capable of measuring the depth of operation of fishing gear or any other object in the range 0-100 m with an accuracy of ± 1 m is described. The main components of the instrument are a hydrostatic inductive type pressure transducer and an electronic solid state indicating meter. The range of measurement can be extended considerably (up to 1000 m) by making easy adjustments in the instruments. The advantages of the instrument over those currently in use are its light weight, ruggedness and low cost.

SEVERAL instruments are currently available for the measurement of the depth of operation of fishing gear. These include underwater self-recording type mechanical instruments¹, wireless telemeter type depth recorders with underwater ultrasonic transmitters² and on-board electronic recorders, instruments using potentiometer type depth transducers³ and simple instruments with mercury filled transducers⁴. Most of these instruments do not possess the desired robustness for their use in research work or for commercial use. Among their other drawbacks are excessive weight and bulk, limited range of operation, high cost and their inability to make instantaneous measurements. For the fishing industry as well as for oceanographic work there is imperative need for a simple and light, yet rugged instrument capable of measuring the depth of operation instantaneously and continuously. An instrument of this type developed at this Institute is described in this communication.

Description of the instrument

The transducer of the instrument has a pressure chamber made of brass, exposed to the external hydrostatic pressure through a rubber diaphragm (Figs. 1 and 2). A light coil of 25 mH is fitted inside the dia-

phragm and a mild steel core which can move freely inside the coil is fitted at the other side of the chamber opposite the diaphragm. As the diaphragm moves along with the coil due to the hydrostatic pressure, the core changes its position inside the coil with a corresponding variation in the inductance of the coil. As the rubber diaphragm is not capable of withstanding the pressure corresponding to several metres depth of water, the chamber is partially filled with silicone oil. The air inside the chamber undergoes contraction according to the

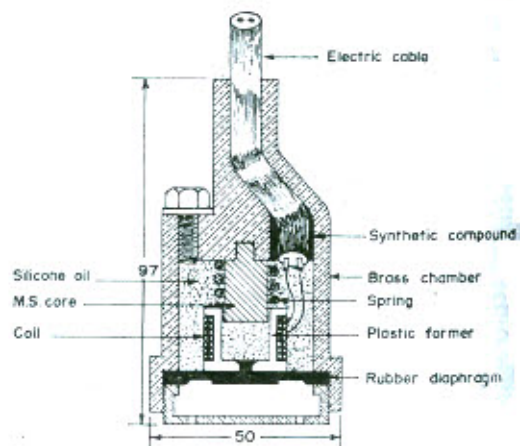


Fig. 1 — Water depth transducer

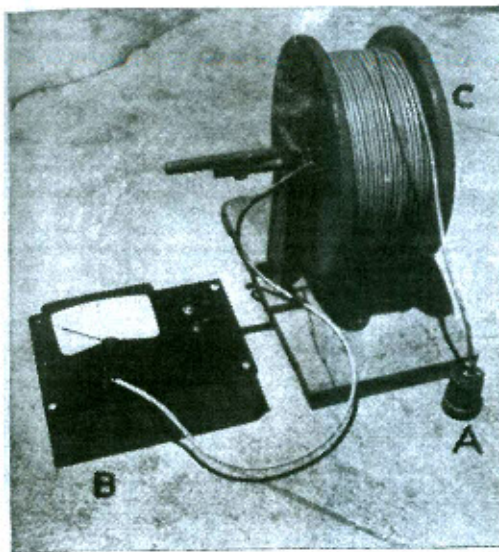


Fig. 2 — Operational depth telemeter with its accessories [(A), Hydrostatic pressure (water depth) transducer; (B), solid state electronic indicating unit; and (C), 2-core insulated and sheathed wire wound on a hand operated winch]

hydrostatic pressure and acts as a spring. An additional light spring used inside the chamber helps the diaphragm to retain its position with exactness. The quantity of liquid inside the chamber is adjusted for maximum safe displacement of the diaphragm, avoiding its prominent non-linear portion, for a particular range of pressure. The bolt given in the wall of the chamber helps easy adjustment of the liquid level. The inductance variation of the coil is transmitted to the electronic indicating meter on board the vessel by means of a 2-core insulated and sheathed electrical wire.

The indicating meter is a solid-state electronic measuring instrument (Fig. 3). It consists of an oscillator producing two rich sources of sinusoidal waves of 1500 c/s. The higher voltage source feeds the transducer along with the primary L_2 of a transformer, so that its total voltage is distributed across the two coils according to the ratio of their impedances. As the impedance of the transducer coil varies, the voltage of the coil L_2 is affected with corresponding

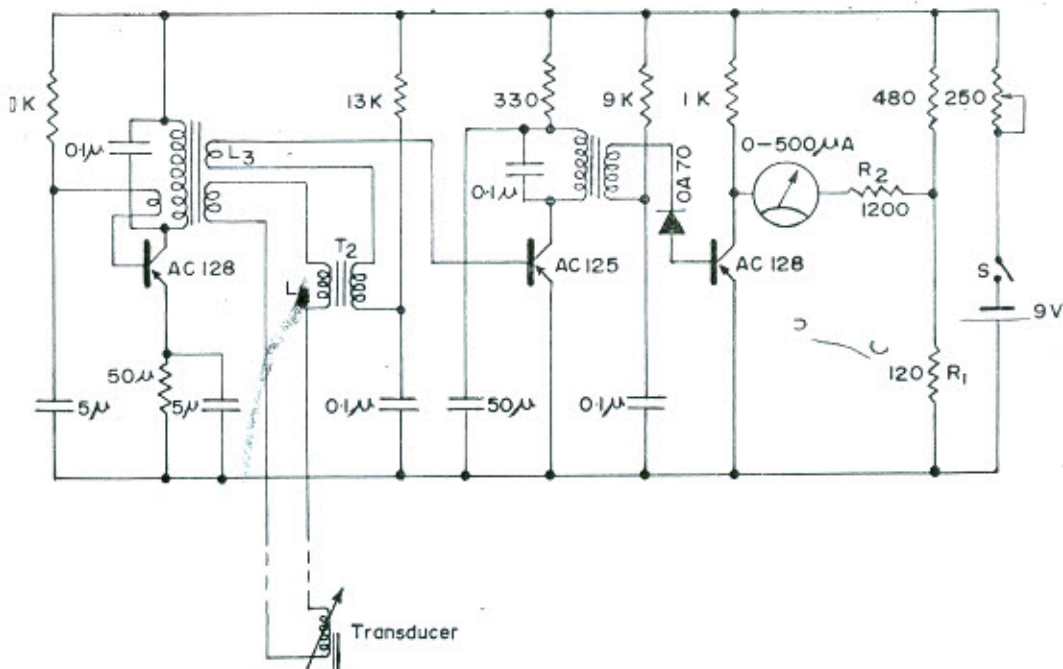


Fig. 3 — Electronic circuit of the instrument

variation of voltage in the secondary coil of the transformer. The secondary winding of the transformer T_2 and the winding L_3 of the oscillator transformer are connected in such a way that their voltages oppose each other. The difference in voltage between the two coils is adjusted to approach zero by proper selection of the primary and secondary turns ratio of the transformer T_2 , as the transducer coil is displaced to its maximum level. The signal is amplified with a two-stage amplifier as shown in Fig. 3 and the output is fed to a microammeter with a balancing circuit. The deflection in the meter is graduated in terms of hydrostatic pressure. The instrument has been provided with a variable wire wound resistance for voltage adjustment. The voltage applied to the circuit is always kept the same by bringing the meter needle to the zero reading of the scale every time after connecting the transducer, while it corresponds to zero depth.

The following are the important features of the instrument developed for trials: Range, 0-100 m; accuracy, ± 1 m; weight of the transducer in air, 550 g; weight of the transducer in water, 370 g; and cable length provided, 100 m. The cost of fabrication is estimated at Rs 1200.

Performance of the instrument

Consistency of readings — The air inside the transducer invariably retains its volume constant under constant temperature conditions. Further, the light spring provided in the transducer helps to retain the position of the diaphragm and the coil quite accurately. As a result there is perfect consistency in the readings obtained. The solid state electronic part has no noticeable drift.

Temperature dependence — Temperature variation in the range 10-40°C made no significant variation in readings and hence no temperature compensation was needed.

Linearity of the scale — The plot between the hydrostatic pressure values and the transducer output was found to be slightly

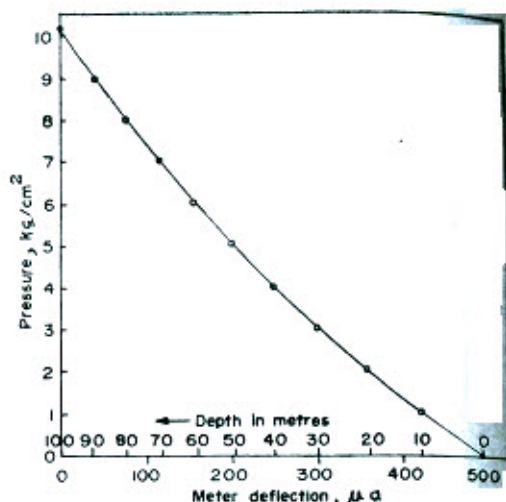


Fig. 4 — Relation between hydrostatic pressure and deflection in the meter

curved, perhaps because of the slightly convex nature of the rubber diaphragm in the transducer. The meter deflection was correspondingly graduated to hydrostatic pressure, which is calculated in terms of depth of sea water. Fig. 4 shows the meter deflection corresponding to hydrostatic pressure.

Extension of the range of operation — The range of operation of the instrument can be altered conveniently by adjusting the quantity of liquid inside the transducer or by adjusting the values of the resistors R_1 and R_2 , as the case may be.

Safety for the meter — As the instrument is to be handled sometimes by unskilled men under the rough conditions on the sea, there is the possibility of the transducer getting disconnected by mistake while the instrument is on; this can cause the needle of the meter to deflect out of scale overloading the meter. It could be avoided by so adjusting the bias current values of the transistors used in the amplifier circuit and also the voltage of the coil L_3 of the oscillator that as the impedance of the transducer coil increases to a limit much away from its usual operating range, the signal is cut off due to the limiting bias

characteristics of the transistors and the deflection comes to a steady state within the meter scale. This condition is equivalent to the transducer being disconnected from the meter.

Acknowledgement

The author wishes to acknowledge many stimulating discussions which he had with the scientific workers of the Fishing Methods Section of the Institute, on the use and utility of the instrument. Thanks are due to Shri G. K. Kuriyan, Director-in-charge

for his interest in the work and permission to publish this paper.

References

1. CHIKAMASHA HAMURO & KENJI ISHII, *Modern fishing gear in the world* [Fishing News (Books) Ltd, London], 1964, 513.
2. CHIKAMASHA HAMURO & KENJI ISHII, *Modern fishing gear of the world* [Fishing News (Books) Ltd, London], 1964, 248.
3. MC. NEELY, R. L., *Modern fishing gear of the world* [Fishing News (Books) Ltd, London], 1959, 363.
4. SIVADAS, T. K., *Res. & Ind., New Delhi*, **13** (1968), 89.

Seminar on Problems Relating to Copper Wire Drawing and Insulation of Magnet Wires and Cables

The Indian Copper Information Centre, in collaboration with the Indian Wire Association, the Magnet Wire & Cable Association and the Indian Electrical Manufacturers' Association is organizing a two-day seminar in Bombay during 12-13 December 1969 on problems relating to copper wire drawing and insulation of magnet wires and cables. The seminar is intended to make a collective approach to the problems and deficiencies regarding the growth of the industry, both by the manufacturers and the end users of copper wire. Special emphasis will be laid on user's view to provide a guideline for future thinking in the field. The following aspects will be covered in the deliberations at the seminar: (1) Selection of raw materials, including control of quality in the production of wire rod; (2) Drawing operation and associated problems

and quality control measures; (3) Annealing characteristics of magnet wire — Effect of temperature, time, atmosphere, impurities, types of furnaces and quality control aspects; (4) Influence of production variables on quality of wire and development in testing techniques; (5) Modern trends in the insulation of magnet wire; (6) Modern trends in the insulation of cables; (7) Tests and quality evaluation of magnet wires and cables; and (8) Thermal degradation of insulating materials.

Enrolment form and further details can be had from Dr L. R. Vaidyanath, General Manager, Indian Copper Information Centre, 27B Camac Street, Calcutta 16 or from Shri M. R. Lodh, Hony Secretary, Indian Wire Association, c/o Devidayal Cable Industries Ltd, Pokhran Valley; P.B. No. 39, Thana, Maharashtra.