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NATIONAL INSTITUTE OF OCEANOGRAPHY

WORMLEY, GODALMING, SURREY

Laboratory Tests of Depth Telemeter "Netzsonde"

Manufactured by Furuno Electric Co. Ltd.

(Model FNZ — 5 N 1)

by

B. J. BARROW

N.I.O. Internal Report No. A 22

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General Description

This instrument is in many ways the same as the N.I.O. depth telemeter but where the N.I.O. instrument uses a capacitance pressure plate to measure depth, the Furuno model FNZ-5NI uses a variable inductance, i.e. the pressure acts on a bellows and spring which deflects a lever movement that moves a slug in an inductance (Fig. 1). (It was not possible to examine the interior of the bellows unit.)

This inductance is part of a tuned circuit of an oscillator giving a frequency range of 50-53 Kc/s for a pressure range 0-300 p.s.i. After amplification this frequency is transmitted acoustically via a transducer which has a resonance of 52 Kc/s.

This is received by a hydrophone using a similar transducer. It is then fed to the indicator in which this signal is heterodyned against a constant frequency oscillator. The difference frequency is then turned into a varying D.C. voltage which increases with difference frequency. This voltage is applied directly to a meter which is calibrated in fathoms.

There is another stage which enables this voltage to be converted to a pulse-delay which allows recording on an echo-sounder.

In the transmitter there is a fixed inductance which is switched into the oscillator circuit by means of a relay for 7 seconds every 40 seconds. This gives a check of the calibration of the transmitter with changes of temperature and humidity.

Tests carried out

1. Transducer

This seemed to be a slab of crystal of approximate dimensions 3 ins. diam., ¾ - 1 in. thick potted in rubber, and of resonant frequencies 52 and 80 Kc/s.

2. Temperature Effect of Transmitter

The temperature coefficient of the transmitter was obtained by noting the meter deflection in fathoms over a temperature cycle of 0-30°C, leaving approximately 30 minutes between increments of 2°C. The temperature coefficient of the calibration inductance was found in one case to be in the opposite direction to the depth measuring variable inductance shown in the graph (Fig. 2, Curve A). Maximum error was 2·8 fms = 2·3% F.S.D.

This test was repeated and the calibration signal was kept constant with temperature as shown in Fig. 2, Curve B; the error was 1% F.S.D.

The transmitter was now preset to 70 and 100 fms respectively and the same procedure was adopted as explained above. The results are shown in Fig. 3, Curves A and B; the errors are 1% and ·2% respectively.

It can be seen from these graphs that there is no consistency in the results. The maximum error when the transmitter was reset was 1%, but at zero pressure it was 2·3%. It is thought that the bad temperature effect at zero pressure may be due to thermal expansion of the microswitch (see Fig. 1). Some of the errors could be caused by humidity as well as temperature, as no provision for a dessicator has been made. There was no measurable hysteresis found due to temperature.

Pressure Effect

This check was made in an N.I.O. pressure vessel. The pressure was checked using a deadweight tester of accuracy better than 0·5% F.S.D. This pressure has been converted to depth of sea water which is shown plotted in Fig. 4.

The test was made after recharging the transmitter with new batteries

and keeping the calibration signal constant at 15 fms throughout the run. The maximum error due to hysteresis was as shown in Fig. 4 and was better than 1·8 fms - 1·5% F.S.D.

The scale reading in fathoms against depth of sea water was more or less constant up to 100 fms, but after this point it began dropping off to give a maximum inaccuracy of 10%.

Battery

The transmitter supply voltage was halved. There was no measurable change in frequency.

Comments

It was found by our tests that this instrument should not be used above 100 fms if an accuracy of 3-4% is required. By using the same tests as explained in this report the N.I.O. depth telemeter to date has an overall accuracy of 1-2%.

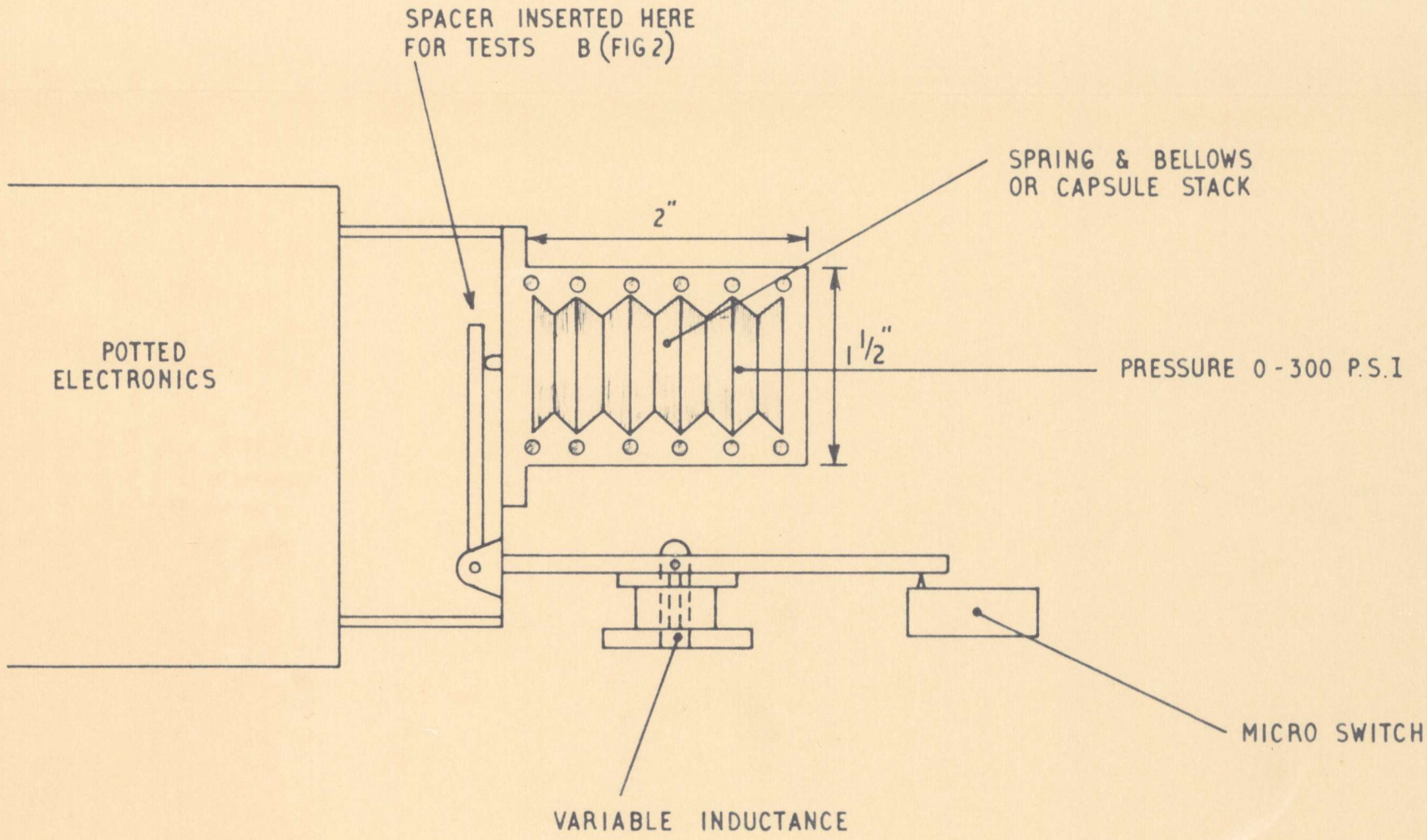

FIG 1

TEMPERATURE CHARACTERISTICS OF NETZSONDE DEPTH TELEMETER

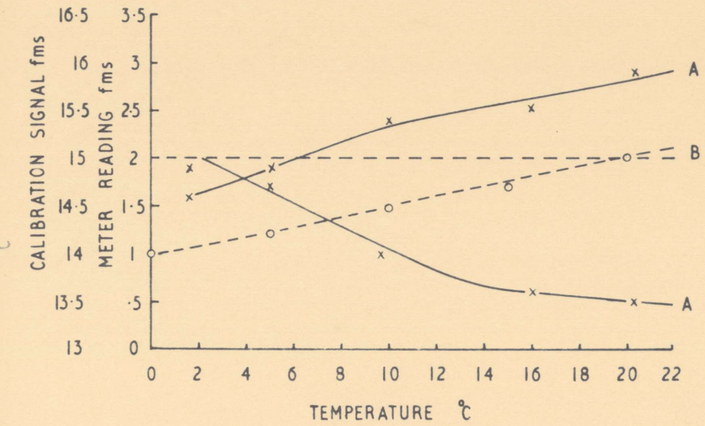

FIG 2

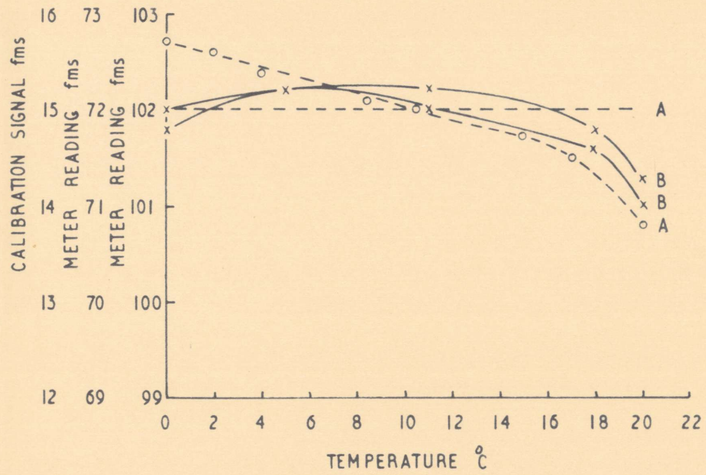

FIG 3

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PRESSURE CHARACTERISTIC FOR NETZSONDE DEPTH TELEMETER

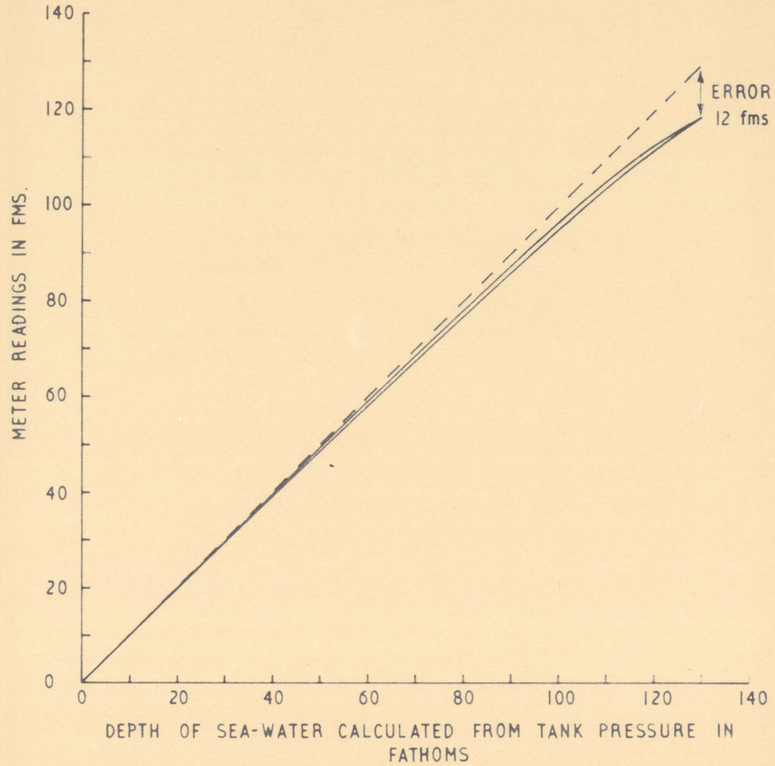

FIG 4