May 9, 1967 G. R. GLEASON, JR., ETAL 3,318,394

METHOD AND APPARATUS FOR OBTAINING SOIL SAMPLES

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FIG. 1

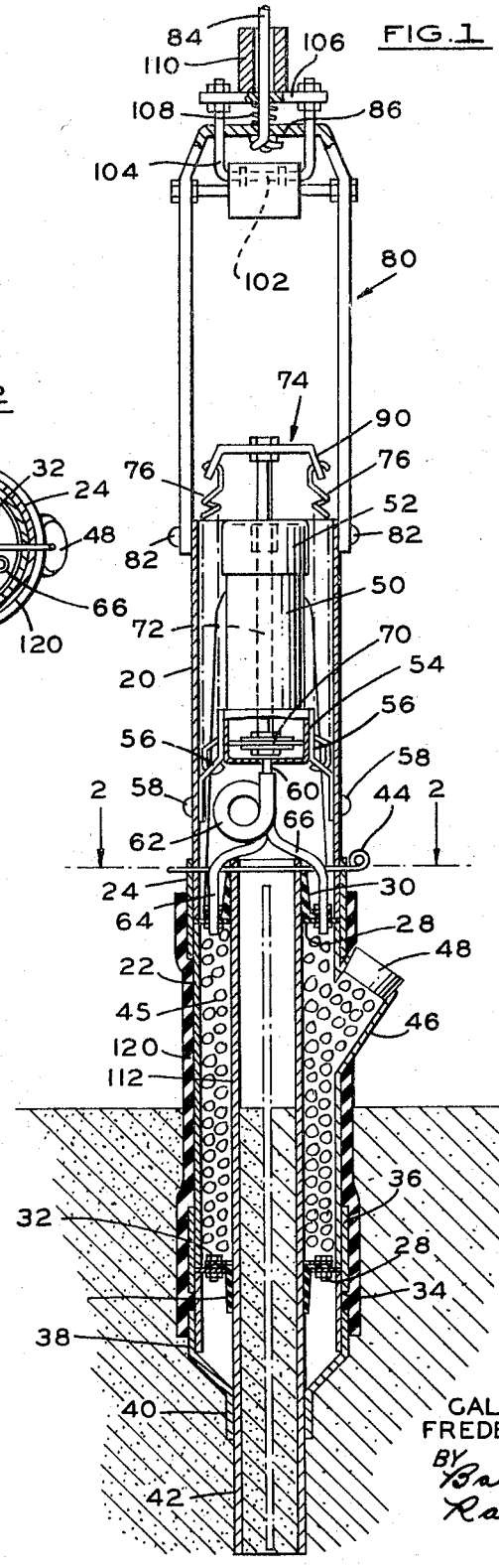
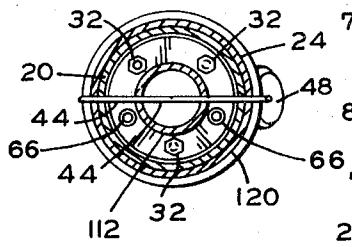


FIG. 2



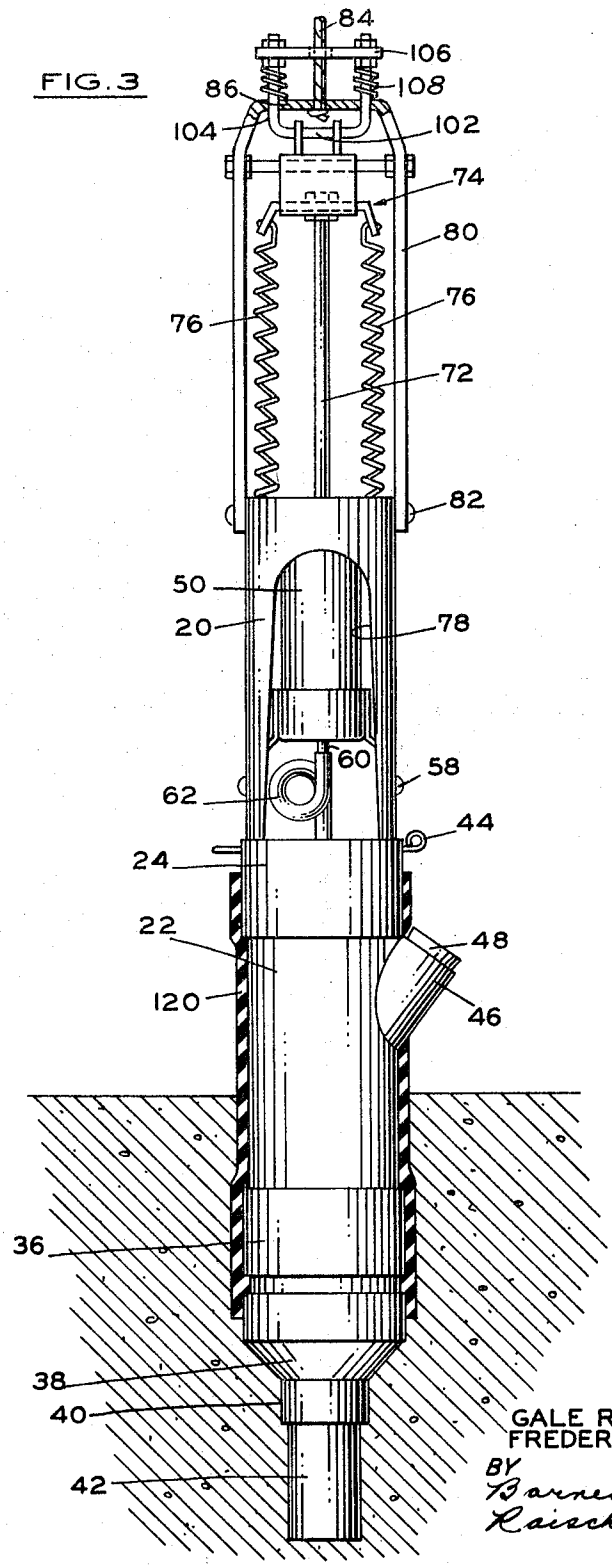
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FIG. 3



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FIG. 4

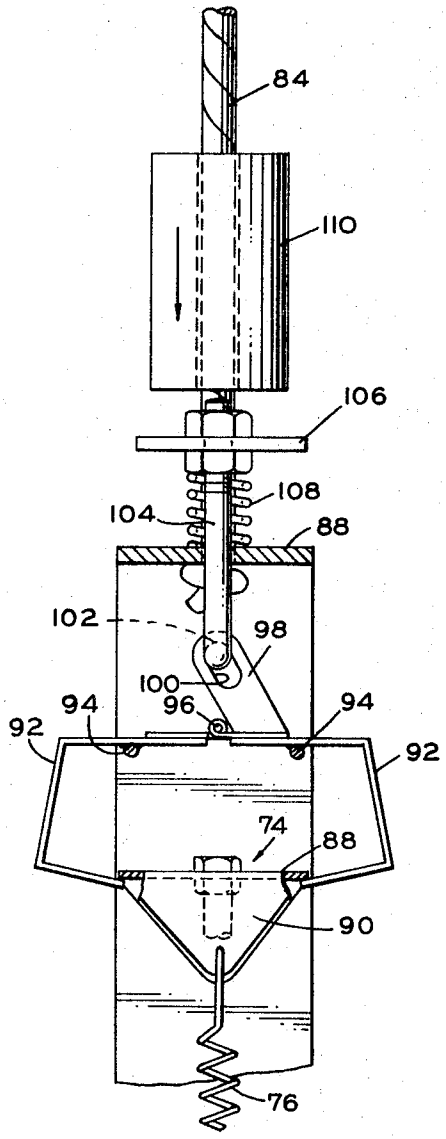
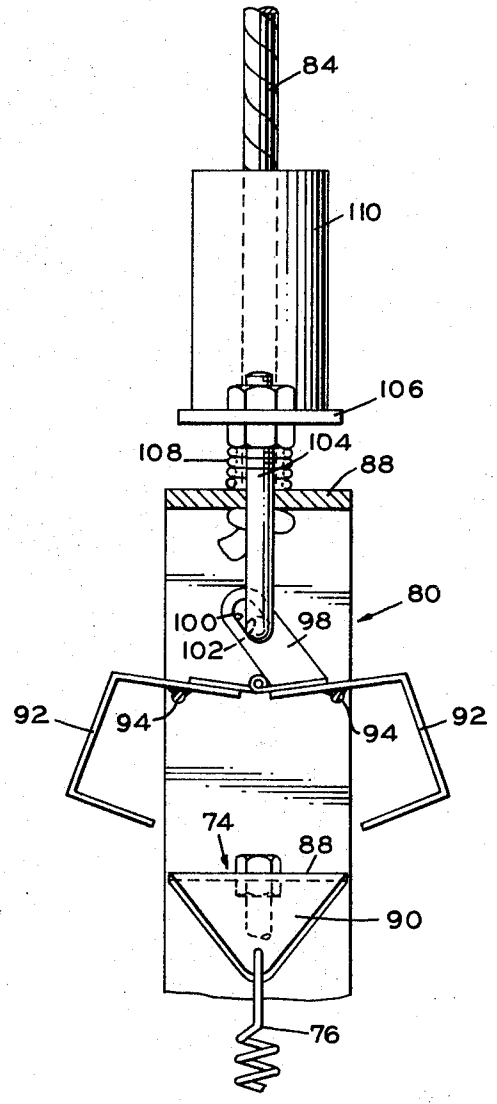


FIG. 5



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METHOD AND APPARATUS FOR OBTAINING SOIL SAMPLES

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10 Claims. (Cl. 175—5)

This invention relates to a method and apparatus for obtaining soil samples such as samples of lake bottom soil and the like. Very often in benthonic exploration, it is important to obtain a sample of soil at the bottom of the sea or the bottom of inland lakes in such a way that the sample is stratified in the same way as it was stratified in situ. Due to the fact that many of the bottoms that are being explored and tested are somewhat soft and muddy, it has been extremely difficult to raise a sample to the surface without disturbing it to the point that stratification was lost.

It is an object of the present invention to permit the recovery of benthonic samples without disturbing the contents so that accurate analysis can be made for whatever purpose the sample is sought.

It is a further object of the invention to provide a device which is simple in construction and operation and which can be repeatedly used.

It is a further object to provide a benthonic sampler device which can freeze the contents of the specimen chamber while in place, permitting the sample to be raised and transported without disturbing its original condition.

Other objects and features of the invention relating to details of construction and operation will be apparent in the following description and claims.

Drawings accompany the disclosure and the various views thereof may be briefly described as:

FIGURE 1, a view of the device partially in section showing the relative position of the parts.

FIGURE 2, a sectional view on line 2—2 of FIGURE 1.

FIGURE 3, an outside vertical elevation of the device.

FIGURE 4, a detailed, enlarged view of a release mechanism in engaged position.

FIGURE 5, a view similar to FIGURE 4 showing parts in released position.

Referring to FIGURE 1, the basic structure is formed by a composite tube formed of a top tube 20 and a bottom tube 22 of the same diameter and axially aligned. These tubes are joined at their juncture by a collar 24 carried by the tube 20 preferably with a brazed joint and telescoping over the bottom of tube 22 in threaded relationship. At the juncture of the tubes a radial disc ring 28 is preferably brazed or soldered to the collar 24 and this disc carries a circular cylindrical gasket 30 having a flange bolted to the disc 28 by bolts 32 and preferably formed of a material which remains flexible at low temperatures.

The disc 28 is clamped at its peripheral edges between the lower end of tube 20 and the top end of tube 22 so that it may be removed for replacement if necessary. At the bottom of tube 22 is a short tube 34 co-axial and aligned with tube 22, this tube being brazed to a collar 36 having a threaded relationship with tube 22. Between the lower end of tube 22 and the upper end of the short tube 34 is a sealing assembly similar to that previously described having the disc ring 28 held by bolts 32 and a flexible cylindrical gasket member 30 extending downwardly in this case rather than upwardly. On the bottom of tube 34 is a reducer tube 38 having a reduced section 40. Insertable into the assembly just described is a sampler core tube 42 having its lower end slidably received in and projecting downwardly beyond the reducer portion 40 and having its upper end extending to a point just above

the gasket 30 and held in place by a transfixing pin 44 which projects through diametrically opposed holes in the tube 20 and the collar 24. The tube has a snug sliding fit in gaskets 30 which support and center the tube in the assembly.

The tube 42 is thus supported by the reduced portion 40 and by the gaskets 30 which form an annular chamber 45 between the gaskets, the tube 22 and the core tube 42. This chamber is opened at a side port 46 which can be closed by a suitable stopper 48 and it is the purpose of this chamber to be filled with pre-chopped ½" cubes of Dry Ice in a quantity of approximately ¾ lb., this to be inserted through the loading port 46.

In the upper part of tube 20, there is located a syringe tube 50 which is composed of a length of copper pipe having caps 52 and 54, the lower cap being supported by a pair of brackets 56 having the upper end affixed to the cap 54 and the lower end fastened to the inner walls of the tube 20 at 58. The bottom cap 54 has a nipple 60 projecting therefrom and this is connected to a flexible Y tube 62 which branches at 64 and 66 to project down through openings in disc 28 into the chamber 45 previously described. Within the tube 50 is a piston 70 actuated by a piston rod 72 projecting down through an opening in end cap 52. This piston has at the top a cross bracket 74 secured to the piston rod and a pair of springs 76 anchored at the top on this bracket 74 are anchored at the bottom on the support brackets 56.

As shown in FIGURE 3, the tube 20 has side windows 78 which permit easy removal of the flexible tube 62 so that the syringe tube 50 can be filled through the bottom nipple 60 as the piston is raised against the action of the tension springs 76. If desired, the tubes 64, 66 can be used to fill but this necessitates dismantling the main assembly.

A U-shaped yoke member 80 has depending arms which are bolted to the top of tube 20 at 82 and the entire assembly is supported by a rope or cable 84 projecting down through a hole in the top 86 of the suspension member 80.

Returning to the cross bracket 74 at the top of the piston rod 72, this member has a central plate portion 88 with side wings 90 extending therefrom to anchor the springs 76. Central plate 88 is adapted to cooperate with a latching mechanism mounted at the top of the U member 80 and illustrated in detail in FIGURES 4 and 5. This latching mechanism is composed of two jaw members 92 each pivoted on cross rods 94 in the legs of the member 80 and hinged together at 96. One actuating arm 98 extends upwardly to a central point above the hinge 96 and this is provided with a slotted opening 100 through which passes the bight portion 102 of a U-bolt having legs 104 which pass through the top portion 86 of the U member 80 and which are connected by transverse plate 106 which is urged upwardly by a spring 108. The spring 108 thus urges the jaw members 92 to the latching position shown in FIGURE 4, and it will be seen that a downward pressure on the plate 106 will effect a releasing action of the jaws as shown in FIGURE 5.

This releasing action is obtained by a messenger weight 110 threaded on the supporting strand 84. When this messenger weight is dropped down the strand 84, it hits the strike plate 106, forcing the U-bolt 104 down against the action of the spring 108 and pivoting the jaws 92 through the arm 98 to the open position.

The core tube 42 is preferably about 13" long and formed of copper pipe approximately 1½" in diameter with a sampling area of approximately 1.77 sq. in. When the assembly as described is plunged into the bottom of a lake, the material will fill into the tube 42 in pretty much the same stratification that it has in situ.

After the core tube has settled to the desired point, the messenger weight **110** is dropped to trigger the release of the piston **70**, thus injecting the acetone, previously loaded into the tube **50**, through the plastic tube **62**, into the chamber **45**. The action of the acetone on the Dry Ice will cause rapid freezing of the sample in the tube **42**. The freezing time is from 5 to 10 minutes. It can be hastened by using a brass divider **112** optionally disposed diametrically in the tube **42**. The tube **22** is preferably insulated by a suitable insulation sleeve or wrapper. For example a ½" thick sheet of plastic foam **120** is wrapped around tube **22** as shown in the drawings and taped in place. After the freezing time, the device may be hauled upwardly and the sampler tube **42** removed preferably after removal of the core **48**. The tube can be slightly warm to free the sample which can be pushed out by a wooden rod and the sample can then be wrapped in aluminum foil and stored in a Dry Ice container. These samples can, accordingly, be used for any biological or geological purpose desired.

It will be seen from the above description that repeated samples can be obtained by following the described procedures.

We claim:

1. A sampler device for use in benthonic exploration and the like which comprises,

(a) an open-ended sampler tube adapted to be plunged into soil to be sampled,

(b) a mounting means for said tube comprising a a jacket for supporting said tube therein to provide a refrigerant chamber around said tube,

(c) means in said jacket to permit the introduction of refrigerant from the outside of said jacket,

(d) a second means for storing a supply of refrigerant adjacent said jacket comprising a piston and cylinder arrangement,

(e) means for cocking said piston against a resilient force in a position poised to drive refrigerant into said jacket, and

(f) releasing means for tripping said cocking means to release said piston.

2. A device as defined in claim **1** in which said releasing means can be tripped by a messenger weight dropped from a remote control position above said device.

3. A device as defined in claim **1** in which the jacket includes axially spaced gasket members adapted to receive said tube and seal the space within said jacket around said tube.

4. A sampler tube for use in benthonic exploration and the like which comprises,

(a) a straight cylindrical sampler tube adapted to be plunged into soil to be sampled,

(b) a mounting means for said tube comprising a tubular jacket for receiving said tube concentrically therein,

(c) means in said jacket to seal a chamber around said tube and simultaneously support said tube within said jacket,

(d) releasable means for locking said tube in said jackets,

(e) a piston and cylinder assembly adjacent said jacket having a tubular connection with the interior of said jacket whereby liquid refrigerant may be injected from said cylinder by said piston into said jacket,

(f) latch means for cocking said piston against a resilient force in a position poised for injection of refrigerant,

(g) means for supporting said assembly from above for remote control thereof, and

(h) a messenger weight on said supporting means adapted by gravity to drop to said device and trip said latching means whereby to cause injection of refrigerant into said chamber.

5. A sampler tube as defined in claim **4** in which said jacket has an axial extension to receive and support said piston and cylinder assembly, said extension being open at portions thereof to permit access to said assembly for reloading and cocking.

6. A sampler device for use in benthonic exploration and the like which comprises,

(a) an open-ended sampler tube adapted to be plunged into soil to be sampled,

(b) mounting means for carrying said tube shaped to provide a chamber around said tube throughout a portion of its length, said chamber being adapted to receive a refrigerant, and

(c) means for hoisting and lowering said tube and mounting means from a control position,

(d) means to store a supply of liquid refrigerant in communication with said chamber, and

(e) control means selectively operable for release of said refrigerant to introduce said supply of refrigerant into said chamber after the sampler tube has reached a sampling position.

7. A device as defined in claim **6** in which the supply of refrigerant is positioned adjacent said chamber to lower and raise with said chamber, and said control means is remotely operable to release refrigerant into said chamber.

8. A sampler device for use in benthoic exploration and the like which comprises,

(a) a sampler tube adapted to be plunged into soil to be sampled,

(b) a container adjacent said tube for receiving particles of a refrigerant such as solid carbon dioxide,

(c) means for storing a quantity of liquid refrigerant,

(d) and injection means for injecting said refrigerant from said storage means into an area adjacent said tube occupied by said solid carbon dioxide to accelerate the creation of a freezing temperature around said tube whereby a cylinder of stratified soil in situ can be introduced into said tube and solidified prior to removal for examination and analysis.

9. A device as defined in claim **8** in which said means for storing refrigerant is arranged in communication with said tube, and said means for injecting said refrigerant is movable from a storage position in an injection stroke, and releasable means for latching said injection means in a storage position, and means controllable remotely from said device for releasing said releasable means to permit the injection of refrigerant.

10. The method of collecting benthonic samples and the like in which a sampler tube and coolant jacket is plunged into soil to be sampled characterized by the steps of:

(a) providing a supply of liquid coolant in communication with the coolant jacket,

(b) lowering the sampler tube and jacket into the soil to be sampled, and

(c) dumping the liquid coolant into the jacket subsequent to the positioning in the soil to be sampled.

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