

[54] **BUOY**

[72] Inventor: **Henry V. Johnson, Panama City, Fla.**
[73] Assignee: **The United States of America as represented by the Secretary of the Army**
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[51] Int. Cl. **B63b 21/00, G01w 1/00**
[58] Field of Search **9/8; 73/170; 244/31**

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Primary Examiner—Milton Buchler
Assistant Examiner—Gregory W. O'Connor
Attorney—Richard S. Sciascia, Don D. Doty and William T. Skeer

[57] **ABSTRACT**

Disclosed is a buoy have a float, a gimbal ring assembly mounted in oppositely disposed and interconnected frusto-conical apertures extending through said float, an instrument package housing releasably latched to said gimbal ring assembly in such manner as to allow it to swing in pendulum like manner with 2° of freedom within said apertures with respect to said float.

19 Claims, 6 Drawing Figures

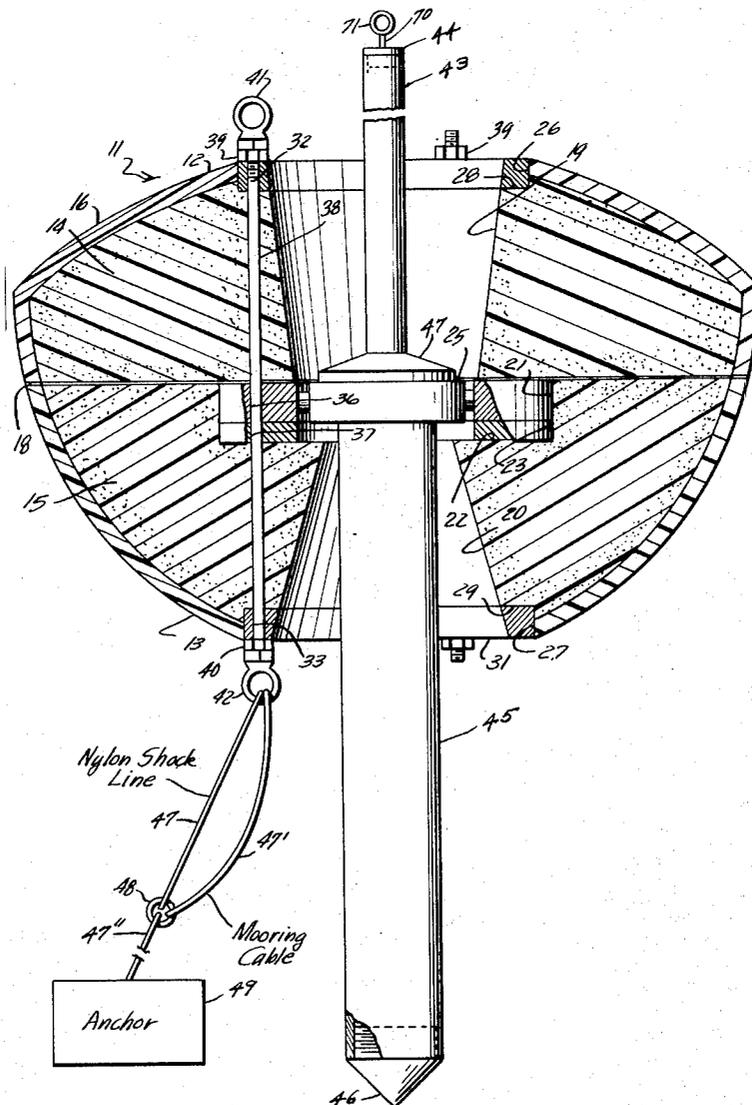
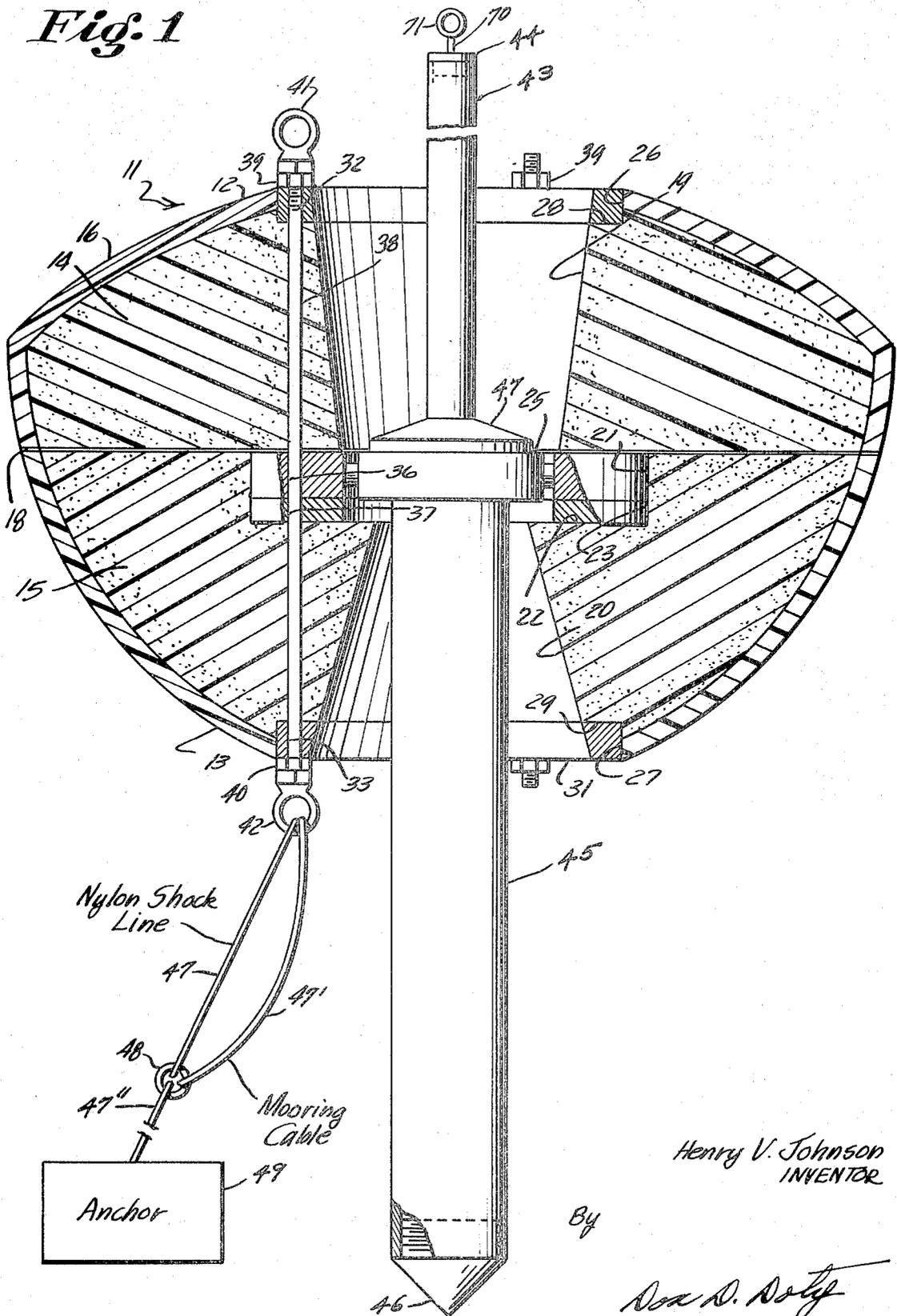


Fig. 1



Henry V. Johnson
INVENTOR

By

Don D. Doty
Attorney

Fig. 2

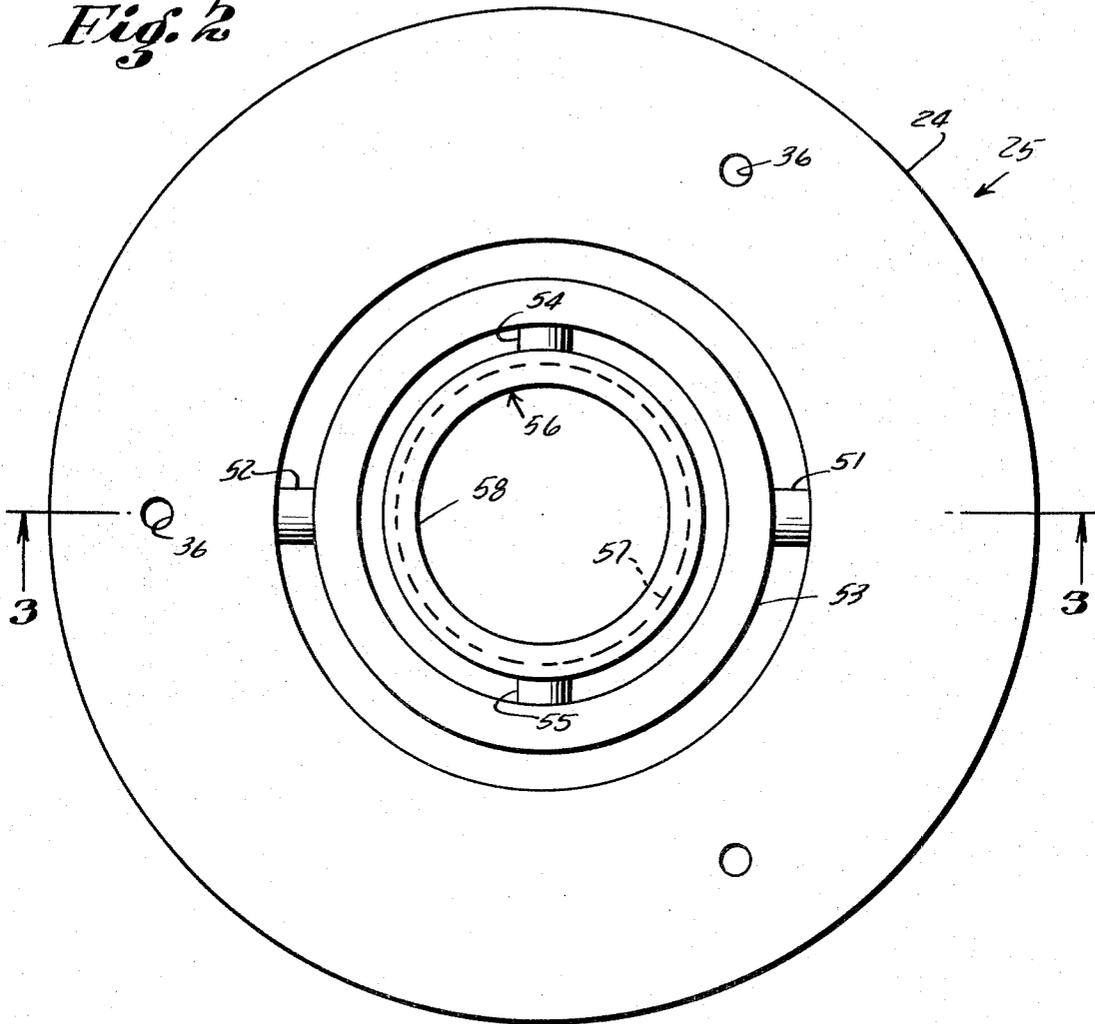
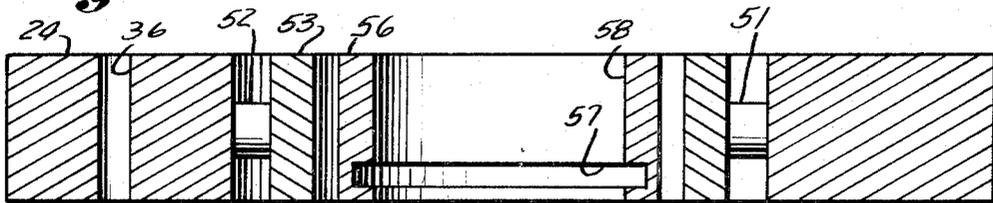


Fig. 3



Henry V. Johnson
INVENTOR

By

ROX D. DUFF
Attorney

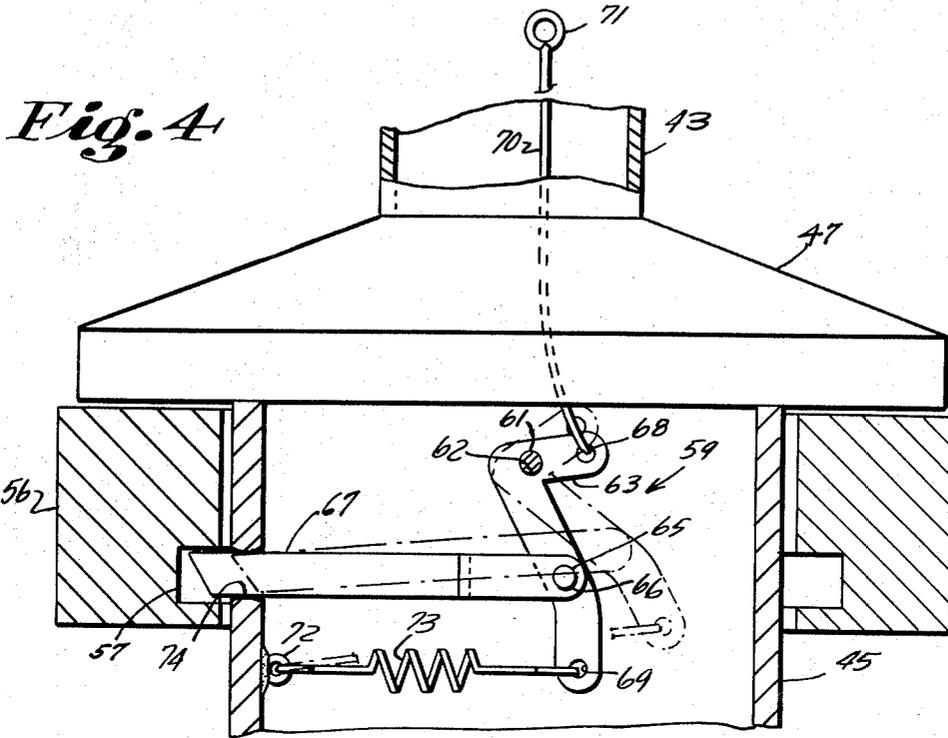
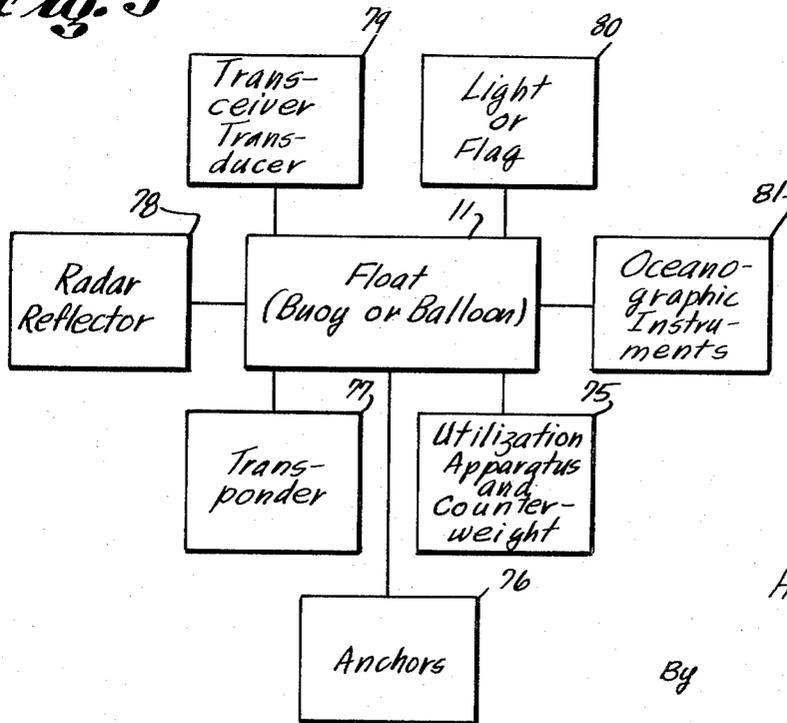


Fig. 5



Henry V. Johnson
INVENTOR

By

Don A. Doty
Attorney

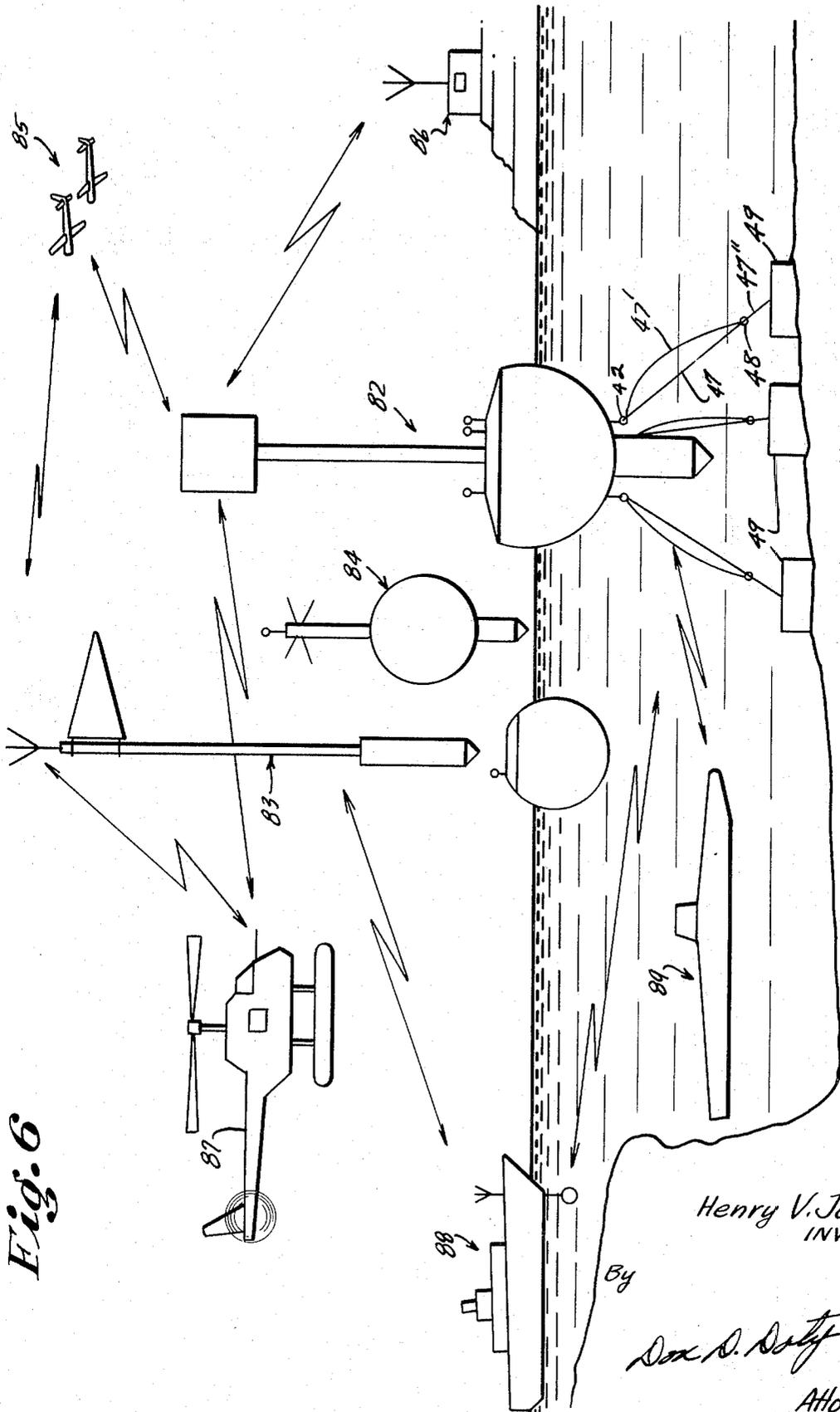


Fig. 6

Henry V. Johnson
INVENTOR

By
Don D. Duff
Attorney

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 therefor.

FIELD OF INVENTION

In general, this invention relates to buoys; and in particular, it is a buoy incorporating a pendulum-like stabilized internal platform, from which removable utilization apparatus may be suspended and upon which other utilization apparatus may be mounted in substantially vertical positions relative to the earth's surface at that particular place, regardless of the attitude of the float portion thereof.

In even great particularity, the instant invention is a unique water or air supported floating platform that incorporates an easily removable mast, which, in turn, has at least 2° of freedom and, thus, a substantially continuous vertical disposition relative thereto, and which is adapted for having any suitable utilization apparatus mounted at any preferred position thereon.

DESCRIPTION OF THE PRIOR ART

Heretofore, most buoys were of the types that were moored by a mooring line attached to a dead weight anchor on the bottom of the sea, river, lake, etc. They were usually configured to have spar, spherical, can, or nun shapes; therefore, they usually presented large profiles to water and wind currents. Furthermore, as a result of such shapes, they had excessively high drag, had large watch circles, and tended to submerge if said wind and water currents became sufficiently large. Moreover, since such buoys are ordinarily constructed in such manner that they have substantially rigid structures, they toss and turn as a result of being exposed to wind and/or water waves and thereby cause such things as flags, reflectors, antennas, instruments, and the like, mounted thereon to be damaged, to become inoperative, or otherwise be adversely affected. Hence, they require replacement after only a few days of use, an operation that can be exceedingly costly, both in time and money, in the event such buoys were disposed at or traveled to remote places in the oceans.

In addition to the above, the buoys of the prior art constantly lean over or tilt due to wind and/or water action. Hence, their uppermost structure is almost constantly moving, sometimes at an arc that is too great for many practical purposes. For example, it is not possible to use said prior art buoys as surface references for precise navigation purposes, such as those that may be required during naval tactical maneuvers.

Last, but by no means least, the replacement of batteries, instruments, and other utilization apparatus mounted on the buoys of the prior art is usually quite difficult and under certain circumstances — such as heavy seas — may be quite hazardous, as well. Of course, in the past, it has not been possible to accomplish such operations with a helicopter. Accordingly, it may readily be seen that the buoys of the prior art, although obviously satisfactory for many practical purposes, usually leave a great deal to be desired where optimum operational results and maintenance are required or desired.

SUMMARY OF THE INVENTION

The subject invention overcomes many of the disadvantages of those of the prior art, in that it provides a float that can wobble as a result of air or water wave action and still tend to maintain an operational structure — such as a mast or the like — in a substantially vertical position relative to the earth's surface at that point, both above and below the air-water interface. Moreover, the invention is uniquely constructed in such manner that the aforesaid mast or other operational structure may be manually lifted as a unit from the float portion of the

buoy and replaced with another, without disturbing said float portion or removing it from the water, thereby facilitating the replacement of power supplies, instruments, and any other utilization apparatus, regardless of whether they are located above or within the water, and regardless of their intended use.

At this time, it might be well to understand that the subject invention is primarily intended to be a buoy that is deployed in or on water, such as that of rivers, lakes, bays, seas, oceans, and the like. As such, it may be said that it is very useful in marine or submarine environments. However, it is also useful in an atmospheric environment, provided the float portion thereof is so designed as to have lift or float characteristics in air. For example, if the float portion thereof were a suitably designed balloon instead of something that would be buoyant in water, the invention would work just as well in air. Making the transition from one to the other would only require the making of suitable design choices, the doing of which would be well within the purview of one skilled in the art having the benefit of the teachings presented herewith. Nevertheless, in order to keep this disclosure as simple as possible, it will, for the most part, be herewith described as a unique buoy that is intended for operation in a marine environment, and particularly on the surface of sea or ocean water, although an airborne embodiment will also be mentioned subsequently.

It is, therefore, an object of this invention to provide an improved buoy.

Another object of this invention is to provide a method and means for optimizing the stability of a predetermined plurality of removable utilization apparatus that are respectively deployed above and below the air-water interface of a body of water in which they are effectively floating, regardless of the wave action occurring therein, by minimizing the respective tilts thereof with respect to a predetermined reference.

Still another object of this invention is to provide a buoy having a relatively stabilized mast and apparatus compartments which may be easily removed and replaced with another without disturbing or relocating the float portion thereof.

A further objective of this invention is to provide a buoy that may be easily and economically serviced by means of a helicopter, a boat, or other appropriate vehicle.

Another object of this invention is to provide an improved buoy that has a substantially vertical mast extending therethrough that does not tilt nearly as much as the float portion thereof is tilted by wave action.

Another object of this invention is to provide a buoy which effectively reduces the watch circle thereof.

Another object of this invention is to provide a buoy that may be moored conveniently by one or more mooring lines and even three thereof in the event it is located at a place where water currents are strong, variable, and unpredictable.

Another object of this invention is to provide a navigation buoy that allows the entire mast section, including all of the components mounted therein and thereon, to be easily, economically, quickly, and safely unlatched, lifted out of the float section, and replaced by a new unit that is latched therein by using such vehicles as small craft, helicopters, or ships, without disturbing the mooring thereof and, thus, without moving the navigation reference point it may constitute.

A further object of this invention is to provide an improved method and means for maintaining a plurality of easily removable instrument packages in predetermined spatial dispositions along a substantially vertical axis, regardless of the environmental medium within which it is located.

Another object of this invention is to provide a method and means for maintaining a plurality of easily removable utilization apparatus in predetermined spatial dispositions along a substantially vertical axis within an atmospheric environment.

Still another object of this invention is to provide a method and means for maintaining a plurality of easily removable utilization apparatus in predetermined spatial dispositions along a substantially vertical axis when submerged in water, such as sea water, river water, lake water, or the like.

Other objects and many of the attendant advantages will be readily appreciated as the subject invention becomes better understood by reference to the following detailed description, when considered in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an elevational view of the invention showing the relative arrangements of the elements thereof pictorially, in cross-section, and schematically;

FIG. 2 is a top schematic view of a 2° of freedom gimbal ring assembly which is typical of that incorporated in the device of FIG. 1;

FIG. 3 is a cross-sectional view of the gimbal ring assembly of FIG. 2 taken at 3—3 thereof;

FIG. 4 is a view, partially in cross-section and partially pictorial, which depicts a representative lock mechanism that may be incorporated in the invention to an advantage;

FIG. 5 is a block diagram of the general concept of the invention, whereby it is illustrated that various and sundry combinations of elements may be optionally incorporated in and/or mounted on the subject invention;

FIG. 6 is a quasi-pictorial view of the many types of operational configurations in which the subject invention may be employed, either independently or in concert as a system that produces a given tactical result.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, there is shown a float 11 which, depending upon the environment within which it is operating, may be any suitable lift device or a buoyant device. As will be discussed subsequently, if it is the former, it may be designed as a balloon or other lift chamber or vehicle; on the other hand, if it is the latter, it may be a float chamber having a body that is configured and constructed essentially as illustrated.

Without intending to limit the possible embodiments which may be constructed, and without violating the scope and spirit of the invention, the device of FIG. 1 will herewith be specifically disclosed as being a buoy adapted for floating on water, in order to keep this case as simple as possible.

Float 11 is preferably manufactured in two parts; that is, an upper part 12 and a lower part 13. Each of said parts are filled with and, thus, formed of polystyrene or styrene foams 14 and 15 or any suitable equivalent thereof that incorporates the physical characteristics desired for any given operational circumstances. Outer surfaces or skins or housings 16 and 17 are respectively attached to the outer surfaces of foams 14 and 15, in order to provide configuration and strength thereto, as well as providing resistance to damage by exposure to all of the elements it may encounter in its ambient environment.

Housings 16 and 17 may be made of fiberglass or other suitable material and attached to the foam portions of the float by any conventional, appropriate means, such as by an epoxy resin, or, for example, in the manner used in the manufacture of fiberglass boat hulls and the like.

The upper and lower sections of float 11 are preferably attached to each other by means of any suitable adhesive 18, such as an epoxy resin, or the like.

At this time, it should be understood that foams 14 and 15 are selected in accordance with the intended use of the subject invention. In other words, it should be of such density as to make the entire device ride on the surface of the water or at some predetermined water depth, as desired. Of course, in the embodiment where the housing portion thereof is a balloon for flight or floating on the air of the atmosphere, foams 14 and 15 may be replaced by a lighter than air gas, such as hydrogen or helium or the like. Obviously, so doing would be well within the purview of the artisan having the benefit of the teachings presented herewith.

A pair of upper and lower apertures 19 and 20 extend through float 11 along the vertical axis thereof and in such manner that the inner ends thereof effectively meet to form a continuous aperture therethrough. As may be seen, upper

aperture 19 is substantially conical in shape with the greater inside diameter thereof being at the outer surface of the float. Of course, lower float section 20 is similarly but oppositely configured, so as to be compatible therewith; but, in addition, it includes a circular cut 21 of sufficient depth to form a shelf 22, so that outer circular or cylindrically shaped elements may be disposed therein for securing purposes. Thus, a circular washer 23 is mounted on the top of shelf 22 and within cut 21 for such purpose. Likewise, the outer ring 24 of a 2° of freedom gimbal ring assembly 25 is mounted between the top of washer 23 and the lower surface of upper styrene foam section 14 within circular cut 21 in such manner as to be secured therein.

At the outer ends of holes 19 and 20, another pair of cuts 26 and 27 are located in upper and lower float sections 12 and 13, respectively, in such manner as to form upper and lower shelves 28 and 29. And located in said cuts 26 and 27 in abutment with shelves 28 and 29, is a pair of metal retainer rings 30 and 31. The inside diameters of rings 30 and 31 vary in such manner that they are compatible with the outer ends of holes 19 and 20 of upper and lower housing sections 12 and 13 and their respective styrene foam fillers 14 and 15. Rings 30 and 31 have a plurality of stud holes 32 and 33 — three in this embodiment — equally spaced therearound and extending through the thickness thereof near the outer edge thereof. Said stud holes are positioned in line with another pair of holes 34 and 35, which are likewise drilled through foams 14 and 15 and with holes 36 and 37 in ring 24 and washer 23, so as to be in line with each other. A tud bolt 38 having threads at each of the ends thereof is inserted through all of the aforesaid holes, and a pair of nuts 39 and 40 are respectively screwed thereon, in order to act as an optional or supplemental means for holding float sections 12 and 13 together. A lifting eye 41 is also screwed on the top threads of stud bolt 38, and a mooring eye 42 is screwed on the bottom threads thereof.

At this time, it should be understood that with such a stud bolt arrangement, adhesive 18 may not be necessary in order to hold the float sections together. And, of course, using such bolt arrangement facilitates the disassembly of the float for easy replacement of gimbal ring assembly 25. On the other hand, when used, it will strengthen an adhesively secured float and act as lifting and mooring connectors, as well.

As a general rule, only a trio of such stud bolt arrangements are used, each of which is equidistantly spaced from the others around rings 30 and 31. But, if operational circumstances so warrant, any number thereof may be so employed. In any event, they cause the entire float assembly, including washer 23 and outer ring 24 of gimbal ring assembly 25 to be firmly and securely held together, so that the entire invention can withstand the battering of heavy seas when deployed therein.

Extending through apertures 19 and 20 of the float and through the center hole of the inner gimbal ring (to be discussed in conjunction with FIGS. 2, 3, and 4) is an elongated, hollow utilization apparatus housing, container, or instrument package unit. The upper portion thereof is a pipe or mast 43 having an upper apertured cap 44, and the lower portion thereof is a larger pipe 45, with a tapered closed end 46 to provide water tightness therefor. In between pipes 43 and 45 is a flange 47 of such diameter that it sets on the upper surface of the inner ring of gimbal assembly 25. Of course, the outside diameter of pipe 45 is such that it may be easily slid in and out of the center hole of said inner gimbal ring merely by pushing and pulling it.

As a general rule, lower pipe 45 functions as a housing for electronic or other apparatus, and mast 43 acts as a support for various and sundry equipment, such as, for instance, flags, antennas, lights, radar reflectors, or any other suitable apparatus or instrumentation. As required to be properly functional, electrical leads can be run through the hollow portions of both mast 43 and pipe 45.

Connected to one or more of the mooring eyes 42, is a nylon or other resilient shock line 47 and a mooring cable 47', the other ends of which are connected to a coupling ring 48,

which, in turn, is connected by means of another line or chain 47' to an anchor or weight 49.

In the event it is desirable for the watch circle of the subject buoy to be as small as possible, said shock line - mooring cable combination is employed in concert with several other such combinations, preferably in a tripod-like configuration. If greater mooring strength is required due to adverse seas, an even greater number thereof may be used. On the other hand, in some instances it may be desirable to allow the subject buoy to be carried along with the water current in order to gather oceanographic or other information therefrom. In that case, no mooring lines are employed and the buoy is free floating.

Because housing 45 is mounted on gimbals and extends below float 11 it also acts as a pendulum type counterweight for mast 43 and its attached devices. Hence, it must have such greater mass as will cause it to be pulled downwardly by the earth's gravity and thereby tend to assume a vertical position at all times, regardless of the mass of mast 43 and the attitude of float 11. To effect such condition, it would be obvious to the artisan having the teachings herewith presented to design the sizes, weights, and shapes thereof — and of the entire buoy, as well — to be optimum for the intended operational conditions, including both shallow and deep water, and possibly even deep space, too.

FIGS. 2 and 3 illustrate schematically a representative type of two degrees of freedom gimbal ring assembly that may be included as assembly 25. Very simply, it contains an outer ring 24 that is mounted between float sections 14 and 15 in cut 21. By means of suitable shafts 51 and 52 and compatible bearings in outer ring 24 and an intermediate ring 53, ring 53 and ring 24 have relative rotation in one direction. By means of shafts 54 and 55 and compatible bearings in intermediate ring 53 and inner ring 56 which are 90° removed from the aforesaid shafts 51 and 52, rings 53 and 56 have relative rotation in another direction that is normal to the aforesaid one direction. Hence, inner ring 56 has two degrees of freedom relative to outer ring 24, and any support housing or other mechanism mounted on said inner ring in a pendulum manner would tend to remain stationary due to gravity, even though outer ring 24 wobbles somewhat. Inner ring 56 contains a groove 57 which may be used as part of a releasable latch mechanism that may optionally be incorporated in the instant invention, in the event the buoy is intended to be used in an environment that is sufficiently rough that the apparatus housing 45 of FIG. 1 could possibly jump out the center hole 58 of inner ring 56.

Referring now to FIG. 4, the assembly shown includes a representative latch mechanism 59 that may optionally be incorporated in the invention to insure that removable unit 45 remains secure within float 11 during rough operation and yet facilitate its removal therefrom without removing the entire buoy from its ambient environment. A shaft 61 is mounted in bearings, by welding, or by any other suitable means 62 in the inside of housing pipe 45, and mounted for rotation thereon is a lever arm 63 which, in this particular embodiment, has a V shape with an extended arm 64. Another shaft 65 is mounted in bearing holes 66 in arm 63, and a latch bolt 67 is mounted for rotation thereon. Lever arm 63 has a pair of holes 68 and 69 located therein, with a cable 70 attached to hole 68 thereof. A lifting or pulling eye 71 is attached to the other end of cable 70. Another eye 72 is mounted as by welding or the like to the inside wall of pipe 45, and a tension spring 73 is connected between it and the aforesaid hole 69 of lever arm 63 in such manner as to effectively urge latch bolt 67 outwardly through a watertight packing gland type of support hole 74 in the wall of housing 45 for engagement with groove 57 of inner gimbal ring 56, when in a latched condition.

As may be seen from FIG. 4, mast 43, like compartment 45, is hollow. Therefore, for waterproofing purposes, the upper extremity thereof may be closed by any suitable cap 44 (see FIG. 1) which preferably has a watertight gland therein (not shown) to allow line 70 to extend therethrough and still allow mast 43 and chamber 45 to remain dry.

In the event other operational conditions and associated equipment permit, the aforementioned latch mechanism may be replaced by a magnetic type latch which, of course, could be of the type that would cause flange 47 to be magnetically attached to inner gimbal ring 56. The magnetism should be of such strength that it would hold them together during rough sea conditions but not be so strong that unit 45 could not be removed from float 11. Such arrangement would, of course, make hole and packing gland 74 in the wall of unit 45 unnecessary.

The block diagram of FIG. 5 merely shows, in general concept, possible combinations of elements that might be combined with the subject buoy, depending on the operational characteristics desired.

Float 11 may be either a buoyant hull or buoy type device intended for operation on or in water, or it may be a gas filled balloon for rising in and floating on air, such as, for instance, the air of the earth's atmosphere. Attached thereto is a counterweight device 75 which hangs from float 11 with 2° of freedom, so as to swing pendulum-like within limits in any direction relative thereto. Of course, said counterweight device may be similar to the hollow housing pipe 45 of FIG. 1, so that it may contain in watertight arrangement any preferred utilization apparatus, instrumentation, electronic or otherwise.

Also attached to float 11 are anchors or weights 76, a transponder 77, a radar reflector 78, a transceiver transducer 79 - which, of course, is connected to any suitable transmitter and/or receiver or telemetering system as associated apparatus — a light and/or flag 80, and oceanographic instruments 81. Of course, such elements may be employed in any number, in any combination, and in any combination with any other instrumentation or utilization equipment, as the operational circumstances warrant.

FIG. 6 depicts in a quasi-pictorial manner how the subject invention may be employed as either a single unit or in concert with several thereof and/or with one or more tactical vehicles and land stations. Hence, it may be seen that an anchored buoy embodiment 82, a free-floating buoy embodiment 83 (with replaceable utilization apparatus removed) and an airborne embodiment 84 may be so used. Aircraft 85, land station 86, helicopter 87, ship 88, and submarine boat 89 are likewise shown as being useful links in communications, telemetering, and maneuvers employing the subject invention. All of such items will be mentioned again in greater detail during the discussion of the operation of the invention.

MODE OF OPERATION

The operation of the subject invention will now be discussed briefly in conjunction with all of the figures of the drawing.

It has long been known that buoys make excellent platforms for the support of various and sundry equipment which perform numerous useful functions in the fields of navigation, oceanography, meteorology, communications, telemetering, and the like. However, as previously indicated, because of their susceptibility to bobble and wobble, any device or devices mounted on the mast or superstructure thereof would sometimes be tilted sufficiently to be submerged within the ambient water, or at least be too near the surface thereof to be seen or otherwise monitored. Within limits, this invention prevents this, due to the 2° of freedom between its unique float and pendulum type mast and apparatus housing — that is, its instrument package, so to speak. Accordingly, the mast-housing unit thereof, in effect, becomes a fairly stabilized platform whenever the invention is employed for the aforementioned purposes.

In addition, as previously indicated, it has been found that it is exceedingly difficult to service the known prior art buoys of unitary construction, because they must be removed from the water or a landing must be made thereon to replace or resupply any instrumentation, or other devices mounted thereon. This particularly burdensome if, for example, batte-

ries must be replaced or some other unit must be replaced or repaired. Hence, this invention was constructed in such manner that the entire instrument package could be removed and replaced without removing the float from, say, its moored position in the water. The convenience of this should be readily apparent and appreciated by those tending buoys and similar instrument probes.

The removal and replacement of the entire instrument package was effected by allowing it to ride by means of gravity in the center hole of the inner ring of a gimbal stabilized platform securely mounted within a float that, in turn, may be disassembled for removal thereof. In addition, a latch mechanism may be employed therebetween that will allow the instrument package as a unit to be withdrawn from its gimbal ring without undue effort and still remain firmly secured therein, in the event the float is tossed and turned sufficiently to otherwise throw the instrument unit therefrom.

Removal and replacement of the instrument unit may be effected by a helicopter having a grapple, grapnel, and/or lifting hook. If no latch is employed, anything that will grasp mast 43 and pull upwards and lower downwards will do the job. Of course, if a latch is used, latch release eye 71 must be pulled upwardly to effect the turning of lever arm 63 against spring 73 and, thus, pull latch bolt 67 out of groove 57 of inner ring 56, so as to allow entire unit 43 to be pulled out of float 11. Being spring loaded, bolt 67 will automatically drop in place in groove 67 when a new unit is inserted into float 11.

To make unit 45 relatively easy to insert in the center hole of inner gimbal ring 56, aperture 19 is tapered and end 46 of housing 45 is somewhat pointed. Of course, the tapers of both apertures 19 and 20 allow mast 43 and housing 45 to swing in all directions within float 11, but due to the counterweight affect of housing 45, within limits, it tends to hold itself and mast 43 in a substantially vertical position, even though float 11 may be tilting to some extent within the aforesaid limits.

Referring now to FIG. 6, any of the vehicles depicted therein may be employed to lift, remove, and replace the instrument packages from their respective buoys. Likewise all such vehicles, including land station 85, may communicate with each or all of the buoys shown for information gathering purposes necessary for optimizing their respective intended individual functions, as well as during converted tactical maneuvers. Obviously, any number of each thereof could be employed for any given purpose, and, likewise, any combinations or permutations thereof could be used, too, without violating the spirit and scope of this invention, inasmuch as so doing would merely involve the making of design choices by the artisan.

Again, it should be understood that any alternate structural configurations or shapes may be incorporated in the invention that will make it applicable for use in many different places. Hence, for example, as previously suggested, float 11 may be a gas filled balloon designed for flying in the earth's atmosphere.

Obviously, other embodiments and modifications of the subject invention will readily come to the mind of one skilled in the art having the benefit of the teachings presented in the foregoing description and the drawings. It is, therefore, to be understood that this invention is not to be limited thereto and that said modifications and embodiments are intended to be included within the scope of the appended claims.

What is claimed is:

1. A buoy, comprising in combination:

support means adapted for floating in a predetermined environmental medium;

aperture means, having a predetermined diametrical configuration, extending through said support means along a given vertical axis thereof;

elongated housing means, having an outside diameter that is less than the smallest diameter of said aperture means, extending through the aforesaid aperture means of said support means in such manner that relative tilt may occur therebetween, with the extremities of said elongated housing means extending out of the upper and lower ends

of said support means, respectively, and with the lower extremity of said elongated housing means having a mass that is greater than that of the upper extremity thereof; means connected to said support means and releasably connected to the aforesaid elongated housing means for effecting relative two-degree of freedom disposition therebetween; and

manually operable latch means connected between said 2° of freedom effecting means and said elongated housing means for the connection and disconnection thereof in response to the latching and unlatching thereof.

2. The device of claim 1 wherein said support means is a platform capable of floating on water.

3. The device of claim 1 wherein said support means is a balloon filled with a lighter than air gas for floating on the air of the atmosphere.

4. The device of claim 1, wherein said elongated housing means comprises:

a mast extending above said support means and having a predetermined mass;

a flange attached to the lower end of said mast adapted for being connected and disconnected to and from the aforesaid 2° of freedom effecting means;

a watertight compartment connected to the bottom of said flange adapted for containing a utilization apparatus, said watertight compartment extending below said support means in a pendulum-like manner and having a mass that is greater than the mass of the aforesaid mast.

5. The device of claim 1 wherein said means connected to said support means and releasably connected to the aforesaid elongated housing means for effecting relative 2° of freedom dispositions therebetween comprises:

an outer gimbal ring attached to said support means;

an intermediate gimbal ring located within said outer gimbal ring and connected thereto for rotation about a predetermined axis thereof;

an inner gimbal ring, adapted for being releasably connected to said elongated housing means, located within said intermediate gimbal ring and connected thereto for rotation about an axis that is normal to the aforesaid predetermined axis of said outer gimbal ring.

6. The invention of claim 1 further characterized by means connected to said support means for the anchoring thereof at substantially a predetermined location in said predetermined environmental medium.

7. The device of claim 1, wherein said support means adapted for floating in a predetermined environmental medium comprises:

a water buoyant plastic foam having closed cells containing confined air bubbles;

a fiberglass protective layer attached to the outer surface of said water buoyant plastic foam; and

a pair of retainer rings respectively attached to said support means around the aforesaid axis and at the extremities of the aforesaid aperture means.

8. The invention according to claim 7 further characterized by:

a trio of holes located equidistant around said pair of retainer rings and extending therethrough and through said fiberglass protective layer, said water buoyant plastic foam, and the aforesaid 2° of freedom effecting means;

a trio of stud bolts, each of which has threaded extremities, inserted in said trio of holes, respectively;

a pair of nuts screwed on the threaded extremities of each of said trio of stud bolts for the securing thereof in said trio of holes, respectively;

at least one lifting eye screwed on a threaded end of at least one of said stud bolts for the removal and deployment of said support means from and into said predetermined environmental medium; and

at least one mooring eye screwed on a threaded end of at least one of said stud bolts adapted for being connected to a mooring means.

9. The device of claim 1, wherein said latch means comprises:

- a groove disposed in said 2° of freedom effecting means;
- a first shaft mounted within said elongated housing means;
- a lever arm mounted for rotation on said first shaft; 5
- a second shaft connected to said lever arm;
- a hole in the wall of said elongated housing means;
- a latch bolt slidably mounted in said hole, adapted for being inserted in said groove, and connected to said second shaft for rotation thereon; 10
- a spring connected between the wall of said elongated housing means and said lever arm for effectively urging said latch bolt toward said groove;
- a line connected to said lever arm in such manner as to cause rotation thereof about said first shaft when pulled, so as to thereby effect the removal of said latch bolt from said groove; and 15
- eye means connected to said line for effecting a connection therebetween and a predetermined pulling means. 20

10. The invention of claim 1 further characterized by a utilization apparatus connected to said elongated housing means.

11. The device of claim 10, wherein said utilization apparatus comprises a light.

12. The device of claim 10, wherein said utilization apparatus comprises:

- a transducer for broadcasting and receiving predetermined energy; and
- a transceiver connected to said transducer. 25

13. The device of claim 10, wherein said utilization apparatus comprises oceanographic instrumentation.

14. The device of claim 10, wherein said utilization apparatus comprises a radar reflector.

15. The device of claim 10, wherein said utilization apparatus comprises a transponder. 35

16. The device of claim 10 wherein said utilization apparatus comprises a telemetering system.

17. A buoy, comprising in combination:

- a support means, having a configured plastic foam with closed cells containing confined air bubbles and a fiberglass protective layer attached to the outer surface of said plastic foam, adapted for floating in an aqueous medium; 40
- aperture means, having a predetermined diametrical configuration, extending through said plastic foam and the fiberglass protective layer attached thereto in such manner as to be disposed along a given vertical axis of said support means; 45
- elongated housing means, having an outside diameter that is less than the smallest dimension of said aperture means, extending through said aperture means in such manner that relative tilt may occur therebetween, with the extremities of said elongated housing means extending out of the opposite ends of said aperture means, respectively, and with the lower extremity of said elongated housing means having a mass that is greater than that of the upper extremity thereof; 50
- means connected to said support means and releasably connected to the aforesaid elongated housing means for effecting relative 2° of freedom disposition therebetween; 55
- a pair of retainer rings respectively attached to the plastic foam and fiberglass protective layer of said support

means and around the peripheries of the extremities of the aforesaid aperture means;

- a trio of holes located equidistant around said pair of retainer rings and extending therethrough and through said fiberglass protective layer, said plastic foam, and the aforesaid 2° of freedom effecting means;
- a trio of stud bolts, each of which has threaded extremities, inserted in said trio of holes, respectively;
- a pair of nuts screwed on the threaded extremities of each of said trio of stud bolts for the securing thereof in said trio of holes, respectively;
- at least one lifting eye screwed on a threaded end of at least one of said stud bolts for the removal and deployment of said support means from and into the aforesaid aqueous medium; and
- at least one mooring eye screwed on a threaded end of at least one of said stud bolts adapted for being connected to a mooring means. 60

18. The device of claim 17, wherein said support means comprises an assembly of a pair of complementary parts, each of which include said configured plastic foam and the aforesaid protective layer attached to the outer surface thereof.

19. A buoy, comprising in combination:

- support means adapted for floating in a predetermined environmental medium;
- aperture means, having a predetermined diametrical configuration, extending through said support means along a given vertical axis thereof;
- elongated housing means, having an outside diameter that is less than the smallest diameter of said aperture means, extending through the aforesaid aperture means of said support means in such manner that relative tilt may occur therebetween, with the extremities of said elongated housing means extending out of the upper and lower ends of said support means, respectively, and with the lower extremity of said elongated housing means having a mass that is greater than that of the upper extremity thereof;
- means connected to said support means and releasably connected to the aforesaid elongated housing means for effecting relative 2° of freedom disposition therebetween;
- a groove disposed in said 2° of freedom effecting means;
- a first shaft mounted within said elongated housing means;
- a lever arm mounted for rotation on said first shaft;
- a second shaft connected to said lever arm;
- a hole in the wall of said elongated housing means;
- a latch bolt slidably mounted in said hole, adapted for being inserted in said groove, and connected to said second shaft for rotation thereon;
- a spring connected between the wall of said elongated housing means and said lever arm for effectively urging said latch bolt toward said groove;
- a line connected to said lever arm in such manner as to cause rotation thereof about said first shaft when pulled, so as to thereby effect the removal of said latch bolt from said groove;
- eye means connected to said line for effecting a connection therebetween and a predetermined pulling means; and
- means connected to said support means for the anchoring thereof at substantially a predetermined location with respect to the aforesaid predetermined environmental medium. 65

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