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Study No. 3112

HYDRAULICS DIVISION

ENGINEERING SERVICES SECTION

Technical Note

DATE: May 1981 REPORT NO. 81-02

TITLE: A Through-the-Ice Water Sampler

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REASON FOR REPORT:

This is a study completion report on the design and construction of a new water sampling bottle for Ocean Science and Surveys.

CORRESPONDENCE FILE NO:

4700, D00-12 (112) : 0A0-99

1.0 SUMMARY

A requirement by O.S.S. Arctic field parties for a supply of water sampling bottles suitable for sampling through ice cover, and being transported by helicopter, aircraft or tracked vehicle was completed by the Equipment Research and Development Unit. The design, manufacture and lab testing of a prototype sampler was done, and this was followed up by the supply of 11 more samplers. Some refinements remain to be done as a result of field experience, this past winter.

2.0 DISCUSSION

In October 1980 the ER&D Unit received a request from D.J. Brooks of the R&D Unit of OSS to design and build 12 prototype water sampling bottles for Arctic use in the winter of 1981.

The following specifications were laid down:

1. Volume of water sample 3 to 6 litres.
2. Sampler to pass through a maximum 23 cm diameter ice hole.
3. No external mechanisms which could snag or collect ice.
4. Materials to be suitable for general biological use in salt or fresh water.
5. Uncontaminated sampling, actuated by a mechanical messenger.
6. Bottle to become its own non-leaking storage unit for transport to laboratory.
7. Bottles to be used singly.
8. Nominal operating depth 300 metres.

A design concept evolved which used an evacuated cylinder sealed at each end by a plug valve. The cylinder was to be evacuated in the field camp laboratory, and opened for water sampling, by actuating the upper valve with a standard messenger at the proper depth.

In the project plan, it was decided to investigate commercially available cylinders which were no more than 20 cm in outside diameter, built of corrosion resistant material, tested to be capable of resisting an external pressure of 7 MPa. A number of cylinders were reviewed including - (1) aluminum SCUBA cylinders; (2) fiberglass hot water tanks; (3) stainless steel sample cylinders. A 'Whitey" 3785 cm^3 stainless steel cylinder was finally selected and purchased, along with a carrying handle and two Nupro P4T series type 316 stainless steel valves.

Referring to Dwg. ME-5112-1, Rev. 1, and the photo enclosed, the sampler consists of the bottle with attached carrying handle (9); a drain valve (14), and dispensing fitting (13) at the bottom; the inlet valve (7); the striker (3); linkages (1,6); suspension fitting at the top (2); and a protective cage (12); A lead weight was also designed for use in high current areas.

Initial testing of the prototype which was built in-house was successful in that the bottle filled in less than one minute, had a capacity of 3785 cm^3, was rugged, did not leak, and could be submerged to at least 685m of sea water and was protected from premature triggering. Stock components were therefore ordered for 11 more units, and a contract was let for the special parts to be manufactured. A total of five units were completed and sent to the Arctic in early February 1981. The final seven units were completed in April, 1981. A short instructional note was prepared and delivered.

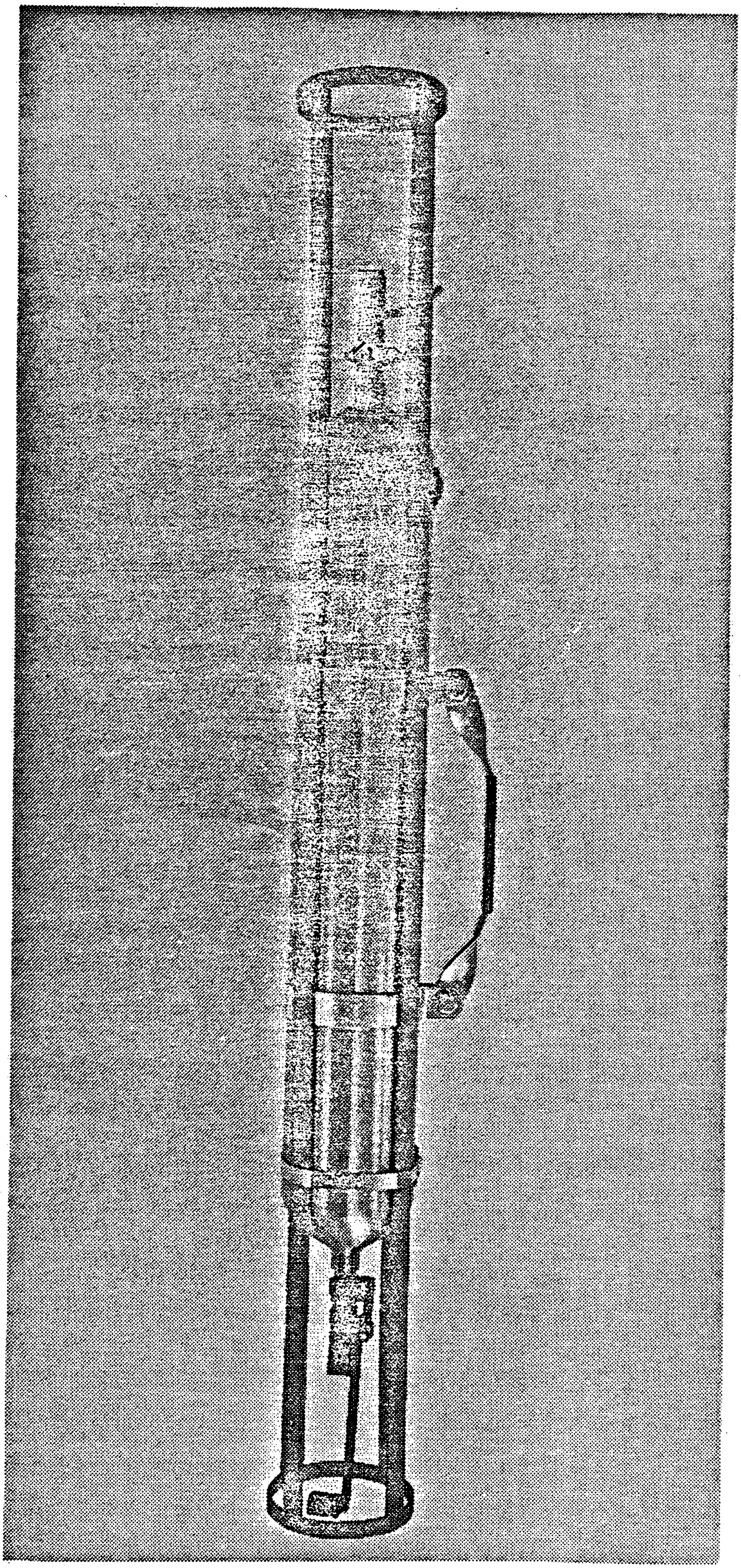
3.0 FIELD EXPERIENCE

Initial field testing has revealed a problem of apparent internal corrosion of the cylinders causing the production of a flocculent iron oxide and discolouration of the sample. The problem may be caused by a lack of passivation internally, and will have to be addressed, before the samplers are used again.

The extra lead weights supplied for ballast in high current situations were found to be unnecessary as currents rarely exceed one knot in the area being studied.

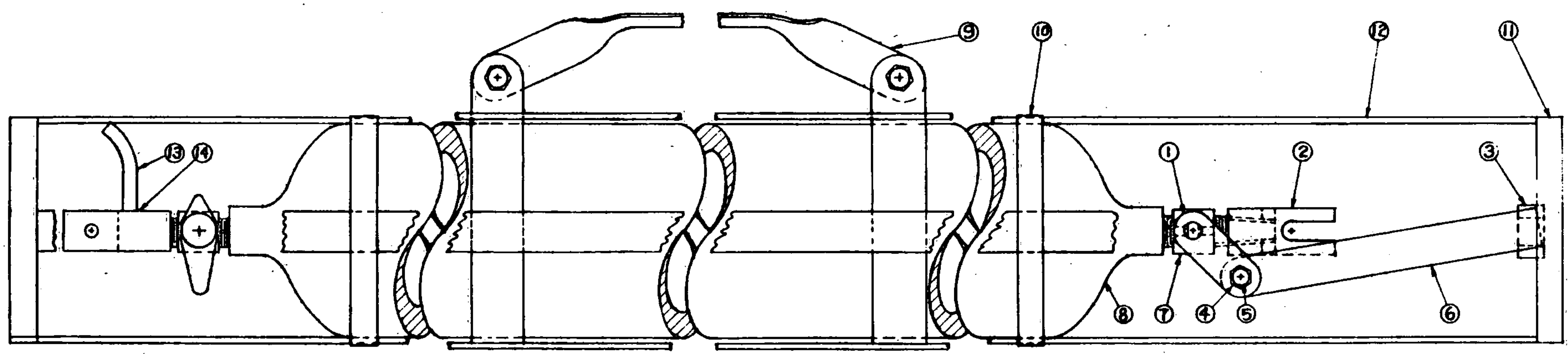
A lighter bottle would be preferred as it is now felt that in the future for some stations, it would be preferable for a number of bottles to be installed on the line, and samples taken simultaneously by relay messengers.

The above problems could be overcome by redesign of the bottle using materials such as fibre reinforced plastic and/or titanium. Except for the corrosion, the bottles are acceptable for less demanding applications.



PARTS LIST

PART NO.	DESCRIPTION	QTY.
1	Valve Operator	1
2	Upper Attachment	1
3	Striker	1
4	Hex Head Capscrew	1
5	Hex Nylock Nut	1
6	Actuator Strap	1
7	Nupro Valve	2
8	Whitey Cylinder	1
9	Whitey Handle	1
10	Bandit and Buckle	2
11	End Ring	2
12	Side Bars	4
13	Spigot	1
14	Lower Attachment	1



Environment Canada — Canada Centre for Inland Waters
Environnement Canada — Centre Canadien des Eaux Intérieures

Arctic Water Sampler
Assembly and Parts List

Designed by H.S. | Checked by | Approved by
Drawn by S.J.V. | Drawing No. ME 5112-5
Scale 1:1 | Date 81-5-25

Material: 304 Stainless