under vacuum. A sensitive electrometer (Hewlett-Packard 425A or dc microvoltmeter Philips GM 6020) connected to the leads of the thermocouple through a DPDT switch is used for measuring both the differential temperature and the sample temperature.

The DTA assembly has been found to work satisfactorily and the thermal decomposition of a number of oxalates, both simple oxalates like ferrous oxalate (unpublished results) and complex molybdenyl oxalates[6], has been studied using ignited alumina as the reference material.

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An Instrument for the Measurement of the Variations in Mesh Shapes of Fishing Nets during Operation

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A solid state electronic portable instrument developed for the measurement of the variations in the dimensions of the meshes of fishing nets during operation is described. The instrument consists essentially of an inductive linear transducer and an indicating meter kept on board the vessel, both being connected by electric cable. The accuracy of measurement is ± 2 mm.

LACK of knowledge of the exact shape of the meshes in various positions of the net during operation is a major hurdle in the design and development of fishing nets. These variations are different in different parts of the trawl net. Too much stretching of the meshes causes considerable decrease in their area, resulting in high resistance to the motion of the net. Moreover, the variations in the shape of the meshes affect the total length of the net, upsetting its very design. If the degree of stretch, and hence the changes in shape of the meshes, are known earlier for a particular type of net, the designer can foresee the changes and make the necessary modifications at the design stage itself.

So far no instrument appears to have been developed for this purpose. The instrument described in this communication measures instantaneously the variations in the shape of the meshes of fishing nets during operation with an accuracy of ± 2 mm.

Description of the instrument and principles of operation

The instrument consists of an inductive type transducer and an electronic solid state indicating meter. The transducer senses the variations in the dimensions of the meshes and converts them into proportional variations in inductance. These inductance variations are conveyed to the

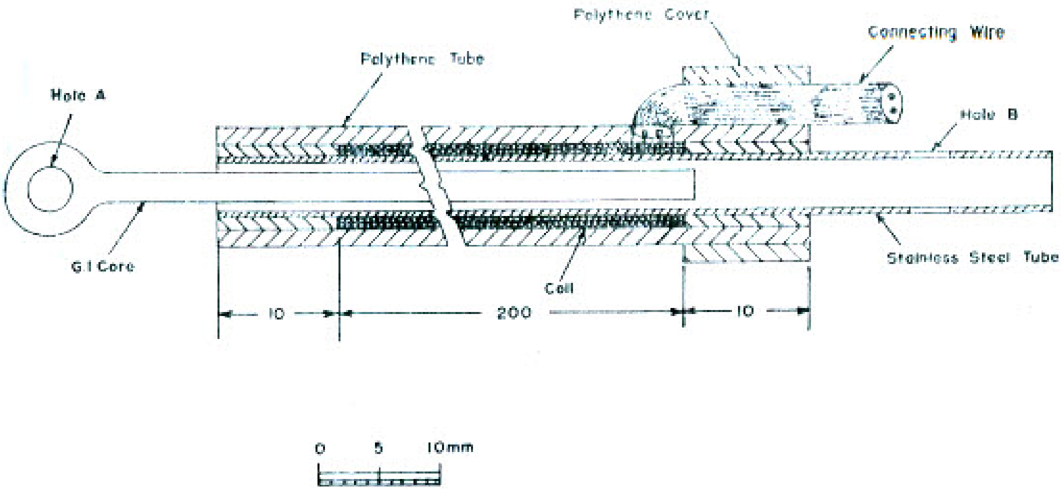

Fig. 1 — Cross-section of the mesh shape transducer

indicating meter by means of a two-core PVC electric wire.

The transducer (Fig. 1) consists of a long uniform bored stainless steel tube measuring 3·5 mm inside diam., 4 mm outside diam. and 250 mm in length. On the tube is uniformly wound 32 SWG copper wire to produce an inductance of about 15 mH. The windings are thickly coated with a synthetic adhesive compound for protection against saline water. For additional protection it is enclosed in a polythene tube. A long thin galvanized MS rod (2 mm diam. and 230 mm long) forms the core of the coil. During operation, the ends A and B respectively of the core and the coil (Fig. 1) are fixed on appropriate knots of the meshes, as shown in Fig. 2. When the distance between the points A and B changes due to the strain in the meshes, the position of the core in the coil changes, producing a corresponding change in inductance of the transducer. The transducer has been made very light (60 g), so that its presence does not affect the natural shape of the meshes.

As shown in Fig. 3, the indicating meter consists of an oscillator producing sinusoidal waves at 1000 c/s. The oscillator output is fed to the transducer in series with a 10 kohms resistance. The total voltage of the oscillator output is fed across the 10 kohms resistance and the transducer according to the ratio of their impedances. For obtaining a linear relationship between the inductance of the transducer and the voltage across it, the essential requirements are: (i) the impedance of the series resistance (10 kohms) is very high compared to that of the transducer, (ii) the ohmic resistance of the transducer is less compared to its reactive resistance, and (iii) the voltage and frequency of the oscillator output are constant. The transducer and the electronic circuit were designed to fulfil the three conditions within practicable limits.

The transducer output was amplified as shown in Fig. 3 with a single stage amplifier and fed to a microammeter by means of a balancing circuit. The deflections in the microammeter were calibrated in terms of distances between the two points A and B. The voltage of the power source connected to the measuring part of the instrument is kept at 6·2 V by means of the Zenar diode ZD.

Fault indicating alarm — As the instrument is often to be operated under rough conditions in the sea, it is likely that the transducer is disconnected or the switch is put

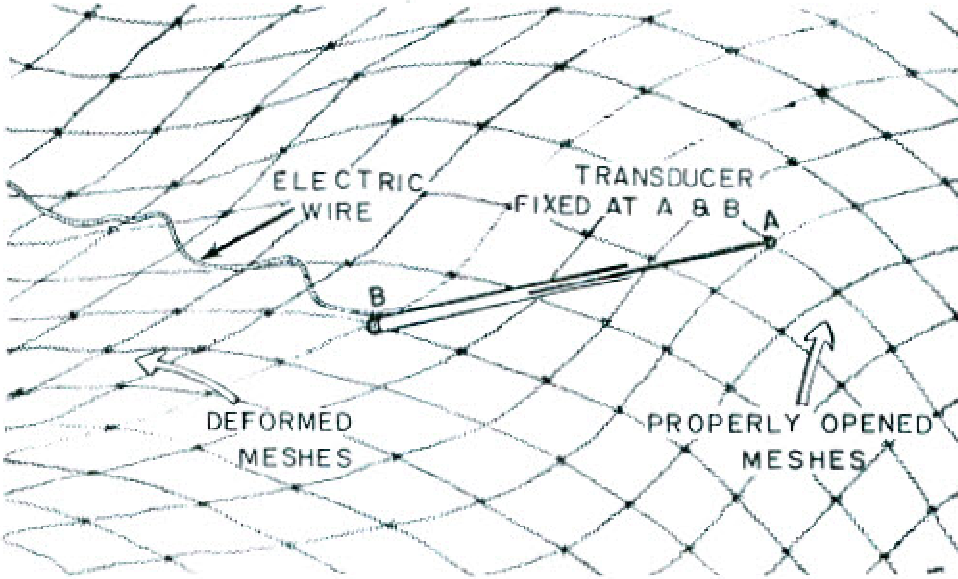

Fig. 2 — Schematic diagram showing the transducer fixed across three consecutive meshes

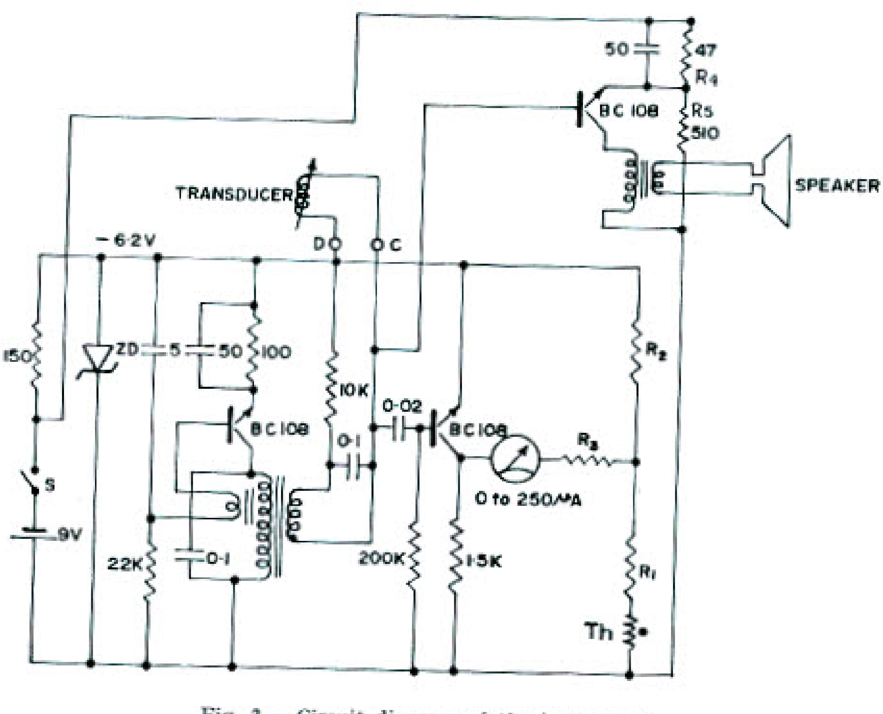

Fig. 3 — Circuit diagram of the instrument

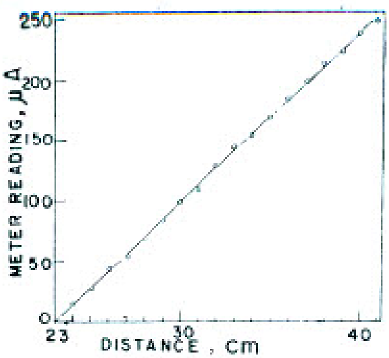

Fig. 4 — Meter deflections vs the distance between A and B [mesh size variations]

on without connecting the transducer. This is undesirable, as it will cause damage to the microammeter due to overloading. An alarm signal provided in the meter gives an indication to the operator about the danger. The alarm will be on also when the transducer is damaged (e.g. when the wire gets broken) during its operation in the net.

When the transducer is connected across the terminals C and D (Fig. 3), the voltage across it varies between approximately 0·2 and 0·6 V. The points C and D are also connected between the base and emitter of the transistor T^3. The emitter voltage of this transistor is permanently kept slightly above 0·6 V by means of the potential divider consisting of the resistors R^4 and R^5. When the transducer is disconnected or its continuity is lost, a much higher voltage is impressed across C and D, which is fed across the base and emitter of the transistor T^3. This signal is sufficient to make the transistor conduct and to operate the speaker connected with it.

Main features of the equipment

Linearity of the transducer — The transducer output is sufficiently linear. For obtaining linear relationship between the inductance and the signal output of the transducer, its ohmic resistance has been brought below 20 ohms, while the reactive resistance varies from 60 to 180 ohms.

Linearity of the meter — For obtaining linearity in the voltage variation across the transducer, a high resistance of 10 kohms has been connected in series with the comparatively low impedance of the transducer. The output voltage and the frequency of the oscillator are sufficiently constant, irrespective of the variations in the impedance of the transducer. The plot in Fig. 4 shows linear relationship between the meter readings and the distance between the knots.

Consistency of readings — There is practically no drift in the readings of the meter. Since the core of the coil in the transducer moves freely and does not require any mechanical contact, high consistency is obtained in the response of the transducer. The transducer is very light and hence does not affect the normal functions of the meshes.

Temperature dependence of the meter — The silicon transistor BC 108 used in the meter has got comparatively low temperature dependence. The slight variation in the readings of the meter due to a wide range of temperature variations has been compensated with the help of the thermistor used in the circuit.

The other important features of the instrument developed for trials are: Range of operation, 230-410 mm; accuracy, ±2 mm, and weight of the transducer in air, 60 g. The instrument has been made entirely from indigenous components and the cost of construction has been estimated to be approximately Rs 800, excluding the cost of the wire. The length of the wire can be extended within reasonable limits without affecting the readings.

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