A NEW SAMPLER LEAD

BY

KAARE MÜNSTER STRØM

(WITH 9 TEXT-FIGURES)

All profile sampler leads described in literature or otherwise known to me are built with a suction valve above the sampling tube. Certainly everybody using profile leads of this type have had a rich experience of the several drawbacks of the top valve. The chief one is its inability to prevent the slipping-out of loose deposits, or indeed of all deposits save stiff clays. Very often only a fragment of the original mud-column remains within the sampler tube, the rest is lost during the passage of the lead through the waters, or only part of the column which entered the tube is ever extracted from the mud. Against loss of mud during passage of lead through the waters when heaving-in, a slip-valve as described by EKMAN (1905) is an effective remedy. The slip-valve slides on the outer sampler tube and is released either through the impact when lead strikes bottom, or through a messenger. I have used both release methods, and prefer the messenger, as very often the slip-valve is released so soon that it travels through loose top layers of deposit and closes below the tube at a moment when the tube is still penetrating the mud, before the more compact layers are reached. In any case the slip-valve cannot improve on the inadequate powers of the suction top-valve to extract satisfying columns of deposits from the bottom.

A further disadvantage of the top-valve is the tendency towards compression of loose deposits, a disadvantage which is not wholly got rid of by using the LUNDQVIST (1923) rubber tube appliance.

A tendency towards compression will be present in all sounding tubes on consequence of friction between sediment and inner tube wall. The friction thus arising can be minimized with use of an inner glass tube of ample diameter.

A profile sounding lead with a positive action valve placed below a sampler tube of ample diameter is the one satisfactory solution of the sampler lead construction problem.

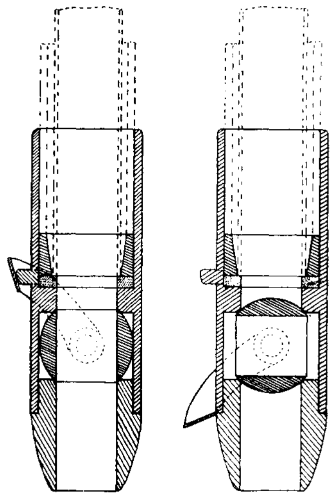

Fig. 1. Fig. 2.

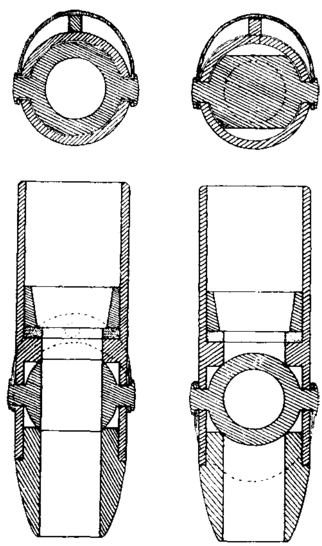

Fig. 3. Fig. 4.

Figs. 1—4 (1/3 natural size).

In collaboration with that excellent maker of oceanographic apparatus, Mr. Bjarne Andersen of Oslo, I got a valve construction which has worked perfectly at all depths and in all kinds of sediments except sand. The honour of the practical development of the valve construction entirely belongs to Mr. Andersen, who has also drawn the illustrations reproduced.

The valve (figs. 1—4) is a ball valve, pierced through with a cylindrical opening of the same diameter as the inner tube of the profile sampler lead. A lever broad enough to be worked by the mud closes the valve immediately extraction of lead tube from the sediment commences. Figs. 1 and 2 show the valve open and closed, as seen in a section vertical to the axis, figs. 3 and 4 illustrate a section through the axis, with the corresponding vertical views.

The working parts of the valve can easily be taken out for cleansing by loosening the lower row of screws (see fig. 5).

The valve has been used for two constructions of profile sounding leads, the one with a 1 m long inner glass tube is now my standard equipment, the other, with changeable outer (and inner) tubes of 1, 2 and 4 ms length has a lead weight moving on guides which can be used as a rammer.

The standard lead (figs. 5 and 6) is made entirely of brass. The total weight is about 12 kgms; the top piece alone weighs 9.5 kgms. A lead weight of 7 kgms (as indicated in the drawing) is usually added on the top so that the total weight is then 19 kgms.

The brass top is made in one piece, and the outer (brass) sounding tube is attached by a self locking bayonet fastening.

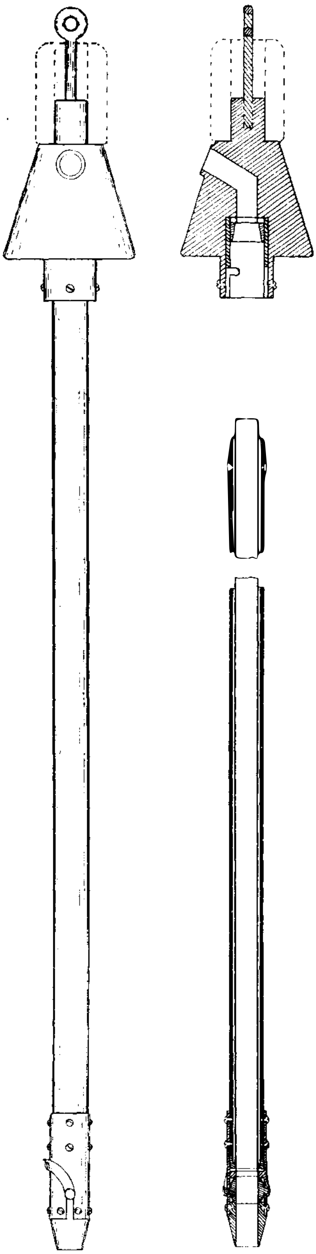

Fig. 5. Fig. 6.

Figs. 5 and 6 (1/8 natural size).

A sampler tube up to 2 ms long would be entirely suitable for this lead. The upper edge of the inner glass tube rests against a rubber ring, as does the lower edge within the brass tube near the valve. Other details of construction are well shown on the drawing.

Working the lead is the easiest thing possible. The wire is run out with just so much brake on the winch drum that the line is vertical. On coming on board the brass tube is detached from the top piece in a vertical position. The tube above the top of sediments is closely filled with hygrophobic cotton and the upper rubber stop set in, then the whole brass tube is turned upside down, the glass tube extracted and furnished with the other rubber stop in the lower end (now uppermost). The sediments are thus perfectly undisturbed and the glass tubes can be packed in cases without care for a vertical position. Finally the rubber stops are secured with strings from the one end to the other and at intervals secured around the glass tube. (A nice test of seamanship!). The mud still filling the valve and constituting the lowermost layers to which the lead has penetrated, can also be collected in a bottle. The length of samples obtained with this lead of course depends upon the bottom, as a rule from 60 cms to nearly 100 cms is collected. Should there be any signs of the top sediments having passed the top of the glass tube (but the broad bottom of the top casting prevents this in all cases of a mud of ordinary constitution) a second sample should also be taken with a greater braking effect on the winch drum. In nearly all cases both columns will be useful, as they can usually be correlated through some distinct zones in the sediments.

The rammer lead (figs. 7 and 8) is somewhat heavier built than the standard type, with a total weight of some 30 kgms (with 4 m tube). It can be used at all depths in the same way as the standard lead, but in addition at moderate depths (up to some 150 ms) the lead weight A (weight about 15 kgms) through pulling and slipping the wire may be worked as a rammer. (SJÖSTEDT (1923) has previously constructed a smaller profile sounding lead on this principle).

To the upper part of this lead there are with 4 nuts attached outer sampler tubes of steel with a valve as described. The interchangeable sampler tubes are of 1, 2 and 4 ms length, respectively. The inner tubes are made of brass in lengths of 1 m, split longitudinally and tinned on the inner side. These 1 metre pieces are joined together by sockets with bayonet locks as shown in fig. 9.

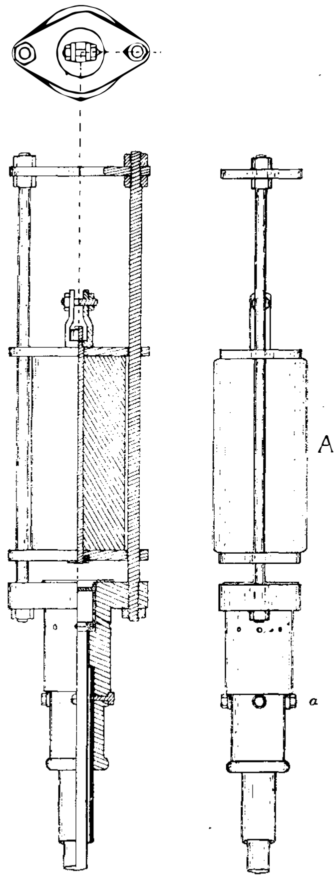

Fig. 7. Fig. 8.

Figs. 7 and 8 (1/8 natural size).

The splits of each piece are covered with a rubber band laid longitudinally which again is covered by a rubber band wrapt in spirals round the whole brass tube piece and fastened with a string continuously spun around the tube in a lathe.

On examination, these layers are cut through and the tube opened. Desirable as this simple procedure is, compared with the disadvantages of pushing the sediments out of the glass tubes, or destroying the tubes, the tinned walls of the brass tubes cause much friction, and in some cases sediment marks on the outer surface of the lead show that it has penetrated into much greater depths of sediment than has been collected in the inner tubes, or has ever been present there. The remedy would either be to use glass tubes with rubber fastenings or to build a sampler lead with tubes of materially greater diameter, thus minimizing the relative friction against the inner walls.

The rammer lead is worked in the same way as the standard lead, except for the ramming itself. Some care must of course be used not to pull on the lead itself for each stroke. On great depths the elasticity of the wire makes it impossible to feel the strokes, and in a seaway the lead can of course not be worked as a rammer.

On coming on board the same procedures are made as with the standard lead, but in many cases, when hard, sandy deposits are met with under the muds and clays even the 4 metre tube may have collected only 1 metre or less of deposits and the three upper metre lengths of inner tubes may be detached, and used again.

For deep sea work the rammer lead is of course quite unsuitable. An eventual possibility for driving the sampler tubes further down into the deposits than what is effected by the first impact, would be to fit it out as a rocket, i. e. with slow-burning explosive charges in cylindrical bores opening upwards in the top piece, and firing on the impact with the bottom.

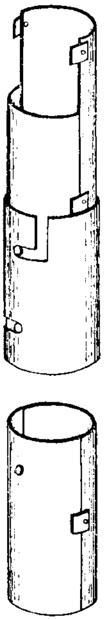

Fig. 9. (1/2 natural size).

Literature cited:

1905. V. W. Ekman: An apparatus for the collection of bottom-samples. — Public. de Circonstance. *27*.

1923. G. Lundqvist: Några nya rörlodtypar. — Skr. utg. av Södra Sveriges Fiskeri-förening. (Lund 1923.)

1923. L. G. Sjöstedt: Undersökningar över Öresund. V. — Lunds Univers. Årsskr. N. F. 2, *18*, 5.

Printed February 12th, 1934.