

SOUNDING EQUIPMENT BY MEANS OF THE FISH-LEAD

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This equipment is devised according to the technical data specified by Hydrographic Engineer MARTI in his paper: *La Sonde au Plomb-Poisson* ("Sounding by Fish-lead") published in the *Annales Hydrographiques de la Marine Française*, 1926. It enables one to obtain on a strip of graduated paper depths encountered by the sounding ship or boat, on the single condition that the latter proceed but at moderate speed and that exploration of the depths be not carried on beyond some 50 metres (150 feet).

The main advantages of this equipment as compared with the old graduated lead-line are the following:

a) Certainty of no longer overlooking any important rise of the bottom without being warned, the lead playing the part of a submarine sentry which remains in the proximity of the bottom between two consecutive casts of the lead.

b) Possibility of sounding at as quick a rate as desired and of giving thereby casts of the lead as close to one another as desired on the track of the sounding craft.

c) Suppression of the graduation on the line, always lengthy to prepare and difficult to keep in good order.

d) Suppression of the depth-reading errors, so often committed by the leadsman when graduated lines are used, the depth reading mechanism automatically recording the length of line paid out at each cast of the lead and the rôle of the leadsman being hence absolutely mechanical and therefore entrustable to any uneducated man.

e) Suppression of the transcription errors of the sounded depths, the apparatus at once supplying a diagram of the depths which is utilized direct for the drafting of the survey.

f) Safeguard of an always accurate distribution of the soundings within the time intervals which separate the moments at which the position of the sounding craft is determined, the recording gear automatically marking the different soundings, each one at the exact time at which it was effected.

g) Suppression of the duties of recorder, the equipment recording the soundings without any attendance.

ROUGH DESCRIPTION AND METHOD OF OPERATION OF THE EQUIPMENT.

The equipment consists essentially:

On the one hand, of a lead whose shape recalls that of a fish and which is suspended to a thin high-resistance steel cable, the whole enjoying the property of remaining practically plumb with the point of suspension notwithstanding the moving of the latter at a certain speed at the surface of the water ;

Fig 1

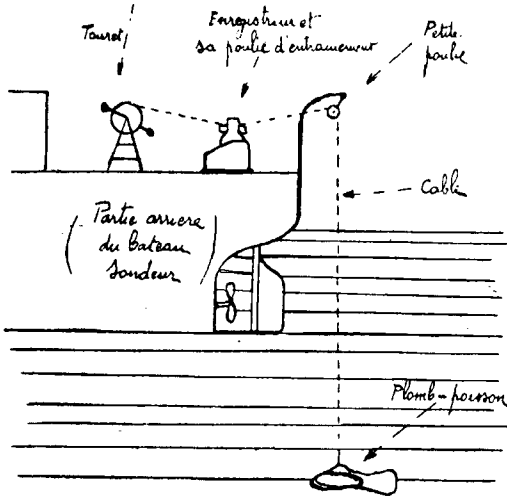


Fig 2

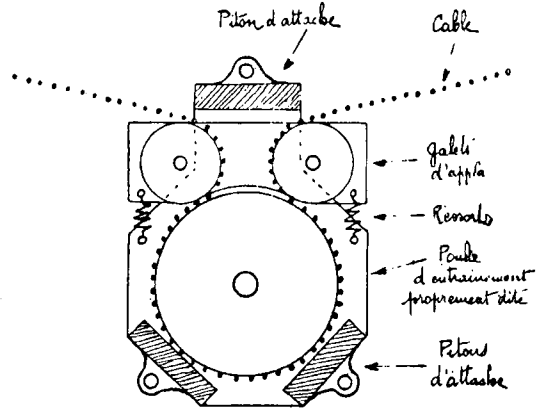


Fig 3

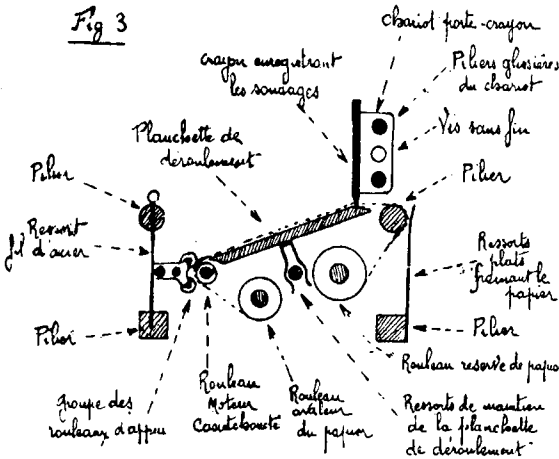


Fig 4

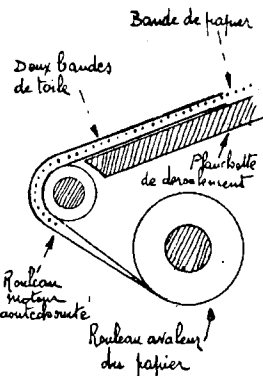


Fig 5

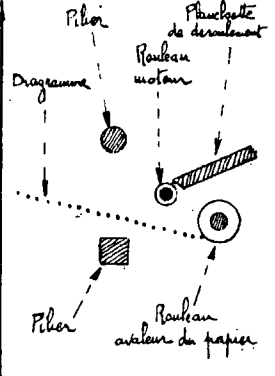


Fig 6

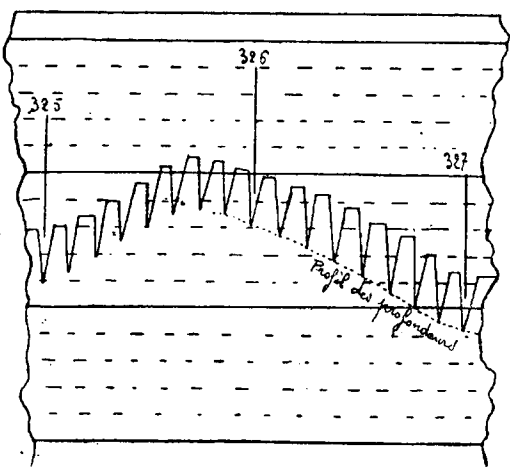
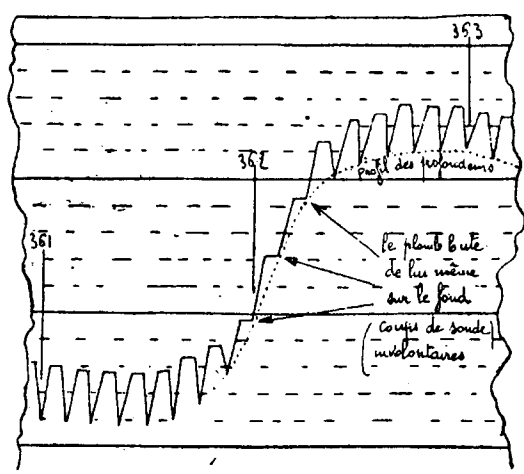


Fig 7



On the other hand, of a recording gear for the length of cable paid out, actuated by a special sheave on which the cable passes, the arrangement of this sheave being such that no slipping of the cable can take place with respect to it.

The equipment is installed in the stern of the sounding boat or vessel; the cable is wound on a hand-cranked drum and passes over a small sheave suspended from a davit which carries the lead clear of the edge of the craft; the special driving-sheave of the recording gear is located, with the latter, between the drum and the small sheave (Fig. 1).

DRIVING-SHEAVE.

The cable must be rove through the block of the recording gear in accordance with sketch (Fig. 2). In order to pass it this way it is necessary to:

Unhook the two pressure-springs from the movable part of the block;

Remove the two upper binding-bolts from the block and the upper securing eye-bolts;

Then, after passing the cable, put everything back in its place.

It should not be forgotten to unhook the springs before removing the movable part, in order to avoid distorting them by an excessive lengthening; the springs should always cause a strong pressure of the rollers on the large sheave.

The driving-sheave must be secured by its three eye-bolts in such a position that neither of the strands of the cable which emerge from its upper part can chafe against the cheeks thereof. It should be placed in a direction such that the end of its axle, on which will be secured the extensible connection linking it to the recording gear, will be directed towards the latter.

CABLE.

Kinks in the cable must be avoided as far as practicable. Each time after having been employed at sea, the cable and its unused portion on the drum should be abundantly oiled to avoid oxydation; some oil should also be dropped on the axles of the sheaves, the universal joints of the extensible connection and on the rollers of the driving-sheave.

In order to pass freely in the sheaves, the cable must be knotless; an excessive length of cable (150 to 200 metres) is therefore generally wound on the drum, so as to be able to sacrifice, if necessary, from time to time the first few tens of metres of the cable which are more exposed to oxydation, while retaining the use of the following piece of cable which is still in good condition.

INSTALLATION OF THE RECORDING GEAR.

The recording gear must be installed close by the driving-sheave, and its driving-screw for the pencil-holder connected to the axle of this sheave by the double-universal-joint extensible connection supplied with the equipment.

The registering gear must be placed in such a way that the hinge of the

lid be on the side of the lead (*i. e.*, generally astern of the boat or vessel), but the apparatus can be placed indifferently to the right of the driving-sheave or to the left thereof, it being possible to secure the extensible connection which connects it to this sheave to either end of the driving-screw of the registering apparatus pencil-holder.

It is not necessary that the driving-screw of the registering apparatus be in alignment with the axle of the sheave; it is not even necessary that it should be parallel to that axle. The double-universal-joint extensible connection which connects both parts is made precisely for the purpose of sparing the operator the trouble of an accurate installation of the one part with respect to the other. Thus it will be possible after each sounding trip to take the registering apparatus into quarters sheltered from the weather and leave the driving-sheave always in place (as well as the cable-drum and small sheave). The separation of the registering apparatus from the sheave is simply effected by moving the two objects away from one another until the solid rod of the extensible connection emerges from the sleeve which contained it; in order to replace the gear, care should be taken to present the key of the tube opposite the key-way of the rod.

The metal case which contains the registering apparatus is sufficiently watertight to protect it against light rain; should it be found advisable to keep it shut whilst in use, the registering of the soundings will be watched through the large glass pane in the lid, and, when it is necessary to plot time reference-marks on the depth diagram, the hand will be passed through the canvas sleeve which covers the circular opening in the lid. The glass-pane in the lid is sufficiently thick to prevent breaking in the event of anybody's treading inadvertently on the registering apparatus.

PREPARATION OF THE RECORDING GEAR.

The strip of graduated paper on which the soundings are recorded must be passed in the apparatus according to sketch (Fig. 3). To do it thus it is necessary to:

Remove the group of pressure rollers after having disengaged, by lifting it, the steel-wire spring which presses this group against the driving-roller;

Remove the paying-out plate by pressing it lightly upwards in order to cause its securing-springs to yield, the hand being for that purpose placed under the plate, near the driving-roller (the pencil-holder carriage will have been previously pushed to the end of the stroke leftwards);

Introduce the cylindrical mandrel into the roll of graduated paper (graduation 0.25 or 0.50 m. as the case may be);

Put the paper roll in its place, the right way round, by engaging the axle extremities of the mandrel in the sockets fixed inside the frame of the apparatus;

Pass the paper over the bar of the instrument and beneath the two flat springs which check its unrolling;

Put the plate back in its place, ascertaining that it is in the right position, its securing-springs gripping the rod of the winding-up mechanism ;

Unroll completely the two pieces of canvas fixed on the storage roller by pulling them gently (the storage roller being thrown into gear merely by friction can at any time be turned when the rolled-up strip is pulled) ;

Engage the beginning of the strip of graduated paper between the two pieces of canvas, at least up to the reference-position marked on the canvas (Fig. 4), making sure that the edges of the strip of paper actually coincide with those of the pieces of canvas ;

Put the group of pressure-rollers back in place and the steel-wire spring which forces this group against the driving-roller.

The beginning of the strip being thenceforth clamped between the two pieces of canvas will be rotated at the peripheral speed of the driving roller (*i. e.* 0.60 m. per jour) as soon as the apparatus is actuated.

The registering gear is supplied with two driving-screws : one (double-threaded) corresponding to the paper graduated from 0 to 50 metres, the other (quadruple-threaded) corresponding to the paper graduated from 0 to 25 metres. On each of these driving-screws is screwed a special nut. The nut utilized houses in a slot cut in the recording-pencil carriage ; the smooth portion of the nut should be placed to the right in order that the holes in it may come opposite the small spring-catch which will hold the nut in the proper position.

At each end of the screw is drilled a hole which permits the end of the extensible connection between the registering gear and the driving-sheave to be pinned to it.

At both ends of the screws, the thread terminates in time for the nut to cease being in mesh before the carriage comes to butt at the end of its travel, the object of this measure being to avoid any damage to the equipment through accidental or undue unwinding or winding of the lead-line.

In order to pass from one registering scale to the other, it is obviously sufficient to change, on the one hand, the graduated paper roll and, on the other hand, the driving-screw and the nut. To do this it is necessary to :

Unscrew the winding key of the mechanism and then remove the cover of the apparatus by unscrewing the screws which clamp it to the wooden base ;

Place the carriage at the end of stroke to the left of its slide, its nut being no longer in mesh with the threads of the driving-screw ;

Dismount the right-hand cheek of the slide by removing the 4 screws which secure it to the frame of the mechanism ;

Take off the driving-screw, then remove its nut from the carriage ;

Set the other nut in the carriage, then the other driving-screw ;

Replace the cover, then the winding key.

UTILIZATION OF THE RECORDING GEAR.

The carriage which contains the nut comprises a small hollow piston with a spring, in which a pencil is introduced by bending the spring a little. The pencil is thus always pressed vertically against the paper strip ; it is this

pencil which plots the profile of the depths sounded. The length of the pencil must not be considerable in order that the lid of the apparatus may be closed.

The carriage also comprises a small metal ruler which follows close to the surface of the paper; the position of this small ruler is such that by pressing the point of a pencil against it, a transverse line may be traced on the diagram at the height of the recording pencil. This small device enables one to make very easily by hand time reference-marks on the graph at the moments when the position of the sounding craft is being fixed. Numbers are generally inserted beside these time reference-marks, so that they can be made to correspond without ambiguity with the positions of the sounding craft thus determined.

The clockwork movement which actuates the recording gear must be wound up every half-hour by means of a key situated on the right-hand side of the case of the apparatus. A small lever placed on the actual casing of the mechanism controls the starting or the stopping.

After a series of soundings, it is generally desired to withdraw the recording diagrams; to do this, it is necessary to:

Cut the paper strip at the level of the unrolling-plate by inserting a pen-knife blade between the strip and the plate;

Remove as before the group of pressure rollers;

Unroll the diagram towards the front of the machine (Fig. 5) by exerting a moderate pull on it, the storage-roller unwinding itself under the effect of this pull.

CARRYING OUT OF THE SOUNDINGS.

The sounding boat or vessel must proceed at a sufficiently moderate speed (1 to 3 knots according to the depth) for the cable which carries the lead to be but slightly inclined with respect to the vertical.

The apparatuses having been installed and prepared as described above, in order to plot a depth profile it is necessary to:

Set the zero of the recording apparatus, and, for this purpose, bring the lead flush with the surface of the water, then turn the nut of the pencil-holder carriage (besides lifting up the spring-catch which holds it) until the point of the pencil is exactly on the zero line of the graduation of the paper;

Start the registering gear;

Lower the lead to the bottom by hand with the cranks of the drum;

As soon as the lead touches the ground, haul it up about 2 metres (7 feet) by giving a few turns to the drum;

After a moment (for instance after 30 seconds) lower the lead again to the bottom and haul it up again about 2 metres (7 feet);

And so forth.

The pencil records constantly the unwinding and the winding up movements of the cable and inscribes on the graduated paper strip a saw-tooth shaped diagram. The depth profile is clearly the curve which passes along all the points drawn by the pencil (Fig. 6); it is generally emphasised by a

red ink line before handing the diagram over to the draughtsmen responsible for the drafting of the sounding work.

If the man who handles the drum feels that the cable slackens suddenly between two casts of the lead, this means that the lead has struck an obstacle, or that the sea-bed, since the last sounding, has risen by an amount larger than the 2 metres (7 feet) by which the lead has been lifted at that moment. The lead should in this case be hauled up at once by a futher couple of 2 metres (7 feet); the involuntary cast thus given by the lead is recorded in the form of a right angle instead of a point (Fig. 7).

REMARK.

It is very important that the leadsman should *bring up the lead as soon as it touches the bottom*; by leaving the lead, even but a short time, on the bottom after a cast, it is dragged on the sea-bed when beginning afterwards to haul it up, thus making the gear run the risk of fouling. A leadsman who hauls up the lead rapidly immediately after the cast loses very few leads, even when exploring rocky regions; on the other hand, a man who does not take this precaution loses a fairly large number under the same conditions. And so, it has always been recognized that it is advantageous to interest the sounding staff financially in the preservation of the leads.

