

## THE ECHOGRAPH.

(Extract from an article by Dr ERNST SCHREIBER,  
in the *Annalen d. Hydr. u. Marit. Meteor.*, Berlin, 15th November, 1932).

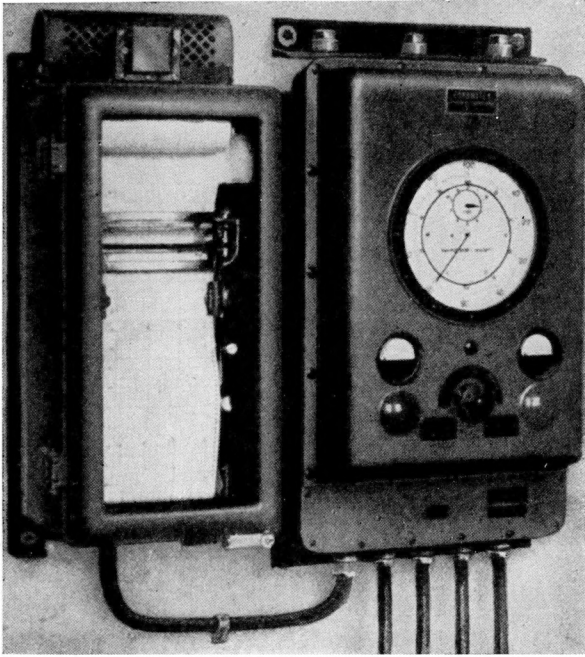
---

The *Elektroakustik G.m.b.H.* of Kiel has developed a self-recording sounder, the so-called "Echograph", which consists of two measuring appliances, the Echometer and a recording device. Figure 1 shows the apparatus as installed in the Norwegian steamer *Kong Ring*. On the right-hand side is the most recent type of Echometer, which is connected by a cable to the recording device on the left. The latter is worked by a distant-control appliance, the method of operation of which depends on a system evolved by Messrs HARTMANN & BRAUN of Frankfurt on Main; the principle on which this operates is the following :- The depths indicated by the Echometer dial are transmitted electrically by an emitter to a recording appliance located at a distance. The emitter consists of a gear drive, constructed by the *Elektroakustik Co.*, the axle of which moves an insulated sliding brush over a resistance. After each setting of the index of the Echometer to the depth sounded, the gear is actuated automatically and electrically thus moving the brush a distance along the resistance which corresponds to the observed depth. The subsequent transmission to the distant recording device is carried out by the following mechanism introduced by Messrs. HARTMANN & BRAUN. Conductors lead from each terminal of the resistance to two intersecting coils, wound on the common frame of a cross-coil ohm-meter in the recording device, and these are connected, by means of a third conductor, to one pole of an auxiliary battery. By connecting the other pole of the battery to the sliding brush through a switch actuated by the gear, the circuit is closed before the beginning of the distant transmission. The current generated by the E.M.F. of the auxiliary battery is divided, according to the amount of the resistance on each side of the brush, into two branch currents the force of which depends on the ratio of the resistances automatically caused by the particular setting of the index of the Echometer dial. Instead of an auxiliary battery, the *Elektroakustik* uses the E.M.F. of the ship's mains, which, by means of a transformer, is reduced to the value needed for operating the distant recording device. The branch currents flow through the two coils of the cross-coil ohm-meter, and thus two contrary turning moments are produced which cause the coil frame to rotate until the two moments are in equilibrium. A pointer fixed on the frame is thus deviated by an amount proportional to the ratio of the resistances. As a result of the mechanical construction of this recording device, the setting of the coils after each reading is maintained even when, after the sounding, the switch, which was closed by the distant emitter, is opened again. It is this peculiarity of the recorder which is used to advantage for making a continuous undisturbed record of the soundings. This record is made by a stylus arm, secured to the pointer of the frame, which inscribes its movements on a moving strip of paper. The stylus arm is bent to a hook shape and is long enough to move the pen (which is secured elastically to its free end) from right to left over the whole width of the paper strip. The pen consists of a very light and short piece of capillary tube of glass which draws the ink out of a cup which is supported separately so that the stylus arm shall not be weighted with the reserve of ink. The pressure of the pen on the paper is very light, in order that the inscriptions shall not be falsified by friction.

The paper is wound on a drum and is moved downwards by two wheels with teeth which catch into rows of holes perforated in the edges of the strip. The gear is controlled by a precision clockwork mechanism, and moves the paper forward 120 mm. per hour. The clockwork is thrown into or out of gear by means of an easily operated lever.

The paper, after being inscribed, is wound on another drum coupled to a second clockwork mechanism the movement of which is regulated by the paper strip. For this purpose, the force of the spring of this clockwork is reduced to such an extent, by the braking action of a sliding spring, that the unrolling of the paper or its retention is capable of releasing or checking the rolling-up mechanism.

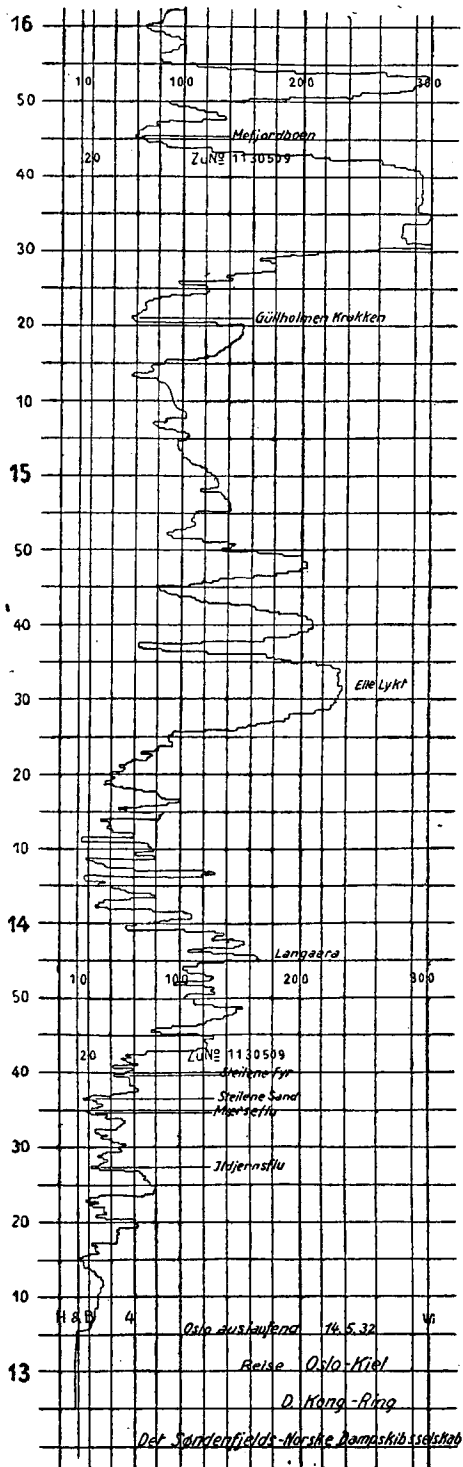
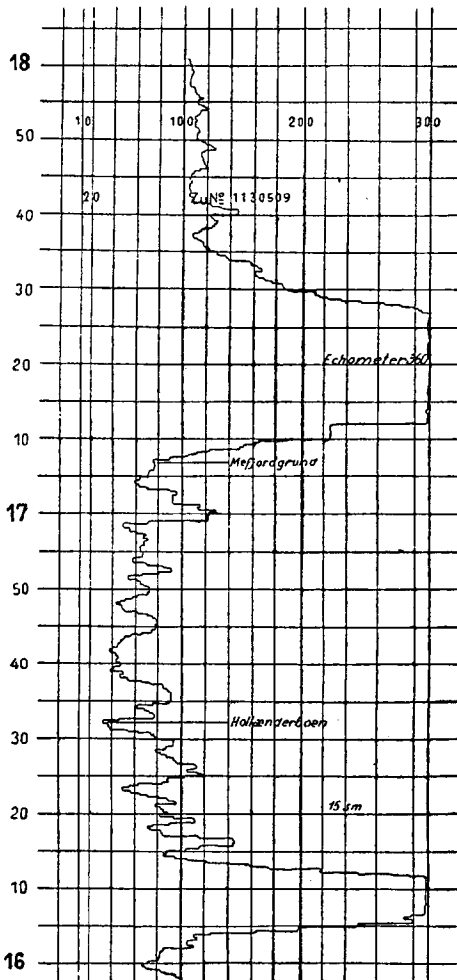
In order to protect the various parts of the recorder against damage from the exterior, the device is enclosed in an hermetically closed case.



*The Echograph.*

*L'Echographe.*

For reading the depths recorded there is a network printed on the paper strip, the cross lines of which indicate equal time intervals of 5 minutes, whilst those drawn longitudinally show the 0, 10, 20, 40... 300 m. depths corresponding to the indications of the Echometer dial. (The scale of the Echometer corresponds to a sound velocity of 1500 m/sec). The varying distances between the depth lines are due, firstly to the unequal division of the Echometer dial within the range of shallow soundings, and secondly to the fact that the deflections of the cross-coil ohm-meter are not exactly linear in progression.



Whenever the paper strip is changed, the pen must be brought to the zero line of the depth scale, but as long as the paper lasts, no further setting of the self-recording

sounder is necessary. When the Echometer is switched on and the stopping-lever of the clockwork is put to release, the sounder works automatically and needs no special attention. As the recording device is moved only after the index of the Echometer dial has indicated the depth sounded, the inscription of the result of the observation is delayed about 1 second, for instance, the time required for the pen to move from the zero to the 300 m. line of the paper strip. In reality, the true shape of the curve is not modified, for the paper, within this interval, has moved forward 0,03 mm. only. Small distortions in the trace occur however owing to the fact that, as a result of the method of operation of the Echometer, the soundings are taken every 15 seconds only. In this interval the paper strip has moved forward 0,5 mm., thus tiny indentations occur in the curve between the soundings whenever the depth varies. The general idea of the trend of the depth is not obscured thereby, so that its utility for practical navigation and other purposes is not prejudiced. It is only in oceanographic surveys that the easily ascertainable and minor deflections of the trace must be calculated and taken into account when utilizing the curve recorded.

The accompanying profile was taken on board the *Kong Ring* when steaming at a speed of 15 knots in Oslo Fjord ; it shows all the details of the configuration of the bottom quite well as long as the depth sounded lay within the range of the recording device. But when the depth was more than 300 m. the curve remained on the 300 m. line of the paper strip, as will be seen in the case of the soundings taken between 5.17 p.m. and 9 p.m. (*see* Figure ). The real depths, in such cases, can only be read off the Echometer dial of the self-recording sounder.

