United States Patent

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[54] **GLIDING ANCHORS**
1 Claim, 9 Drawing Figs.

[52] **U.S. Cl.** ..... **114/206 R**
[51] **Int. Cl.** **B63b 21/24**
[50] **Field of Search** 114/206, 206.1, 209, 235, 235.2, 236; 244/1-3, 113

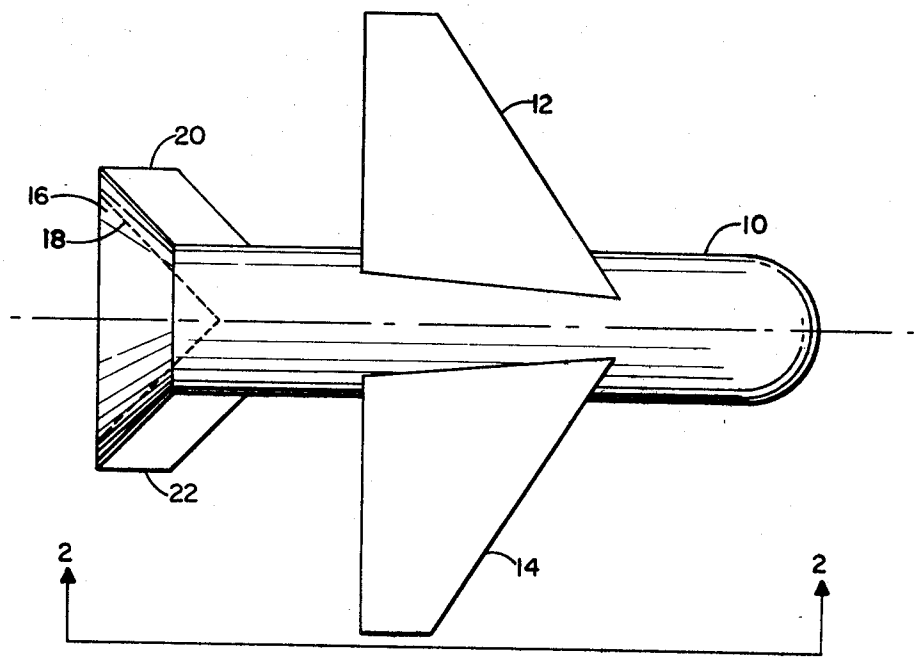
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ABSTRACT: A gliding anchor for use in an automatic anchor deployment system wherein one or more anchors are launched from a fluid-supported device. Each anchor is designed to glide at a given angle from the deploying device to the bottom of the fluid container where it rests and provides anchor for the deploying device.



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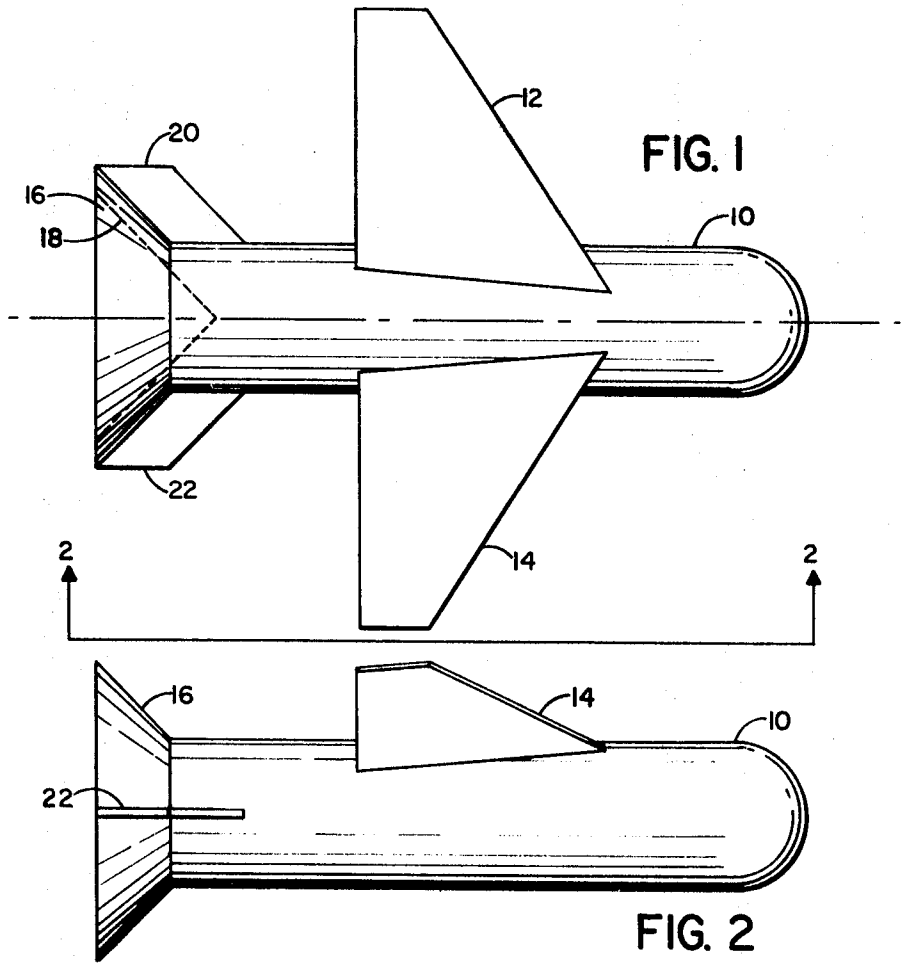


FIG. 1

FIG. 2

FIG. 3

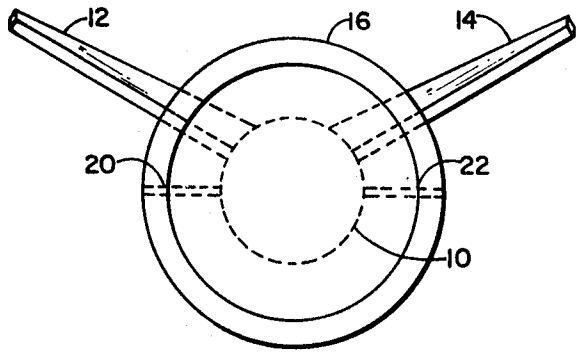
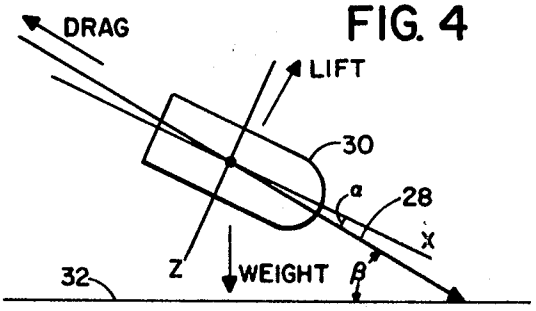


FIG. 4



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FIG. 5

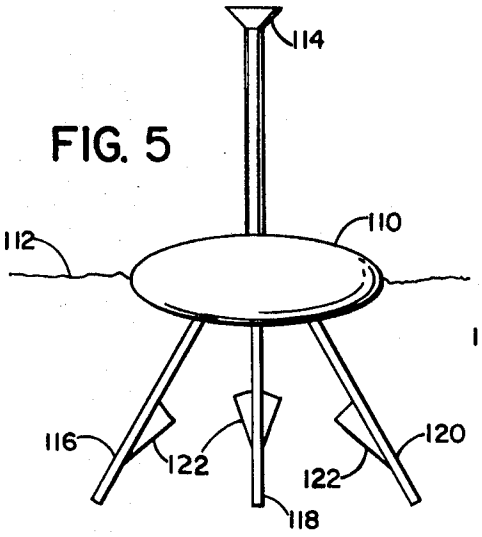


FIG. 6

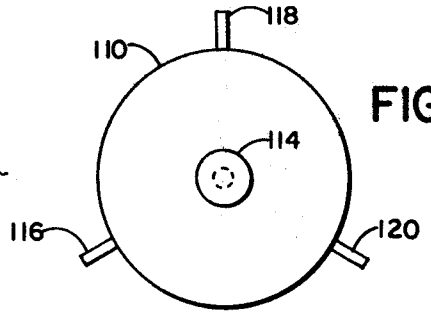


FIG. 8

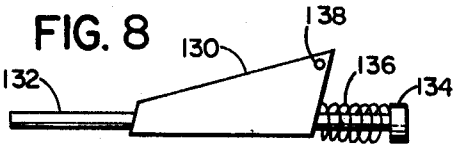
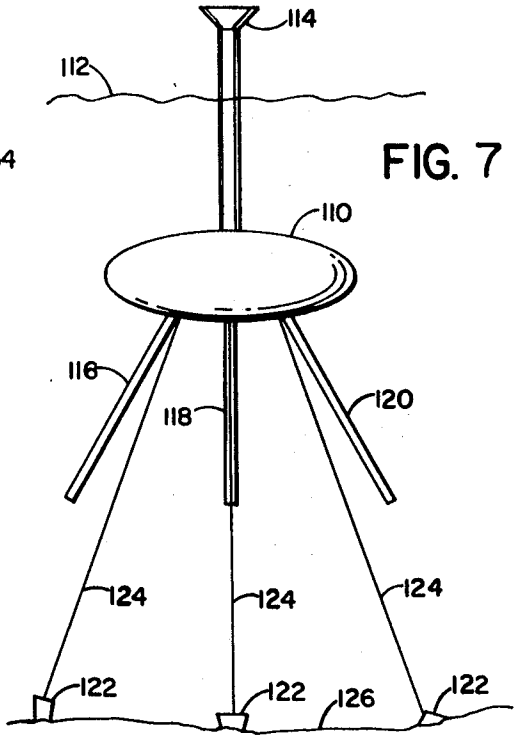


FIG. 7



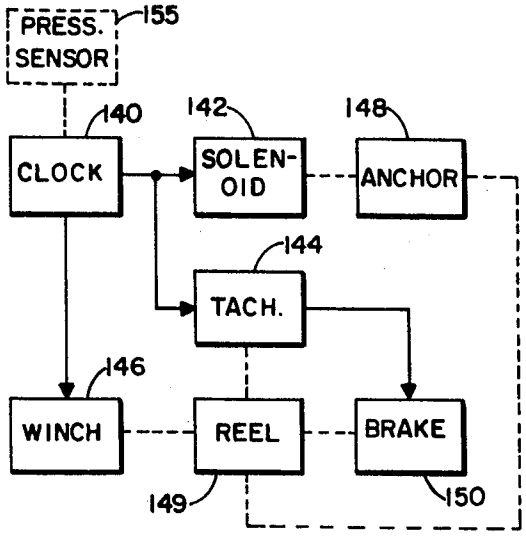


FIG. 9

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GLIDING ANCHORS

THE INVENTION

The present invention is related to anchoring devices and more specifically related to a gliding anchor which will, after initial deployment, glide through the water in a straight line at a predetermined angle. When the anchor is used in conjunction with other anchoring devices deployed in different directions, a multipoint anchor system is provided without the necessity of complicated anchoring maneuvers by cooperating vessels.

In the prior art, multipoint anchoring systems have required the utilization of at least two vessels for dropping first and second anchors which are attached to a buoyant reference device. One of the vessels is then used to drop a third anchor at a point spaced away from the other two anchors, and later to attach the third anchor to the reference device. The above-described operation is very time consuming and accordingly expensive.

The anchoring device described herein allows automatic deployment of two or more anchors in a spaced relationship. The use of multiple spaced anchors reduces the size of the watch circle for a moored buoyant device.

It is therefore an object of the present invention to provide a new and novel anchor.

Other objects and advantages of the present invention will be apparent from a reading of the specification and appended claims in conjunction with the drawing wherein:

FIG. 1 is a top view of a preferred embodiment of the applicants' gliding anchor;

FIG. 2 is a side view of the anchor shown in FIG. 1 taken from position 2—2;

FIG. 3 is an aft view of the anchor shown in FIG. 1;

FIG. 3 is a schematic diagram for use in explaining the flight path of the anchor as it glides through the fluid toward the bottom of the fluid container;

FIG. 5 is a side view of a device to be anchored with the anchors attached;

FIG. 6 is a top view of the apparatus of FIG. 5;

FIG. 7 is a view of the device to be anchored with the anchors deployed;

FIG. 8 is a detail view of a deploying device for an anchor;

FIG. 9 is a block diagram of a system which may be used in the apparatus of FIG. 5 to provide the deployment and later the takeup of the slack cable.

Referring now to the gliding anchor of FIG. 1, it will be noted that the anchor has a main body 10 with wings 12 and 14 attached to the sides thereof. Further, the anchor has a drag skirt or cone 16 which, as shown by the dashed lines 18 has a hollow interior. In addition to the cone 16 there are horizontal stabilizers 20 and 22 which are attached to both the cone 16 and the body 10. The same numerals or designations are used in the FIGS. 2 and 3. In one working model of a preferred embodiment of the invention the wings form a 135° angle with the body on the leading edge and a 90° angle with the body at the trailing edge. The cone 16 forms a 135° angle with body 10, as do the leading edges of the horizontal stabilizers 20 and 22. The vertical lift or wing incidence angle of the wings as viewed from position 2—2 in FIG. 1 and FIG. 2 is 11°. As shown in FIG. 3 the trailing edge of the wings form a 30° dihedral angles with horizontal. The base diameter of cone 16 is approximately twice the body diameter. The ratio of length of the body 10 to its diameter is 4.5 to 1.

The above dimensions are for a particular glide angle of 45° and for the particular preferred embodiment shown. As will be realized by those skilled in the art, other dimensions may be used if other angles of attack and/or glide paths are desired and if other embodiments of the gliding anchor are utilized.

In FIG. 4 a main glide path of a gliding anchor 30 is shown by the arrow 28. X and Z axis are shown through the center of gravity of anchor 30. An angle of attach α designates the displacement of the X axis of the anchor 30 from the glide angle path 28 which makes an angle β with the respect to the bottom

or horizontal 32. In operation the lift and drag forces have to exactly counterbalance the weight to keep the anchor in a stable glide position. The forces along the Y axis (perpendicular to the X and Z axes) also must be balanced to prevent the anchor from straying from a straight path. The lift to drag ratio in this particular model which was designed to glide at a 45° angle has a value of 1.

For ease of design, the model shown has the center of lift in vertical alignment with an axis which passes through the center of gravity of the anchor. However, other designs within the scope of this invention may be originated in which compensation for any moment arms about the Y axis is provided by locating the lift axis at a point not in vertical alignment with the center of gravity, by changing the angle of the stabilizers and/or by changing the amount of drag to produce a counteracting moment in the opposite direction. In any event, the end product must have balanced forces and moments along all axes in order to maintain a stable glide slope path in a given direction. The hollow cone, in addition to producing drag forces while gliding, serves as a scoop when the anchor is emplaced if the anchoring line is attached at the interior apex of the cone.

FIGS. 5 and 6 illustrate a buoy or vessel which may utilize the anchor of FIG. 1. A vessel 110 is illustrated as just entering a body of water whose surface is identified by reference numeral 112. Extending from the vessel is an antenna 114 and three guide rods 116, 118 and 120. In diagrammatic form are also shown gliding anchors 122 which are similar to the anchor shown in FIGS. 1 and 2. FIG. 6 is a top view of the same vessel.

FIG. 7 shows the vessel after the anchors have reached the bottom 126 of the fluid container. The vessel 110 may be pulled under the surface 112 of the water either by knowing the depth of the water and making sure the lines 124 are not as long as the water is deep or by utilizing a circuit such as shown in FIG. 9 to reel the lines 124 back into the vessel 110 or the anchors 122 after the anchors 122 reach the bottom 126.

FIG. 8 shows a guide rod 132, similar to guide rods 116–120, with an anchor 130 in engagement therewith. A spring 136 is utilized to exert force against the anchor 130 after a catch is removed from hole 138 to allow the anchor 130 to slide down the guide 132 toward the bottom.

FIG. 9 is relatively self-explanatory and utilizes a solenoid 142 to release the anchor 148 a predetermined time after deployment of the vessel 110. Alternatively, anchor 148 may be released when the vessel 110 is a predetermined distance beneath the surface 112 of the water, as sensed by a pressure sensor 155. The clock 140 can also provide for energizing a tachometer 144 after anchor 148 is released to sense unreeling of the anchor line. Tachometer 144 can be connected to actuate a braking mechanism 150 when it senses the anchor has hit bottom. After a period of time a winch 146 can be used to reel in a predetermined amount of line on reel 149 to lower the vessel 110 below the surface 112.

The guides 116–120 are separated from one another by 120° in azimuth and in one design embodiment extend downwardly at an angle of 45° from the horizon. Preferably, the guides will extend in a downward angle which corresponds with the design glide angle of the anchor shown in FIGS. 1 and 2.

As will be realized by those skilled in the art, the anchors may have more weight than the buoyant force of the vessel 110 so as to pull the vessel 110 beneath the surface 112 of the water directly if this form of mooring is so desired, or in the alternative, anchors of less total weight than the buoyant force of the vessel can be launched to glide at a fairly shallow angle with respect to the horizon. In this method of operation, tangential drag of the anchors along the bottom rather than weight is relied on for anchoring force to allow the buoy to be pulled beneath the surface.

In summary, the present invention pertains to a gliding anchor, having a preferred embodiment as shown in the drawings, which may be used in an anchoring system. The

anchor, after being deployed at a given initial velocity to help maintain the correct direction will continue to glide in that direction at a given design glide angle until reaching the bottom of the fluid container at which time it acts in the capacity of a normal anchor.

We claim:

1. Gliding anchor apparatus comprising in combination:

snub-nosed body means of generally circular cylindrical configuration having a length-to-diameter ratio of 4.5 to 1;

wings on said body means for providing lift, said wings lying in planes which form approximately 11° angles with the central longitudinal axis of said body means, said wings having leading and trailing edges which respectively form 135° and 90° angles with said body means in planes parallel to its central longitudinal axis, said wings further forming 30° dihedral angles with a plane containing the central longitudinal axis;

circular, flared tail means at the rear of said body means for producing drag, said tail means having a hollow interior with a rearward facing opening, and a diameter approximately twice the diameter of said body means; and

horizontal stabilizing means connected to said body means and said tail means.