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DESIGN AND OPERATION OF AN IN SITU FROZEN CORE GRAVEL SAMPLER

TECHNICAL REPORT 1970 - 12

by P. RYAN

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Sample taken in Big Qualicum River
gravel sampler described

INTRODUCTION

The objective of the gravel sampler design is to provide a method of extracting a near undisturbed sample of gravel and silt from shallow salmon spawning streams. The sample is frozen in situ using "dry ice" dissolved in acetone as a freezing mixture.

DESIGN

The general arrangement of the device is shown in Figure 1. It is built around a 21 quart pressure cooker as this container comes with an airtight quick opening lid and is designed to withstand internal pressure. The major parts are aluminum for minimum weight, and the pipe couplings are steel for maximum thread life.

METHOD

1. Drive the outer pipe with its pointed tip (item 7) into the stream bed using a sledge hammer and the driving bar (item 12) until between 1 and 2 inches of the pipe remains above the gravel surface (Fig. 2).

Note: If the top two inches of gravel are required in the sample, a water saturated 2" thick disk of open cell foam plastic must be placed over the protruding end of the outer pipe tip. The edges of this pad must be held down tight against the gravel with rocks (Fig. 3).

2. Apply "Pipetite-Stick" to the threads on the bottom of the insulated outer pot (item 1), then screw onto the pipe installed in step 1. (Use the outer pipe extension (item 8) if water depth is between 18" and 3'-0".) Insert the locking bar (item 9) through the pot and lock it into the section of pipe in the gravel by tightening the nut at the top.
3. While holding the locking bar tighten the outer pot onto the pipe in the gravel (Fig. 4).
4. Loosen and remove the locking bar. Insert the inner pot (item 3) complete with the inner pipe (item 6) attached (4'-5" pipe required if the outer pipe extension is being used). Insert the screen (item 4) in the pot.
5. Insert the blow-out tube (item 5) complete with holddown for the inner pot (item 11) down to the bottom of the outer pipe tip, then fasten it to the fitting through the outer pot (Fig. 5). It is important that the blow-out tube touches the bottom of the outer probe tip so that all the water can be blown out in the next step.

Note: Use heavy woolen mitts when handling dry ice in the following steps.

6. In the inner pot place a quart can about 1/3 full of water, add about 1/2 pound of dry ice to the water in the can and quickly place the lid (item 2) on the outer pot (Fig. 6). allow the expanding CO₂ gas to blow the water out the blow-out tube. When the water flow decreases, plug the outlet

with a finger to build up pressure then release. Repeat this several times until no more water is expelled.

Note: Take special care when handling the dry ice/acetone mixture, it will produce a far more severe burn than the dry ice alone. Eye protection from possible splashing is essential.

7. Remove lid and the can from the inner pot. Pour about 2 gallons of acetone into the inner pot. Note if acetone is cold from a previous sample and saturated with CO_2 , pour it in slowly to prevent excessive boiling and spillage. Add dry ice to the acetone in the inner pot as rapidly as possible without the acetone boiling over (Fig. 7).
Crushed dry ice is more easily handled than 50 pound blocks. Continue adding dry ice as it dissolves in the acetone for one hour. The second sample will require less freezing time as the operation will start with cold acetone. Freezing times for later samples should be adjusted to provide the required sample size with the particular gravel and flow conditions encountered.
8. Hold bucket under blow-out tube then lock lid onto outer pot. Recover the acetone that is forced out the blow-out tube by the CO_2 pressure (Fig. 8).
9. Remove the lid, blow-out tube, screen and inner pot. Screw in the lifting pipe (item 10) and hoist the equipment and frozen sample out of the gravel using a tripod and small comealong (Fig. 9).

10. Unscrew the outer pipe tip complete with sample. If it necessary to break the sample into horizontal slices, pour boiling water into the pipe and withdraw it from the sample, which then can be broken into layers or allowed to thaw out over a series of containers.
11. When sampling is complete and acetone is returned to drums for transportation DO NOT SEAL cans until acetone has been at normal temperature for at least eight hours or the cans may burst from the internal CO₂ pressure.

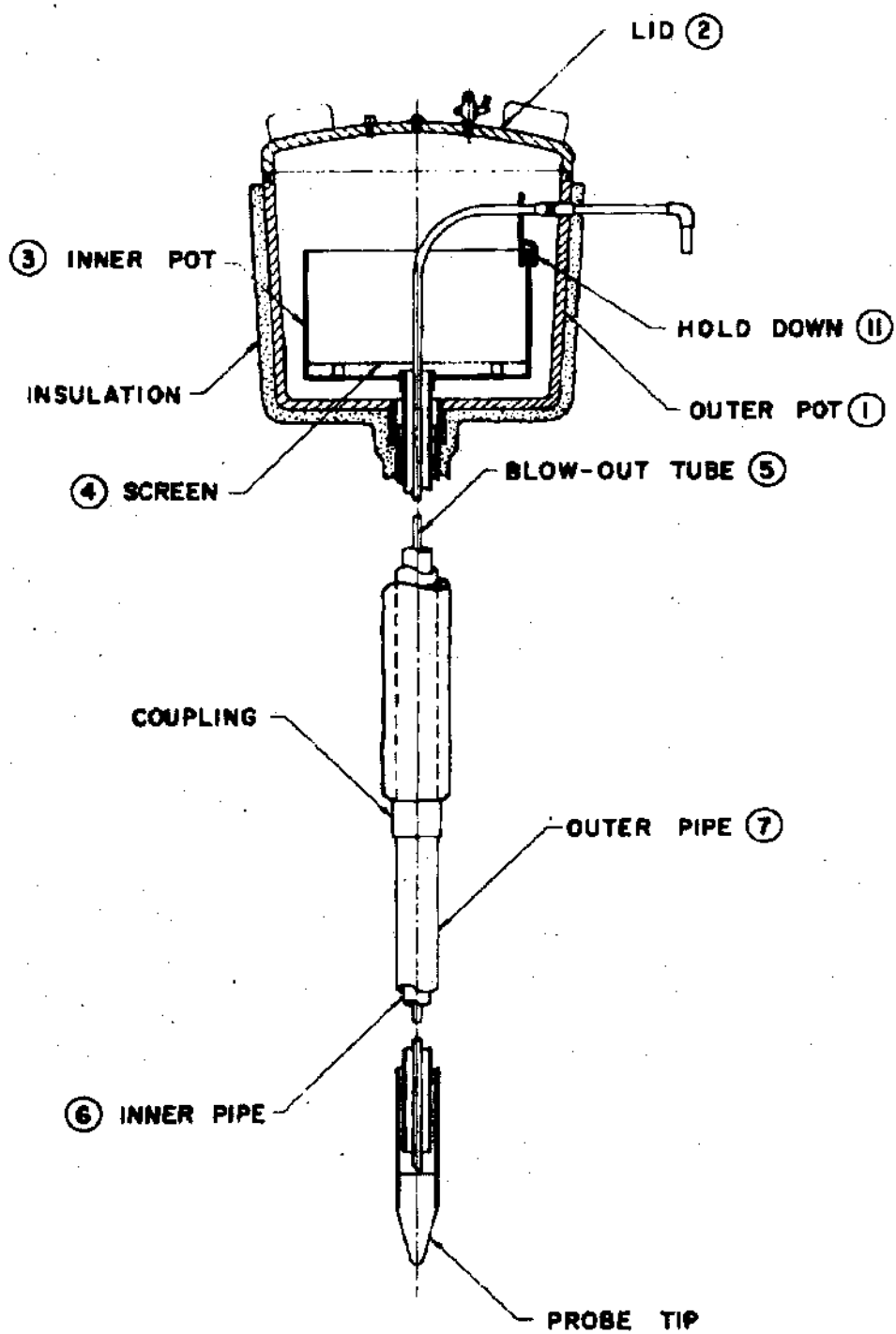


FIG. 1

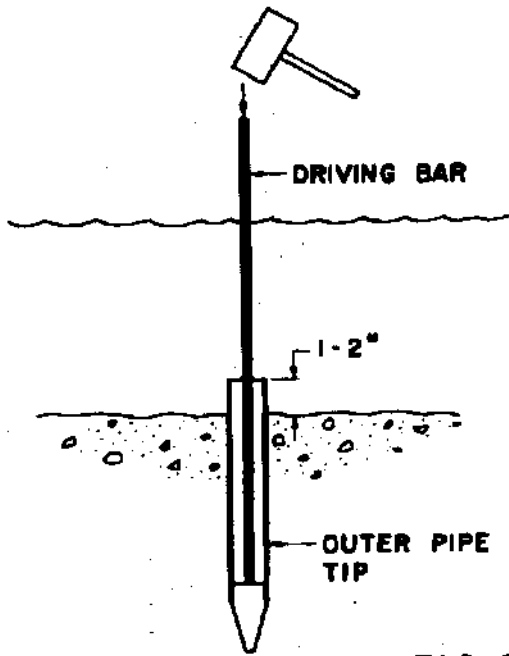


FIG. 2

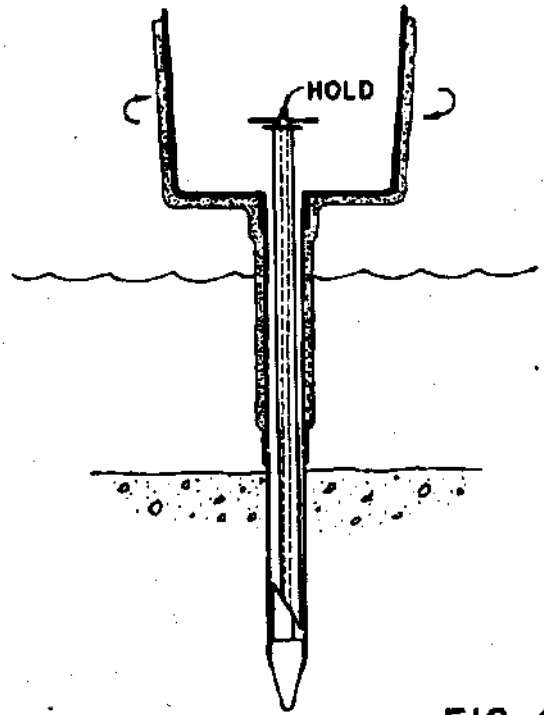


FIG. 4

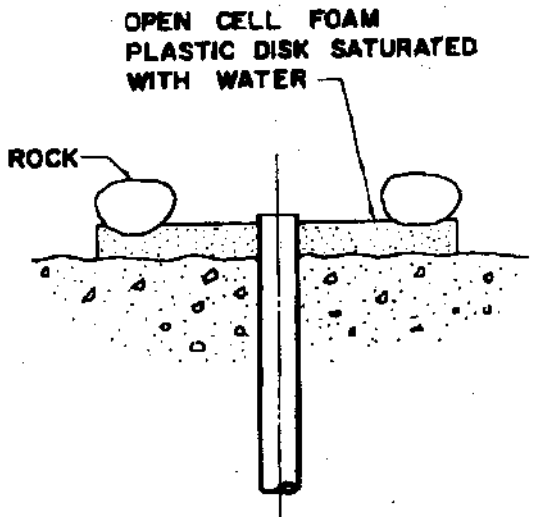


FIG. 3

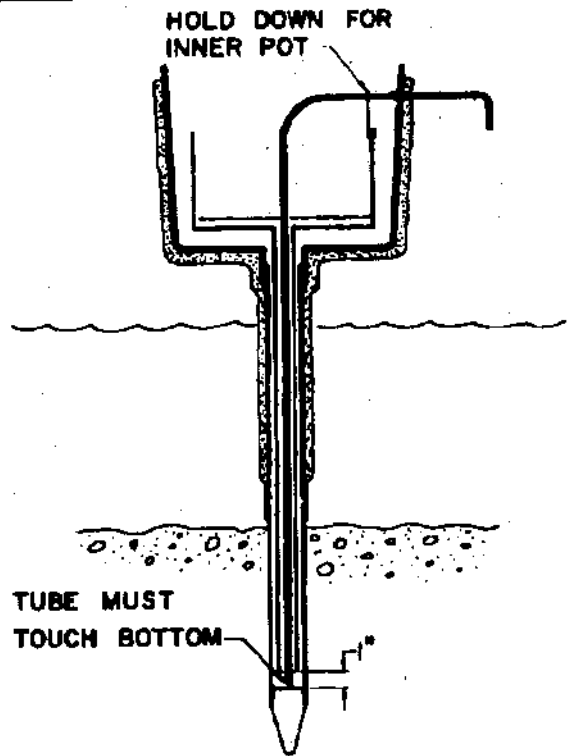


FIG. 5

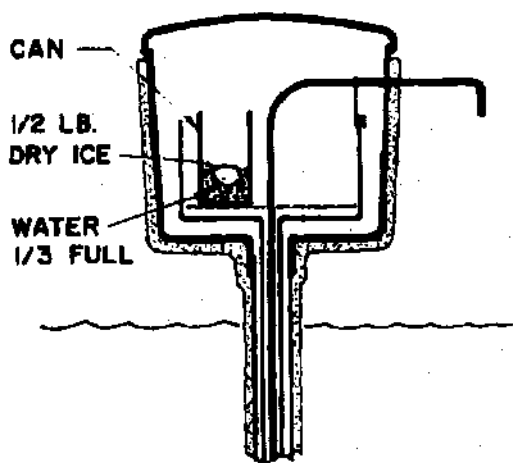


FIG. 6

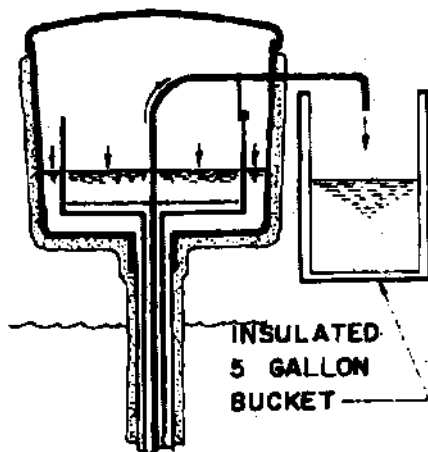


FIG. 8

CAUTION

COLD ACETONE (-109°C) IS CAPABLE OF INFLECTING A SEVERE BURN

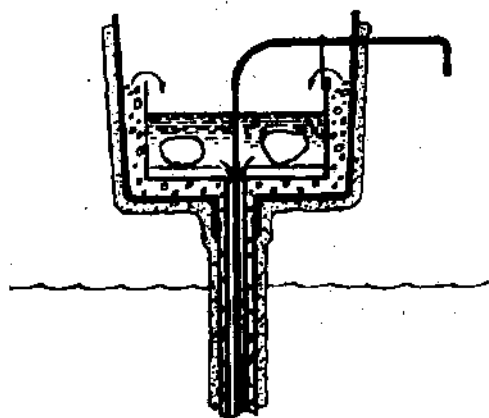


FIG. 7

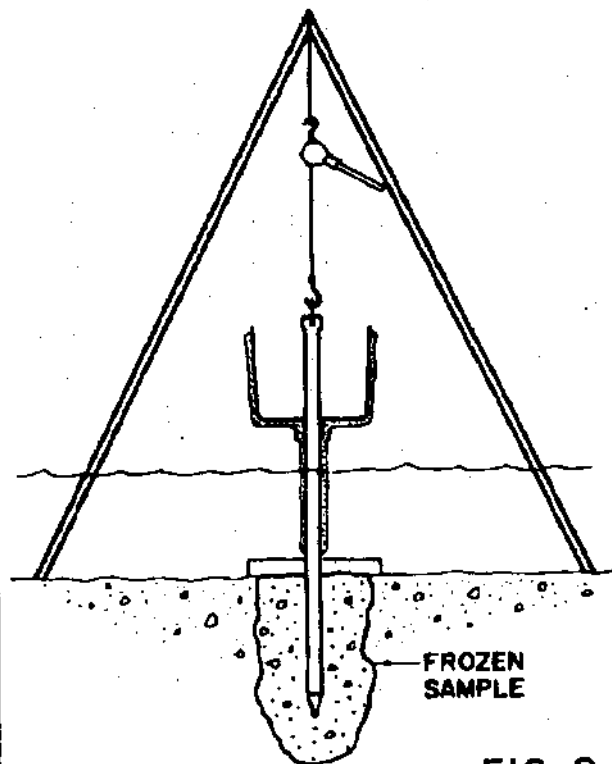


FIG. 9