Jan. 31, 1967 W. L. BRUNDAGE, JR 3,301,067

BAROPHILIC BACTERIA SAMPLER

Filed Oct. 13, 1964

FIG. 1

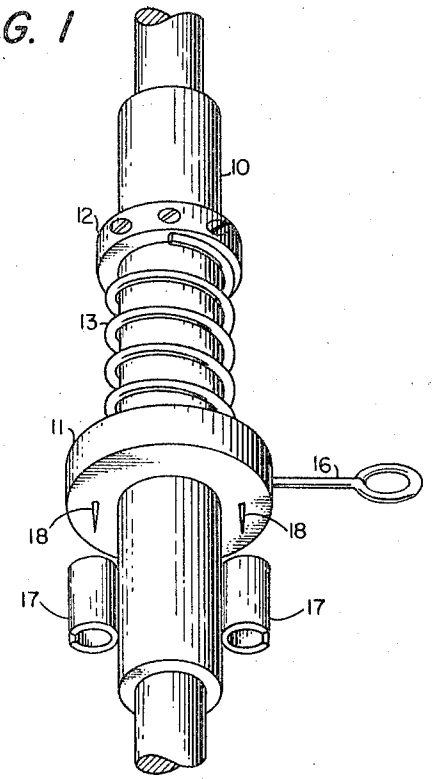


FIG. 2

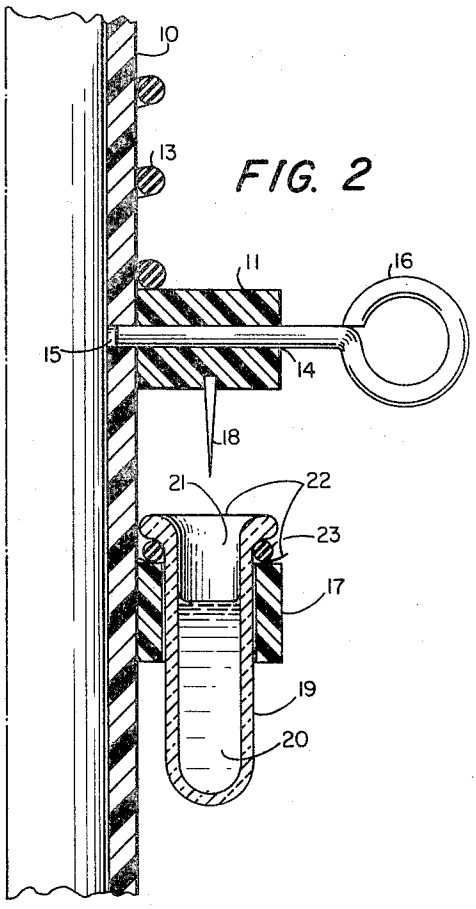


FIG. 3

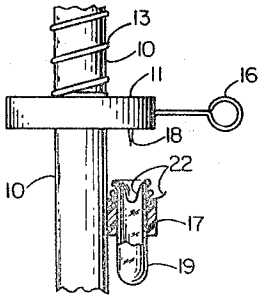
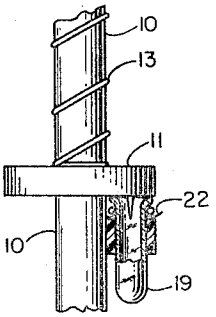


FIG. 4



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BAROPHILIC BACTERIA SAMPLER

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4 Claims. (Cl. 73—425.4)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

The present invention relates to a Deep Ocean Environmental Sampler and more particularly to a Deep Ocean Sampler capable of securing and retaining a sample of water in the conditions of pressure, etc. of the environment from which it was taken.

A competent device for collecting water samples for bacteriologically analysis from any depth in the ocean has been sought since before the turn of the century. It is imperative that such a sampler be capable of operating at the greatest hydrostatic pressures encountered, that it be sturdily constructed of biologically inert materials, that it be easily sterilized and that it remain aseptic while being prepared for use. Simplicity of construction and operation are also desirable features and should be designed so that multiple units may be fastened to a hydrographic cable in order to recover different samples from various depths.

Heretofore most bacteriological samplers have been unsatisfactory for various reasons. The sample containers in a majority of cases are incapable of being sterilized, are made of metals which have a bactericidal effect or are susceptible to contamination. Many other samplers are suitable only for shallow water use. The remaining few bacteriological samplers which are acceptable for operation at great depths all share a common fault. In returning the water to the surface these devices subject the sample to a gradual release in pressure. The barophilic (pressure-loving) bacteria which survive the change in pressure may represent only a part of the total population which exists under the original pressure. The truly barophilic bacteria or obligate barophiles may therefore be described as those which cannot remain viable during this decrease in pressure of up to one thousand atmospheres.

Suitable prior art devices are incapable of withstanding great depths and at the same time capable of preserving a trapped sample at the pressure of the depth from which the sample is taken. The present invention is a Deep Ocean Sampler capable of taking samplings not only at great water depths but in any liquid or fluid environment of extreme pressure not exceeding the limitations of the materials from which the device is made. The present invention is directed to a barophilic bacteria sampler which performs water sampling and bacteria culturing in one step and without a loss of pressure of the environment from which the sample is taken or of danger of contamination of the sample.

It is therefore an object of the present invention to provide an accurate dependable sample of simple construction for bacteria culturing at the water pressure of the environment from which the sample is taken.

Another object is to provide a device for water sampling and bacteria culturing without the danger of contamination.

Other objects and advantages of the invention will hereinafter become more fully apparent from the following description of the annexed drawing, which illustrates a preferred embodiment of the invention wherein:

FIG. 1 illustrates a perspective view of the device,

FIG. 2 illustrates a partial sectional view of the sampler as prepared for lowering into a liquid environment;

FIG. 3 illustrates a partial sectional view of the device positioned at pressure depth for taking a sample.

FIG. 4 illustrates a partial sectional view of the device after the sample has been taken.

The present invention makes use of a plastic tube about which a plastic collar is assembled above a series of barophilic bacteria sampler tubes. The collar has secured thereto a series of glass or plastic needles which are positioned to puncture a thin sheet rubber held over the adjacent end of the barophilic bacteria sampler. The collar is spring loaded and upon withdrawal of a release pin the collar is free to slide along the tube and punch a hole in the thin rubber sheet over the end of the barophilic bacteria sampler. Water under the surrounding pressure will be aspirated into the tube at the time of being punctured. Subsequent thereto, the solid plastic collar is forced over the end of the tube by the spring, thereby sealing the end of the tube while sealing the water therein against escape by use of the spring pressure and the end sheet of rubber which acts as a seal between the lip of the tube and the collar. A more positive seal may be obtained by inbedding the needle in a rubber stopper and positioning the stopper on the collar.

Now referring to the drawings wherein the same reference characters represent the same parts throughout the drawings. As shown the device includes a plastic tube **10** in which a solid plastic collar **11** is placed over the plastic tube and is free to slide along the tube. A ring **12** is secured adjacent to the upper end of the plastic tube to provide a shoulder for a compression type coil spring **13** which is positioned about the plastic tube **10** between the shoulder **12** and the solid plastic collar **11**. The plastic collar has an aperture **14** there through perpendicular to the axis of the plastic tube in which a release pin **16** is inserted into an aperture **15** in the tube **10**. The aperture in the plastic tube is positioned at a point such that the coil spring is under compression between the shoulder and the solid plastic collar when held in position by the release pin. One or more split plastic test tube holders **17** are secured to the plastic tubing below the freely slideable collar **11** within which test tubes are placed to obtain water samples under pressure. One or more glass or plastic needles **18** are secured to the bottom of the plastic collar above the split test tube holders secured to the plastic tube and pointing in the direction of the test tube holders. The number of needles depend on the number of test tube holders or test tubes desired to obtain samples of liquid.

The plastic collar is provided with a keyway and is prevented from rotation about the plastic tube by a key secured to the plastic tube.

In making use of the device for obtaining samples at various pressure levels, sterilized test tubes are partially filled with nutrient liquid allowing an air space equal to the sampling volume desired. The test tube is closed off with a rubber cover or dam secured thereto with an O-ring which fits over the lip of the tube and secures the end rubber sheet thereto. The tubes are inserted in the split test tube holders on the sampler, the solid plastic collar is slid over the tubular element **10** and held in place by the insertion of the release pin into the hole or aperture in the tube. Then the spring and ring forming the shoulder are positioned in place and the ring forming the shoulder is secured to the plastic tube element by suitable screws. The assembled device is placed in an autoclave and sterilized for a period of time which is well known in the art. Subsequent to assembly and sterilization the assembled device is placed onto the moveable piston rod of a deep ocean environmental sampler such as described in patent application Serial No. 334,055

filed December 27, 1963, now Patent No. 3,266,323. Thus, the device of the present invention is used with the deep ocean environmental sampler that is described in said patent application.

In operation, once the present device has been assembled onto the piston rod of the deep ocean environmental sampler the entire assembly is secured to a cable and a plurality of such devices are spaced periodically on the cable to obtain samples from different levels of the ocean, lake or any fluid environment from which a sample is desired. The deep ocean environmental sampler is activated by a pin released by a messenger such as in the release of a Nansen bottle. The release pin of the present device is secured to the pin which releases the deep ocean environmental sampler piston rod; therefor the plastic collar is released at the same time as the deep ocean environmental sampler piston rod. Upon release of the plastic collar, the plastic collar is forced along the tube by the compressed spring. The plastic or glass needles secured to the collar then punctures the thin sheet of rubber placed over the test tubes. As shown in FIG. 3 the thin sheet of rubber has been forced into the tube filling the void created by the collapsed air space within the tube due to the pressure of the water at the level at which the device is secured on the cable. When the needle punctures the rubber sheet covering the sampler tube, the rubber sheet then under tension is forced upwardly and the water between the rubber sheet and the plastic collar is then aspirated into the test tube. Thus the punctured rubber sheet returns elastically to the natural position as before the device was lowered into the water. The spring under compression on the collar forces the collar against the rubber sheet surrounding the lip of the test tube such that a seal is made between the rubber sheet, the plastic collar and the test tube. Upon release of the housing of the deep ocean environmental sampler the piston rod is forced into the housing thereof carrying with the piston rod the device of the present invention. Thus the test tube is within the deep ocean environmental sampler surrounded by the water at the pressure at the level from which the sample was taken. Therefore the bacteria within the test tube will be grown at the pressure of the water at the level at which the water sample was taken. Since the test tube is made of glass, the test tube will not kill the bacteria such as done in the prior art devices by use of metallic containers. Thus it is readily seen that the device of the present invention obtains bacteriological water samples without the possibility of extraneous contamination and without producing an oligodynamic effect. The sampler may be retained in the deep ocean environmental sampler at the pressure from which taken for as long of a period as desired to permit the bacteria to go. Opening of the environmental sampler would release the pressure and destroy the natural environmental features.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A barophilic bacteria sampler which comprises:
a tubular holder means,
a collar means positioned about said tubular holder,
means for positioning said collar at a specific position along said holder,
elongated sharp pointed means secured to said collar means parallel with the axis of said holder,
a test tube holding means secured to said tubular means in alignment with said elongated sharp pointed means,
and means for forcing said collar means and said sharp pointed means toward said test tube holding means.

2. A barophilic bacteria sampler which comprises:
a tubular element,
a cylindrical ring secured about said tubular element near one end thereof,
at least one test tube holder secured to said tubular element near the opposite end thereof from said cylindrical ring,
a collar positioned about said tubular member and freely slidable therealong between said ring and said test tube holder, sharp pointed means secured to the side of said collar opposite from said ring,
a compression spring assembled between said ring and said collar,
collar positioning means cooperating with said collar to position said collar at a specific position along said tubular element relative to said test tube holder
whereby release of said collar positioning means permits movement of said collar and said sharp pointed means toward said test tube holding means.

3. A method of obtaining a water sample from deep oceanic waters and growing a culture of bacteria from said water sample without subjecting the water sample to a pressure different from that at which the sample was originally taken which comprises:
sterilizing a container in which the sample is to be obtained,
partially filling the container with nutrient liquid while allowing an air space equal to the sample volume desired,
closing off said container with a thin sheet of rubber and securing said thin sheet of rubber in place,
placing said container in a holder,
lowering said holder and container into the oceanic waters to a desired depth,
piercing said rubber sheet permitting water to be aspirated into said container
forcibly sealing off the end with the pierced rubber sheet,
and recovering said container with the sample of water therein.

4. A method of obtaining a water sample from deep oceanic waters and growing a culture of bacteria from said water sample without subjecting the water sample to a pressure different from that at which the sample was originally taken which comprises:
assembling a barophilic bacteria sampler holder,
sterlizing at least one glass test tube,
partially filling said glass test tube(s) with nutrient liquid of a desired culture media and allowing a desired air space for a desired volume of a sample,
closing off said test tube(s) with a thin sheet of rubber and securing said thin sheet of rubber in place,
placing said test tube(s) in said holder,
placing said holder and test tube(s) in an autoclave and sterilizer for a desired period,
removing said holder and test tube(s) from said autoclave,
lowering said holder and test tube(s) into a desired environment to a desired depth,
piercing said thin rubber sheet secured over said test tube(s) to permit liquid of the surrounding environment to enter into said test tube(s),
sealing off said test tube, and
withdrawing said holder and test tubes from the environment.

No references cited.

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