



THERMOELECTRIC SOUNDER

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The following information concerning the LABOUREUR, Thermoelectric Sounder is extracted from a notice concerning this instrument, which is made by the *Société Indépendante d'Exploitation Radioélectrique*, 19, rue Morère, Paris (XIV^{me}).

The problem of immediate and direct reading of deep-sea temperature on board ship, and even proceeding at slow speed, is one of great interest to fishing vessels, to students of Oceanography and of other submarine scientific matters.

The result is of far greater interest if the depth at which the temperature was obtained can be ascertained at the same time.

This is the object of the LABOUREUR, S.I.E.R. Thermoelectric Sounder. It may be supplemented, as will be seen later on, by a means of measuring the salinity of the water and also by an arrangement which actuates a bell if the apparatus strikes the bottom.

PRINCIPLE.

The principle of the apparatus is as follows (Fig. I) :

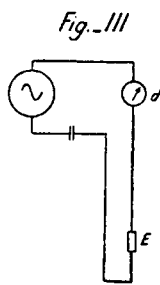
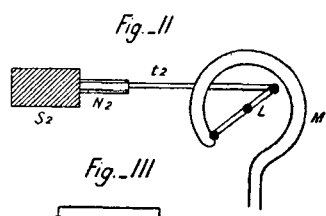
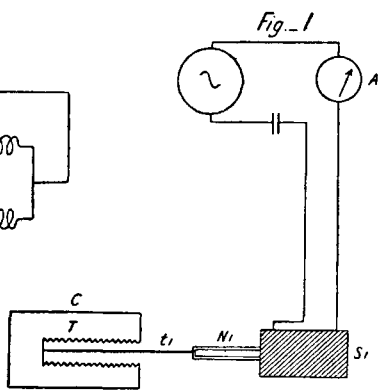
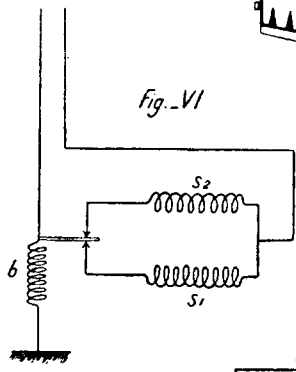
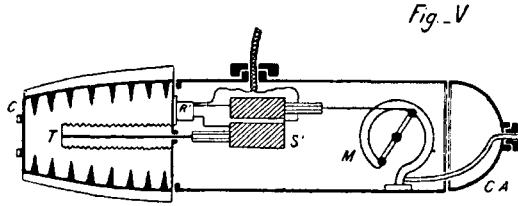
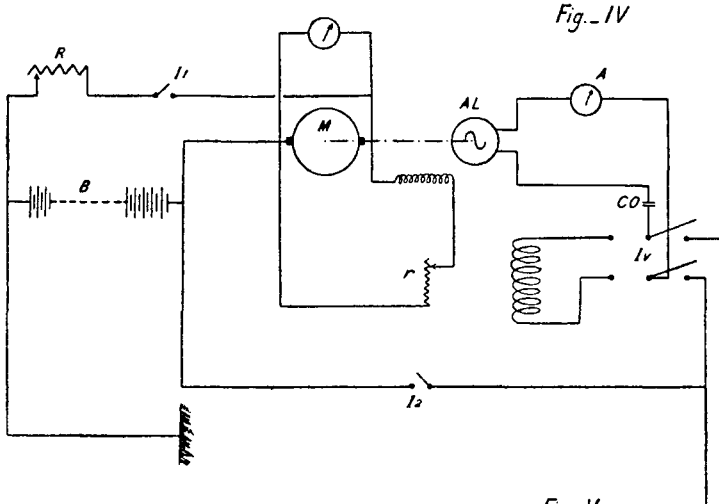
The effect of temperature is made use of to cause the movement of a built up iron core N_1 surrounded by a coil S_1 through which an alternating current of musical frequency is passed ; if the characteristics of the circuit are made suitable, the value of the current, as read off on an ammeter A , indicates the position of the bar N_1 in the self-induction coil S_1 and, consequently, the temperature of the medium.

The thermometric effect is obtained by means of a container C filled with a special liquid and containing a thermostatic expansion chamber T which directly controls the core N_1 by means of a rod t_1 . The container C is fitted with fins and is immersed in the sea - water ; it rapidly takes up the same temperature as the sea, and thus a well determined position of the expansion chamber and of the iron core is obtained.

For the depth (Figure II) a special manometer M is used which, by means of a lever L and a rod t_2 , acts on an iron core N_2 inside a second self-induction coil S_2 . The action of water pressure produces the same effect as temperature and thus the current reading under the same conditions indicates the depth of the apparatus.

The salinity is obtained by means of a special ammeter *a* (Fig. III) which records the current passing through a test tube *E* full of sea water.

Relays enable one measurement to be taken after another, using only one cable consisting of two wires of as small a size as possible (diameter 13 $\frac{m}{m}$). This specially prepared cable carries the whole weight of the apparatus.



DESCRIPTION.

Supply (Fig. iv). — The current is supplied by a small alternating plant comprising a continuous current motor and an alternator *AL* of musical frequency, fed by a battery of accumulators *B*. A voltmeter *V* controls the speed regulated by means of fine setting rheostat *R*. A switch *I1* starts the group; the continuous current supplies the alternator and is regulated by means of a second rheostat *r*. The alternator leads through the standard

ammeter *A* and a battery of condensers *CO*. A two-way switch *Iv* admits the current either through the cable and the submerged apparatus or else through a standard control circuit *S3*.

Submerged Apparatus. — The submerged apparatus is torpedo-shaped, about 60 $\frac{\text{cm}}{\text{m}}$ in length, (Figure v) constructed of specially-stiffened steel and contains :

In the fore part, the finned container *C* with the thermostatic expansion chamber *T*.

In the body of the apparatus, the two self-induction coils *S1* and *S2* with their movable cores, the relays *R1* which make changing over from temperature measurement to depth measurement and *vice versa* possible, the manometer *M* with its transmission and, if the apparatus be so fitted, the salinity recording arrangement with the supplementary relays which enable the salinity to be observed.

In the after part, the cap *CA*, in the middle of which is the inlet for the manometer. Outside this cap are horizontal blades acting as stabilising rudders to maintain the horizontal position of the apparatus when it is towed.

The circuit of the relay *R1* and of the self-induction coils *S1* and *S2* is shown in Figures iv and vi: the continuous current supplied by the battery passes through the coil *b* of the relay when the switch *I2* is actuated; the current returns to earth via the salt water. It is clear, therefore, that when the switch *I2* is not closed the alternating current passes through the self-induction coil *S2* and measures the depth; when the switch is closed it will pass through the self-induction coil *S1* and measure the temperature.

Cable and Drum. — The cable is reeled up on a drum which has on one of its flanges a collector with two brushes to connect this cable to the switch board. The drum is worked by a handle to reel up and unreel the cable.

METHOD OF WORKING.

The ammeter *A* has two graduations, one for temperature (degrees and tenths), the other for depths (metres) and it has a reference mark on the voltmeter *V*; there is likewise a reference mark corresponding to the selected voltage (16 volts).

Before every observation the two-way switch *Iv* (Fig. iv) is set to the standard circuit and, starting the motor, the voltmeter *V* is regulated by means of the rheostat *R* to its reference mark, and the ammeter *A* is similarly regulated by means of the rheostat *r*.

The accuracy of the observations depends on this previous regulation.

When the switch *Iv* is reversed, *M* measures :

- 1st. The temperature when the switch *I2* (Fig. 4) is opened.
- 2nd. The depth when this switch is closed.
- 3rd. The salinity (if the apparatus is fitted for this).

Observations are made very rapidly and the manipulation is extremely simple if the instructions on the various parts are followed.

RESULTS.

Every part of the apparatus is very stoutly made, and the electric energy brought into play being large (in the neighbourhood of 1 ampere of current) the apparatus is absolutely accurate. Having been previously checked by means of a standard thermometer its accuracy will remain equal to that of this standard.

Measurement of temperature to within a tenth of a degree over a range of more than 20° is possible.

The depth is ascertained with an error of less than 1%.

If fitted with the salinity recording arrangement, this measurement can be obtained to within 1/200th of a gramme to one litre of sea-water.

USE.

The LABOUREUR S.I.E.R. Thermoelectric Sounder can be used either with the vessel stopped or proceeding dead slow (trawling speed).

Besides its purely scientific uses, therefore, it can be used by a trawler to explore fishing grounds in advance and to ascertain at once whether the sea temperature be favourable to the presence of fish above the bottom.

