United States Patent [19]

White

[11] **3,800,346**

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[54] **SELF DESCENDING AND SURFACING WATER DEVICE**

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[21] Appl. No.: **382,086**

[52] **U.S. Cl.** ..... **9/8 R,** 9/316, 73/170, 114/50

[51] **Int. Cl.** **B63b 21/52**

[58] **Field of Search** ..... 9/8 R, 9, 316, 318; 114/50, 52, 53; 73/170

[56] **References Cited**

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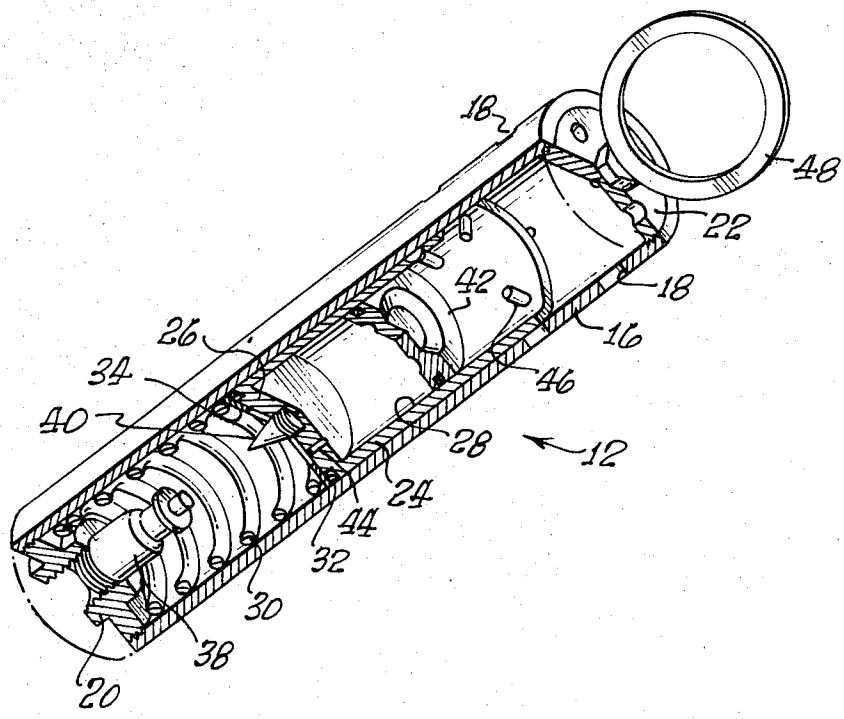
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Assistant Examiner—Donald W. Underwood
Attorney, Agent, or Firm—Richard S. Sciascia; Ervin F. Johnston

[57] **ABSTRACT**

A self descending and surfacing water device for deploying instrumentation, such as a bathythermograph, including a cylinder and piston combination. The cylinder has a water port at its top end. The piston is hollow and has a closed bottom end and an opening at its top end. A spring is provided for biasing the piston upwardly within the cylinder. Water pressure forces the hollow piston downwardly against this spring, and a gas is released for driving the hollow piston upwardly in the cylinder when the device has descended to a predetermined depth. A free floating piston is disposed within the hollow piston, and the bottom of the hollow piston has an aperture so that upon the release of gas the free floating piston is driven upwardly within the hollow piston to increase the buoyancy of the device.

12 Claims, 8 Drawing Figures



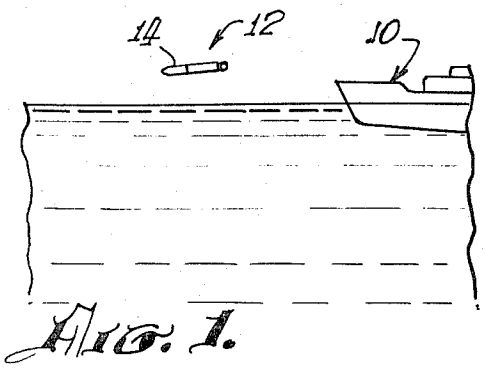


FIG. 1.

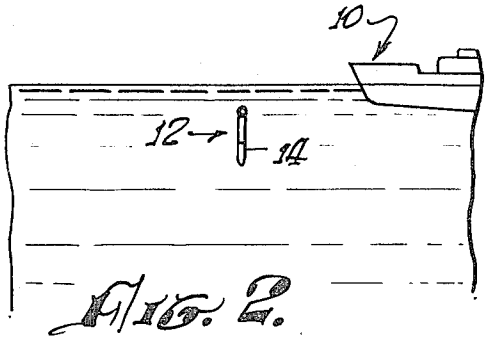


FIG. 2.

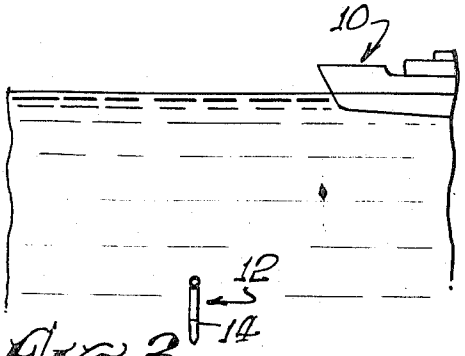


FIG. 3.

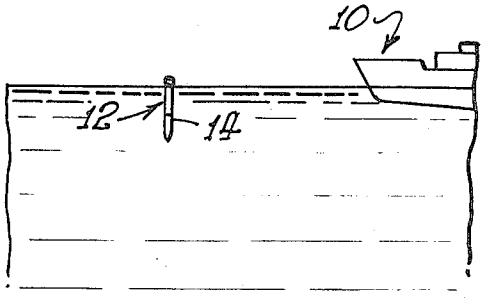


FIG. 4.

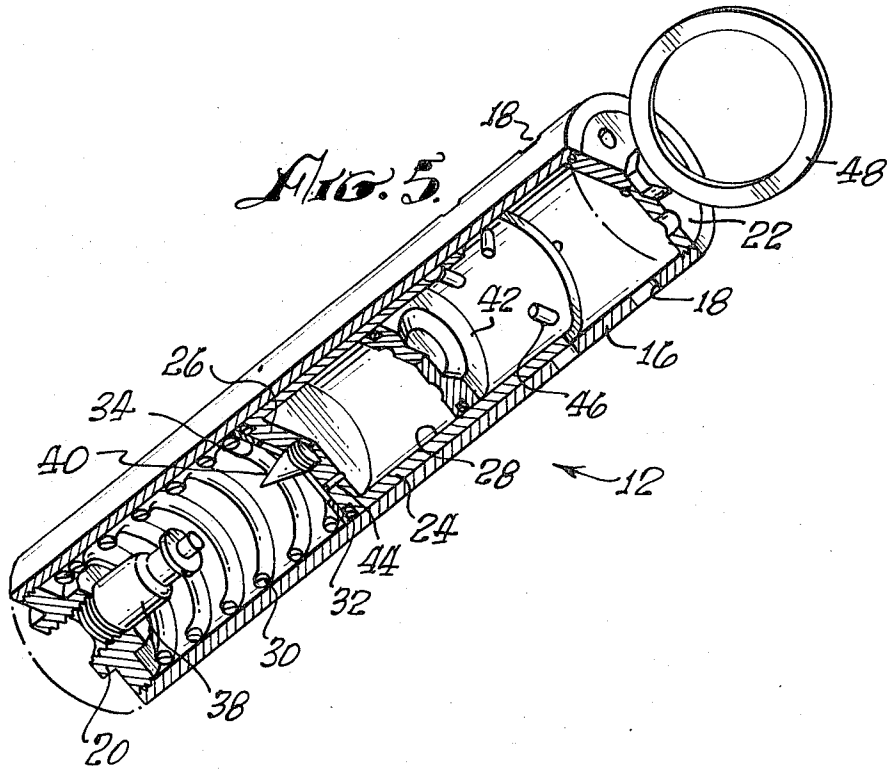


FIG. 5.

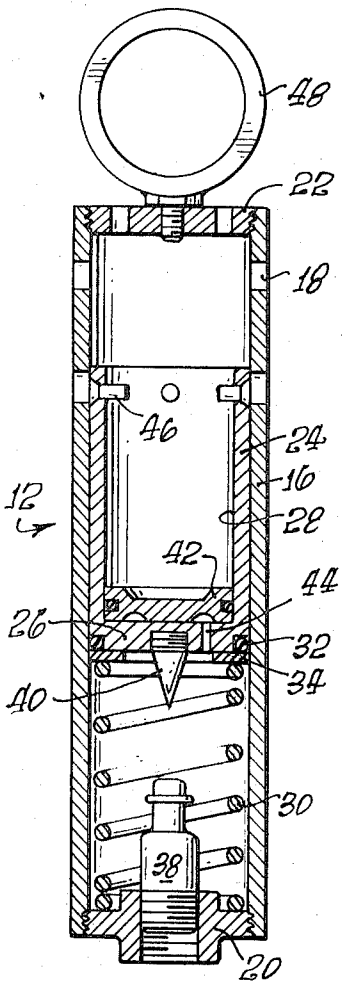


FIG. 6.

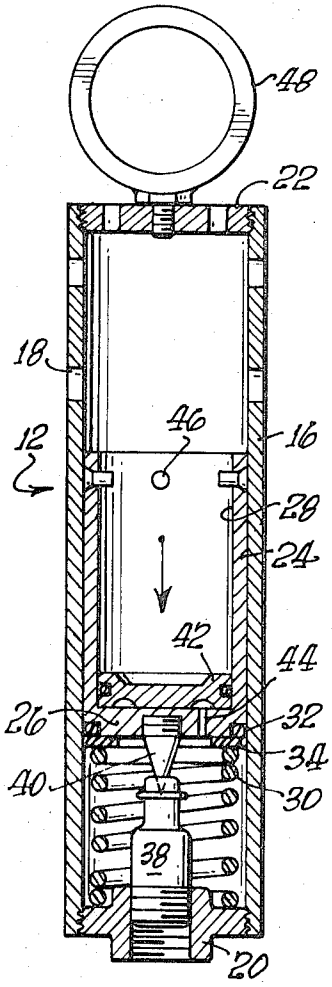


FIG. 7.

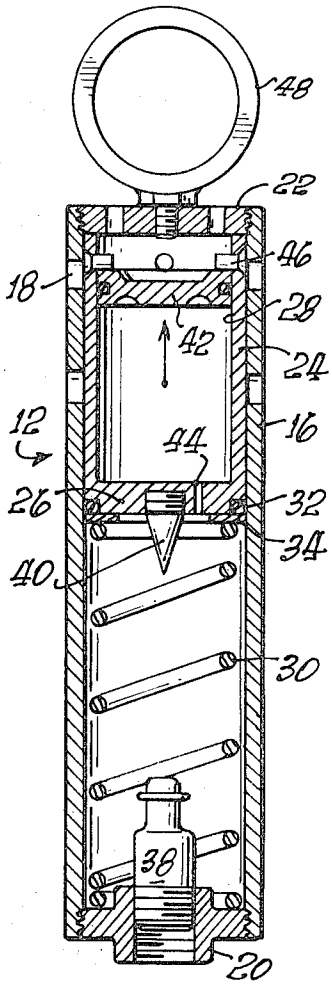


FIG. 8.

SELF DESCENDING AND SURFACING WATER DEVICE

STATEMENT OF GOVERNMENT INTEREST

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 therefore.

BACKGROUND OF THE INVENTION

The present invention relates to a self descending and surfacing water device for deploying instrumentation, such as a bathythermograph.

In submarine hunting operations it is essential to know the temperature profile of the water. The temperature profile is utilized for predicting the capability of sonar to detect submarines. Sonar beams from a surface ship may bounce upwardly from a thermocline, thereby destroying the capability of detecting a submarine below the thermocline. Thermoclines must be ascertained to predict sonar bouncing, and temperature gradients must be known so as to predict the bending of sonar beams in the water. An instrument which is utilized for determining temperature profiles of the water is known as a bathythermograph.

A bathythermograph must be progressively lowered in the body of water in order to obtain the desired temperature profile readings. In the past, bathythermographs have been paid out from surface vessels by attached lines or wires and either retrieved after descent, or the temperature readings are taken via the wire as the bathythermograph descends. Under certain conditions it is desirable that temperature profile readings be obtained without the necessity of paying out a line or a wire from the surface vessel. It is this situation that the present invention provides a solution, whether the instrument package is a bathythermograph or similar device.

SUMMARY OF THE INVENTION

The present invention is a self descending and surfacing water device which requires no attached lines or wires from a surface vessel for deploying instrumentation, such as a bathythermograph. The device includes a cylinder and piston combination wherein the cylinder is closed at both ends and has at least one water port at the top end. The piston is hollow and has a closed bottom end and an opening at its top end. A compression spring may be disposed within the cylinder for biasing the hollow piston upwardly, and a gas releasing means is provided for driving the piston upwardly in the cylinder when the device has reached a predetermined depth. Within the hollow cylinder there is a free-floating piston which is likewise driven upwardly by the released gas. The operation of the free-floating piston greatly increases the buoyancy of the device and enables an earlier surfacing of the device for retrieval of the desired information. The self descending and surfacing water device can be utilized for any type of instrumentation which must be descended into the water.

OBJECT OF THE INVENTION

An object of the present invention is to provide a self descending and surfacing device for deploying instrumentation into a body of water.

Another object is to provide a self descending and surfacing water device which will ascend in the water on its own buoyancy as rapidly as possible.

Other objects, advantages, and novel features of the invention will become apparent from the following detailed description of the invention, when considered in conjunction with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIGS. **1** through **4** are ocean elevation views illustrating the operation of the present invention from a surface vessel.

FIG. **5** is an isometric view of the present invention with portions broken away to illustrate various details thereof.

FIGS. **6** through **8** are longitudinal cross sectional views illustrating the three modes of operation of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings wherein like reference numerals designate like or similar parts throughout the several views there is illustrated in FIG. **1** a surface vessel **10** which has just deployed the self descending and surfacing water device **12** into the water. Attached to the bottom end of the water device is an instrumentation package, such as a bathythermograph **14**, for indicating the temperature profile of the body of water. It should be understood that other instrumentation packages, such as a salinity indicator or optical indicator, could be attached to the water device in lieu of the bathythermograph **14**.

Referring now to FIG. **5** there is illustrated the water device **12** which includes a cylinder **16** which is closed at each end and has at least one water port **18** at its top end. It is preferred, however, that the cylinder **16** have a series of ports about its circumference as illustrated in FIG. **5**. The bottom end of the cylinder may include an end cap **20** which is threaded into the cylinder **16**, and the top end of the cylinder may include a top end cap **22** which is threaded within the top of the cylinder. Disposed within the cylinder **16** is a hollow piston **24** which has a closed bottom end **26** and an opening **28** at its top end. A biasing means, such as a compression spring **30** is disposed within the cylinder **16** between the bottom of the cylinder and the bottom of the hollow piston **24** for biasing the hollow piston upwardly in the cylinder. The hollow piston **24** may be sealed to the wall of the cylinder **16** by an O-ring **32**. The O-ring may be held in place within an annular recess in the bottom of the hollow piston **24** by a spring load distributor disc **34** which is interposed between the O-ring and the top of the compression spring **30**.

When the water device **12** has reached a predetermined depth it is desired that its buoyancy increase so that the water device will rapidly ascend to the surface of the water. This is accomplished by a means which is responsive to the downward movement of the piston **24** for releasing gas below the hollow piston. This gas will in turn develop a pressure for driving the hollow piston upwardly in the cylinder **16**. The gas releasing means may include a puncturable pressure bottle **38** which may be threaded within the bottom end cap **20**, and a puncture dart **40** which may be threaded within the bottom end **26** of the hollow piston **24**. Accordingly, when the dart **40** is brought downwardly by the ambi-

ent water pressure on the hollow piston **24** the top of the bottle **38** is punctured and gas escapes to cause a pressure below the hollow piston. This pressure drives the hollow piston upwardly within the cylinder **16** and causes water thereabove to be expelled through the ports **18** to increase the buoyancy of the water device.

A very significant feature of this invention is the provision of a means for increasing the buoyancy of the water device in the space of the hollow piston **24** so as to cause a rapid ascent of the water device after it has reached its predetermined depth. This has been accomplished by providing a free floating piston **42** which is sealably disposed within the hollow piston **24**, and providing the bottom **26** of the hollow piston **24** with an aperture **44**. Accordingly, when the bottle **38** is punctured the pressurized gas not only drives the hollow piston **24** upwardly, but it also is disseminated into the hollow piston **24** through the aperture **44** to drive the free-floating piston **42** upwardly within the hollow piston **24**. Upward movement of the piston **42** within the hollow piston **24** may be restrained by stop pins **46** which extend through the wall of the hollow piston **24** into the space therein.

The bathythermograph **14**, or other instrumentation package, may be mounted to the bottom of the device by a threaded connection within the bottom end cap **20**. After the water device **12** and instrumentation package **14** have come to the surface of the water the entire assembly may be recovered by grabbing a capture loop **48** which may be mounted to the top of the end cap **22**. In the preferred embodiment it is desirable that the ocean device have a positive metacentric height so that the capture loop **48** may be positioned upwardly in the water for retrieval purposes. Further, it is desirable that the water device have a negative buoyancy when the free floating piston **42** is at the bottom of the hollow piston **24** and the hollow piston is filled with water through the water ports **18**, and that the water device be positively buoyant when the gas pressure has driven the floating piston **42** to the top of the hollow piston **24**.

OPERATION OF THE DEVICE

It should be noted that the arrangement of the components of the ocean device is such that the device can be easily assembled or disassembled for cleaning and general maintenance purposes. The strength of the spring **30** is an important consideration since a stronger spring will cause the water device to activate at a lower depth and a weaker spring will cause the water device to activate at a shallower depth. After the spring **30** has been selected minor adjustments in the desired depth can be accomplished by threading the pressure bottle **38** to a desired location within the bottom end cap **20**. Upon deploying the water device **12** and instrumentation package **14** into the water, as illustrated in FIG. **1**, the top end of the cylinder **16** and the hollow piston **24** are filled with water through the water ports **18**. By spacing the apertures **18** about the cylinder **16** the entry of water is assured regardless of the orientation of the water device after it hits the surface of the water. As illustrated in FIG. **2**, the water device **12** commences its descent within the body of water, and during this phase water pressure on the top of the floating piston **42** and the hollow piston **24** will progressively drive the hollow piston downwardly against the force of the spring **30**. This operation is illustrated in FIG. **6** of the drawings. After the ocean device has reached the predetermined depth, as illustrated in FIG. **3**, the water pressure has built up sufficiently to drive the dart **40** into the top of the pressure bottle **38** so as to cause the release of pressurized gas below the hollow piston **24**. The positioning of the components of the water device **12** in this condition is illustrated in FIG. **7**. As illustrated in FIG. **4**, the water device has ascended to the surface of the water due to the gas pressure driving the hollow piston **24** upwardly within the cylinder **16** and the driving of the free-floating piston **42** upwardly within the hollow piston **24**. The arrangement of the components in this condition is illustrated in FIG. **7**.

After the ocean device and the instrumentation package have come to the surface of the water, as illustrated in FIG. **4**, the surface vessel may return and retrieve the entire apparatus by grabbing the capture loop **48**. The instrumentation package may then be removed and opened for the purpose of collecting the desired data.

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.

I claim:

1. A self descending and surfacing water device for deploying instrumentation, such as a bathythermograph, comprising:

a cylinder which is closed at each end and has at least one water port at a top end;

a piston disposed within the cylinder;

said piston being hollow and having a closed bottom end and an opening at its top end;

means for biasing the hollow piston upwardly within said cylinder;

said cylinder being capable of receiving means which are responsive to downward movement of the hollow piston for releasing gas below the hollow piston which in turn will develop a pressure for driving the hollow piston upwardly in the cylinder;

a free floating piston disposed within the hollow piston to increase buoyancy upon release of the gas; and

the bottom of the hollow piston having an aperture for communicating pressurized gas into the hollow piston for driving the floating piston upwardly therein upon release of the gas,

whereby, upon deploying the device into the water with the gas releasing means, the device descends and water pressure through said water port forces the hollow piston downwardly until the gas is released, whereupon the hollow piston is driven upwardly in the cylinder and the floating piston is driven upwardly in the hollow piston so as to expel water through said water port and cause the device to become buoyant and ascend to the surface of the water.

2. A self descending and surfacing water device as claimed in claim **1** including:

said device being negatively buoyant when the free floating piston is at the bottom of the hollow piston and the hollow piston is filled with water through said water port; and

said device being positively buoyant when the gas pressure has driven the floating piston to the top of the hollow piston.

3. A self descending and surfacing water device as claimed in claim 2 including:

stop means mounted at the top of the hollow piston for stopping upward movement of the free floating piston within the hollow piston.

4. A self descending and surfacing water device as claimed in claim 1 including:

the top of the cylinder comprising a threaded cap;

a capture loop mounted to the top threaded cap; and

the water device having a positive metacentric height.

5. A self descending and surfacing water device as claimed in claim 1 including:

said gas releasing means;

said gas releasing means including:

a puncturable pressure bottle mounted in the cylinder opposite the bottom of the hollow piston; and

a puncture spike mounted to the bottom of the hollow piston for puncturing the pressure bottle.

6. A self descending and surfacing water device as claimed in claim 5 including:

the bottom of cylinder comprising a threaded cap; and

said pressure bottle being threaded into said cap so that the distance between the bottle and puncture spike can be selectively adjusted.

7. A self descending and surfacing water device as claimed in claim 1 including:

the biasing means being a compression spring which is disposed in the cylinder between the bottom of the cylinder and the bottom of the hollow piston.

8. A self descending and surfacing water device as claimed in claim 6 including:

said device being negatively buoyant when the free floating piston is at the bottom of the hollow piston and the hollow piston is filled with water through said water port; and

said device being positively buoyant when the gas pressure has driven the floating piston to the top of the hollow piston.

9. A self descending and surfacing water device as claimed in claim 8 including:

stop means mounted at the top of the hollow piston for stopping upward movement of the free floating piston within the hollow piston.

10. A self descending and surfacing water device as claimed in claim 9 including:

the top of the cylinder comprising a threaded cap;

a capture loop mounted to the top threaded cap; and

the water device having a positive metacentric height.

11. A self descending and surfacing water device as claimed in claim 10 including:

the cylinder having a series of ports about its circumference.

12. A self descending and surfacing water device as claimed in claim 11 including:

the biasing means being a compression spring which is disposed in the cylinder between the bottom of the cylinder and the bottom of the hollow piston.

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