May 5, 1970 A. E. BLAIR 3,509,772

HYDROGRAPHIC SAMPLING DEVICE

Filed May 22, 1968

FIG. 1

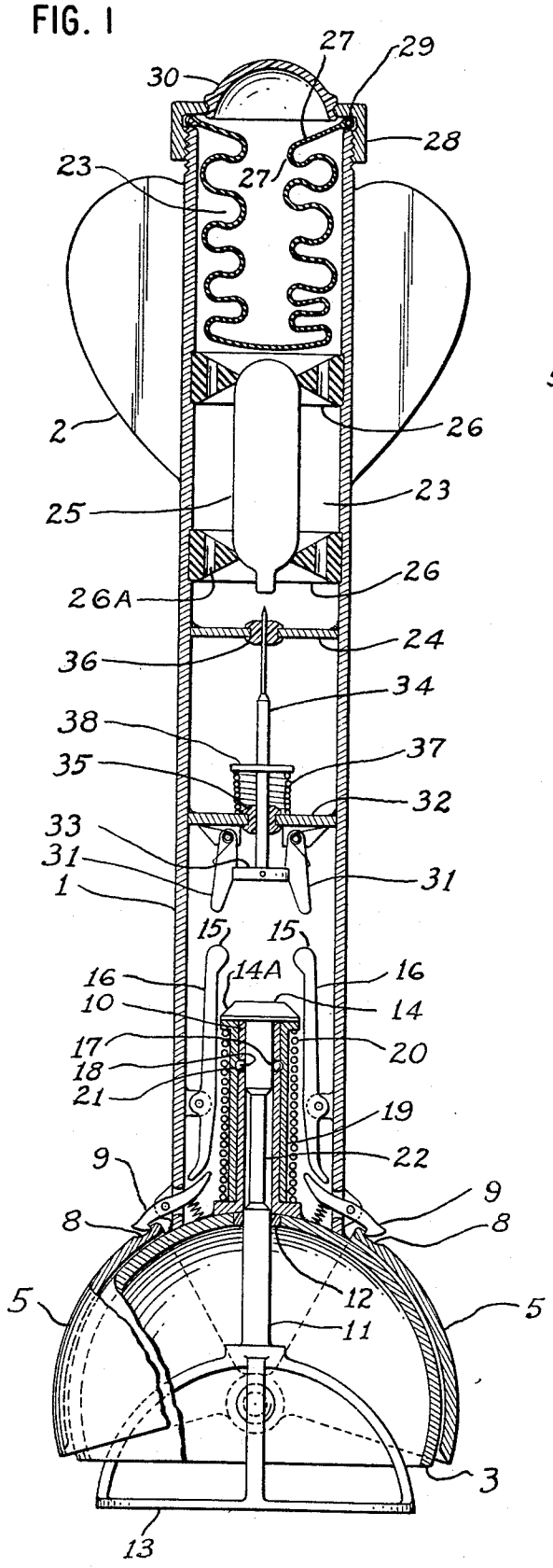


FIG. 3

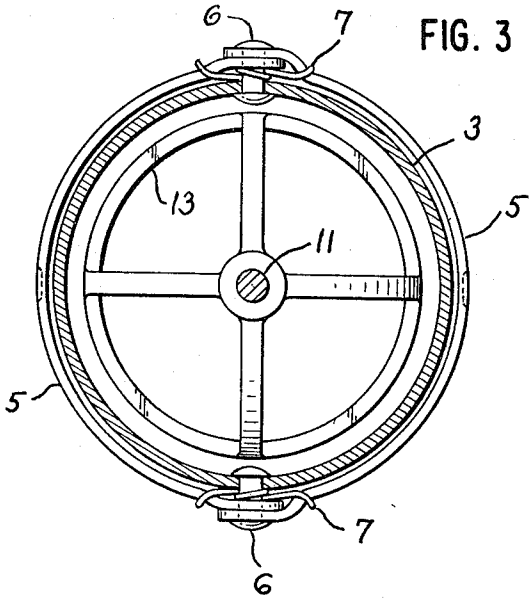
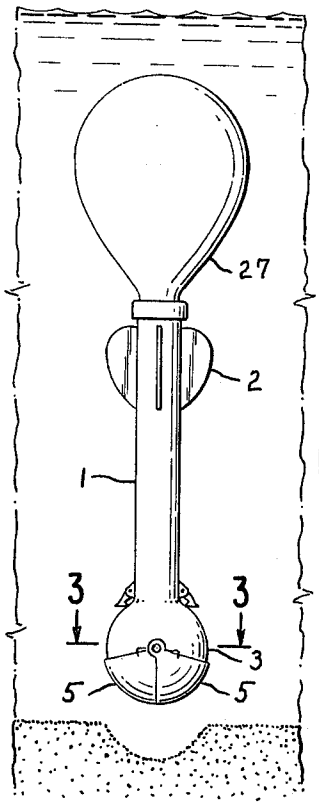


FIG. 2



INVENTOR.

BY Alexander E. Blair

Russell, Chittick & Pfund

Attorneys

United States Patent Office

3,509,772

Patented May 5, 1970

3,509,772

HYDROGRAPHIC SAMPLING DEVICE

Alexander E. Blair, 75 Willow St.,
Marshfield, Mass. 02050

Filed May 22, 1968, Ser. No. 731,034
Int. Cl. G01n 1/04
U.S. Cl. 73—425.2 8 Claims

ABSTRACT OF THE DISCLOSURE

A hydrographic bottom sampling device which operates free of connection to any surface craft to sense the bottom to be sampled, operate a sample taking mechanism and return itself to the surface where it may be recovered. Bottom sensing is accomplished by a probe which extends downward below the device. On contact, the probe is pushed into the device and releases a spring loaded trigger mechanism. The trigger mechanism releases clam-shell scoops which rotate to take in a sample and close to contain it within a recess. The trigger mechanism also releases the return mechanism which consists of a deflated bag open to a source of compressed gas and stored in a sealed container. The trigger mechanism releases a sharpened pin into the compressed gas container releasing the gas into the bag. As the bag inflates it pushes a cover off the container and pops out to become fully inflated so that it carries the entire apparatus to the surface.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to remote sampling apparatus and to automatic initiating means operated by contact with the surface to be sampled. It also relates to automatic compressed gas release and inflating apparatus. In particular, the invention relates to hydrographic sounding apparatus free of external control for taking a bottom sample by automatic actuation of a sampling device combined with automatic actuation of a buoyancy increasing means so as to effect return to the surface of the entire apparatus. Both automatic functions are initiated by a simple triggering means.

Description of the prior art

Prior art devices of this type show two types of sampling devices:

(a) The core tube type consisting of a bottom tube which penetrates the bottom and in so doing fills itself with a sample;

(b) The bottom recess type, for example, a downwardly open spherical recess and a rotating spherical wedge acting as a scoop and a closure.

In addition, prior art devices for reclaiming the apparatus can be grouped into two major categories:

(c) Rope or wire for simply hauling the apparatus back to the surface;

(d) Automatic buoyancy increasing devices.

U.S. Pat. No. 1,782,139 to D. G. Dedrick discloses a bottom recess and scoop actuated by contact of a trip-rod on the bottom. Scooping and closure action is provided by moving, via the trip-rod, one end of an extended spring over the center of rotation of the scoop, so that the return force of the spring rotates the cup.

A disadvantage of this mechanism which is overcome by the present invention is that a spring of considerable travel is required to achieve total closure. Such a spring would have relatively low return force, thus limiting the utility of the device to relatively soft or loose particles or samples as is pointed out in the Dedrick patent.

U.S. Pat. No. 2,798,378 to A. Del Raso et al. discloses a core type sampling apparatus having inherent buoyancy with an automatic ballast release means comprising weights and a mechanism to release the weights which is actuated by contact with the ocean bottom.

Disadvantages of the Del Raso patent which are overcome by the present invention are:

(a) The ballast weights are not recovered;

(b) The ballast release mechanism is relatively complex;

(c) The buoyancy tank, containing a buoyant liquid is of considerable volume and bulk.

SUMMARY OF THE INVENTION

The invention herein disclosed lies in an improved hydrographic bottom sampling apparatus particularly in the type of such apparatus utilizing a scoop type sampling means, and an improved automatic actuating device. In addition, in the type of such apparatus wherein reclamation is achieved through buoyancy, the present invention shows a more compact lightweight and efficient means for automatically increasing the buoyancy, and an actuating means, wherein the same actuating means is used for both automatic functions.

In brief summary, a sensing probe extends below the apparatus to contact the bottom surface to be sampled. On contact, the relative upward movement of the probe as the apparatus continues to drop frees a trigger mechanism to release a first spring which in turn operates a caming surface against a latch means releasing a scoop powerfully spring loaded by a torsion spring. The first spring continues to operate the caming surface against a second latch means to release a spring loaded pin which punctures an internally carried compressed gas container. The expanding gas proceeds to fill a flexible inflatable balloon or bag which is carried internally in the apparatus communicating with the container. The bag, on inflating, disengages a resilient cover on the apparatus, exits the apparatus while still fixed thereto and by displacing sufficient water gives the apparatus buoyancy to return to the surface with the sample.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a side elevation view partly in section of the invention prepared for use.

FIG. 2 shows a view of the invention after a sample has been obtained and a buoyancy increasing means has been inflated.

FIG. 3 shows a view through section 3—3 of FIG. 2 of the sampling recess and the scoop rotating mechanism.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The preferred embodiment of the invention as shown in FIGS. 1 and 3 is constructed about a cylindrical shell body **1** having stabilizing fins **2** at its upper end. At the downward end of the body **1** is fixed a hollow spherical segment **3**, downwardly open for receiving a sample.

Referring to FIG. 3, two scoops **5** in the shape of hollow spherical wedges are mounted concentrically for rotation around the segment **3** on pins **6**. Powerful torsion springs **7** wound around the pins **6** provide the force necessary to rotate the scoops **5** through the material to be sampled to a closed position (shown in FIG. 3) completely sealing the segment so that the sample is retained therein. The forward edges of the scoops **5** may be beveled or toothed although in the closed position they should mate to prevent leakage. The scoops **5** are held open by engagement of notches **8** with pivotable latches **9**.

The trigger mechanism for releasing the scoops **5** comprises a tubular bearing **10**, fixed at one end to the spherical segment **3**. A shaft **11** is slidably mounted in bearing **10**. The shaft **11** extends downward through a watertight seal **12**, having at its lower end a bottom probe **13** which projects below the apparatus. The bottom probe **13** is so shaped that when it is pushed into the spherical segment **3** it conforms to the shape thereof, so as to occupy a minimum of the interior volume which is to contain the bottom sample.

At the upper ends of shaft **11** is an actuating shoulder **14** extending horizontally beyond the bearing **10**. The shoulder **14** limits downward movement of the shaft **11**. Shoulder **14** has an upwardly facing caming surface **14A** in line with lugs **15** on one end of levers **16** which are pivotally mounted on the cylindrical body **1** so that their lower ends are engageable with the latches **9**. By this arrangement, upward movement of shaft **11** through levers **16** releases the latches **9** from engagement with the notches **8** whereby the scoops **5** close.

While it is evident that this upward movement of shaft **11** could be caused by the relative movement thereof due only to contact of the bottom probe **13** with the bottom surface to be sampled, it is desirable that the probe be used to trigger a separate, more dependable and powerful driving force. More significantly, it is desirable that scoops **5** not be released until the bottom probe **13** is retracted completely so that the spherical container **3** rests substantially on the bottom at the time of closure of scoops. The additional driving force also provides extra travel of the shaft **11** so that the actuating shoulder **14** can release the buoyancy increasing device after the scoops **5** are released. This insures that the apparatus does not commence to ascend before the sample is secured.

Referring to FIG. 1, the triggering mechanism will be described. The bearing **10** has two circular apertures **17** oppositely disposed through its walls generally toward its upper end.

A ball **18** is positioned in each aperture **17** for free horizontal movement therein. The ball **18** must have a diameter more than the thickness of the wall of the bearing **10** but less than twice said thickness, so that when the ball **18** rests against the shaft **11**, it protrudes outward less than one-half its diameter.

A cylindrical drive tube **19** slidably mounted around bearing **10** is urged upward toward engagement with the shoulder **14** by a drive spring **20**. The drive tube **19** has spherical cavities **21** of radius at least equal to that of the ball **18** and aligned with the aperture **17** to contain the protruding portion of the ball **18**.

By this construction, upward movement of the drive tube **19** is prevented by the ball **18** resting partly in the cavity **21** and partly in the aperture **17**, being restrained there by contact with the shaft **11**.

When the shaft **11** is pushed upward by contact of the probe **13** with the bottom, narrowed portions **22** thereof become positioned opposite the balls **18** which are free then to move inward due to the horizontal component of the upward force of the drive spring **20** on the drive tube **19** through the angular contact of the ball **18** with the cavity **21**.

The narrowed portions **22** should begin a distance below the apertures **17** equal to the distance of the probe **13** below the opening of the spherical segment **3** so that the scoops **5** are not triggered until the opening is in substantial contact with the bottom.

The travel and power of the drive-spring **20** is such that after engaging the levers **16**, it continues to drive the shaft **11** upward so that the camming surface **14A** of the shoulder **14** actuates the buoyancy increasing means which will now be described.

The buoyancy increasing means is located in an upper chamber **23** of the body **1** defined by a sealed bulkhead **24**. A compressed gas container **25** is firmly mounted in resilient supports **26** which have a plurality of gas ports **26A**.

An inflatable balloon **27** is invertedly stored in the chamber **23** with its mouth clamped to the upper opening thereof by a threadedly attached flange **28** against a steel retaining ring **29** integral with and defining said mouth for a leakproof seal. A resilient expendable protective cover **30** is snap-fitted in place on the flange **28**.

When released from the compressed gas container **25**, the gas expands throughout the chamber **23** exerting pressure on the balloon **27** against the cover **30**. When sufficient pressure is built up to dislodge the cover **30**, the balloon **27** exits the chamber **23** and fully inflates outside the body **1** still in water-tight contact therewith at its mouth as shown in FIG. 2. When sufficient water is displaced to give positive buoyancy to the apparatus it rises to the surface where it and the sample may be recovered.

The aforesaid buoyancy means is triggered by release of a second pair of latches **31** pivotally mounted on a second sealed bulkhead **32** for engagement with a shoulder **33** on the downward end of a sharpened pin **34** aligned for puncturing the gas container **25**. The pin **34** is slidably mounted in watertight seals **36** and **35** axially located in the bulkhead **24** and the second bulkhead **32** respectively. The pin **34** is urged upward by a spring **37** compressed against the second bulkhead **32** and a washer **38** fixed to the pin **34**.

The second latches **31** are released by the continued upward travel of the drive shaft **11** as previously explained, which pivots them out of engagement with shoulder **33**. The upward movement of the shoulder **14** ceases when the bottom probe **13** contacts the inner surface of the spherical segment **3**. A somewhat more compact structure may be achieved by locating the scoop release latches **9** and the second latches **31** in the same vertical location resulting in simultaneous rather than sequential actuation. This can be done if the release of compressed gas is set at a rate slow enough that buoyancy is not achieved until after the scoops **5** close. This is especially true in view of the rapid and forceful closing of the scoops **5** available by utilization of torsion springs.

For re-use, an unused compressed gas container **25** is installed, the various latches set in the detent positions against the particular parts as described above; and the balloon **27** installed and covered by the cover **30**.

It is intended to cover all changes and modifications of the preferred embodiment herein chosen for purposes of the disclosure which do not constitute departures from the spirit and scope of the invention.

I claim:

1. A hydrographic bottom sampling apparatus comprising:

a housing having at one end a sample receiving recess;

at least one scoop rotatably mounted to obtain a sample as it closes said recess;

torsion spring means communicating with said scoop normally acting to close said recess;

means for releasably holding said scoop open;

triggerable means within said housing for displacing sufficient water to make said apparatus buoyant; and,

trigger means for actuating said means for displacing water and for releasing said scoop holding means.

2. The apparatus of claim **1** wherein said trigger means comprises:

a downwardly extending bottom sensing probe mounted for movement relative to said apparatus upon contact with the bottom;

an actuating member for actuating said closure means and said buoyancy increasing means;

biasing means for operating said actuating member; and

locking means detaining said biasing means and releasable by movement of said probe.

3. A hydrographic bottom sampling apparatus comprising:

a housing having at one end a sample receiving recess;

closure means for obtaining and retaining a sample within said recess;

buoyancy increasing means contained within said housing;

a downwardly extending bottom sensing probe mounted for movement relative to said apparatus upon contact with the bottom;

an actuating member for actuating said closure means and said buoyancy increasing means;

biasing means for operating said actuating member;

an upwardly extending longitudinal bearing having at least one hole in the side thereof attached to said housing;

a shaft slidably journalled in said bearing for upward movement therein in response to the movement of said probe and having a narrowed portion commencing below the hole in said bearing and a shoulder comprising said actuating member at its upper end external of said bearing and extending horizontally therebeyond;

a drive tube slidably mounted external of said bearing housing having an upper end engageable with said actuating shoulder for upward driving by said biasing means and having a partially hemispherical indentation communicating with the hole in said bearing; and

a ball in said hole having a diameter larger than the thickness of the side of said bearing such that a portion thereof rests inside the hemispherical indentation of said drive tube and is restrained therein by opposing contact with said shaft, such that said drive tube is held immovable by said ball against the action of said biasing means until the narrowed portions of said shaft are moved in line with said hole by the upward movement of said probe allowing said ball to move out of said indentation freeing said drive tube, driving said actuating shoulder upward to actuate said closure means and said buoyancy increasing means.

4. A hydrographic bottom sampling apparatus comprising:

a housing having at one end a sample receiving recess;

closure means for obtaining and retaining a sample within said recess;

a compressed gas container;

means for triggerably releasing compressed gas from said compressed gas container;

trigger means for actuating said closure means and said means for releasing compressed gas;

a sealed chamber in said housing having an opening therein and in which is contained said compressed gas container;

an inflatable bag invertedly stored inside said chamber having an opening fixedly coextensive with the opening of said chamber; and,

an expandable cover releasably attached over said coextensive openings such that hydrostatic external pressure tends to retain it in place but internal pressure due to expansion of said compressed gas tends to dislodge it.

5. An apparatus as described in claim 1 wherein said water displacing means comprises:

a compressed gas container;

means responsive to said trigger means for releasing compressed gas from said compressed gas container; and,

means for inflating a bag with said gas to displace sufficient water to make said apparatus buoyant.

6. A hydrographic bottom sampling apparatus comprising:

a housing having at one end a sample receiving recess;

closure means for obtaining and retaining a sample within said recess;

a compressed gas container;

a sealed chamber in said housing having an opening therein and in which is contained said compressed gas container;

a pointed rod extending sealably into said chamber toward said compressed gas container;

biasing means for urging said rod piercingly into said container to release compressed gas;

releasable latch means for detaining said rod against the urging of said biasing means;

means within said housing for displacing sufficient water by said gas to make said apparatus buoyant; and

trigger means for actuating said closure means and releasing said latch means.

7. In combination with a hydrographic apparatus of the type having a container for carrying items desired to be returned to the surface, an automatic return apparatus comprising:

a chamber having an opening therein;

a container of compressed gas inside said chamber;

an inflatable bag invertedly stored inside said chamber having an opening fixedly coextensive with the opening of said chamber;

means for releasing said compressed gas into said chamber; and,

an expandable cover releasably attached over said coextensive openings such that hydrostatic external pressure tends to retain it in place but internal pressure due to expansion of said compressed gas tends to dislodge it and whereby said bag exits said chamber inflating externally thereof.

8. The apparatus of claim 7 wherein said means for releasing compressed gas comprises:

a pointed rod extending sealably into said chamber toward said compressed gas container;

biasing means for urging said rod piercingly into said container; and,

latch means for detaining said rod against the urging of said biasing means releasable by said trigger means.

References Cited

UNITED STATES PATENTS

2,798,378	7/1957	Del Raso	73—421
3,071,787	1/1963	Burker	9—8
3,295,616	1/1967	Charlton	175—5

FOREIGN PATENTS

18,401	1909	Great Britain.

S. CLEMENT SWISHER, Primary Examiner

U.S. Cl. X.R.

9—8; 175—5