



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/AU90/00368 (22) International Filing Date: 22 August 1990 (22.08.90) (30) Priority data: PJ 5900 22 August 1989 (22.08.89) AU (71)(72) Applicant and Inventor: FIOTAKIS, John, Michael [AU/AU]; 678 Sandy Bay Road, Sandy Bay, TAS 7005 (AU). (74) Agent: PHILLIPS ORMONDE & FITZPATRICK; 367 Collins Street, Melbourne, VIC 3000 (AU). (81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI pa- tent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CM (OAPI patent), DE*, DE (European patent)*, DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), HU, IT (Eu- ropean patent), JP, KP, KR, LK, LU, LU (European pa- tent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NL (European patent), NO, RO, SD, SE, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent), US.</p>		<p>Published <i>With international search report.</i></p>
<p>(54) Title: RETRIEVABLE AND SUBMERSIBLE BUOY</p>		
<p>(57) Abstract</p> <p>A retrievable and submersible buoy (10) which is adapted to be retained below the surface of a mass of water, and to be subsequently released to allow ascent to the surface, while being tethered to an underwater mooring (22). The buoy comprises a body (16, 17) having positive buoyancy such that, when below the surface, the buoyancy urges the buoy towards the surface. The buoy also comprises a spool (19) capable of having at least a portion of the length of the tether (20) wound thereon, and a releasable holding mechanism (24, 28) capable of preventing the tether (20) from unwinding from the spool (19) while the buoy is restrained below the surface, while also being capable of allowing the tether (20) to unwind from the spool (19) at a predetermined time for ascent of the buoy to the surface. The buoy may then be retrieved from the surface, and if desired the underwater mooring (22) may be raised by raising the tether (20).</p>		

DESIGNATIONS OF "DE"

Until further notice, any designation of "DE" in any international application whose international filing date is prior to October 3, 1990, shall have effect in the territory of the Federal Republic of Germany with the exception of the territory of the former German Democratic Republic.

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RETRIEVABLE AND SUBMERSIBLE BUOY

This invention relates to a retrievable and submersible buoy. In particular, the invention relates to a submersible buoy which is capable of being deployed and
5 subsequently retrieved at a predetermined time.

Buoys are commonly used in the fishing industry and other marine applications to indicate the location of an area, or a body of some type, or to indicate the location of a particular activity. For example,
10 ship-wrecks, popular fishing areas, spectacular underwater scenery, and crayfish-pots, often have their locations marked by a buoy tethered thereto. However, problems with these systems have been encountered due to the buoys be easily locatable by third parties, and also due to the
15 navigational hazard presented by uncharted obstacles. Specifically, poaching is a particular problem in the fishing industry, where crayfish-pots are often illegally tampered with.

Large numbers of buoys are used by operators in
20 the fishing industry. Thus, slight variations in costs of manufacturing have a significant effect on commercial acceptance. Accordingly, a buoy that can be manufactured simply and with a low cost will provide a significant advantage over known buoys.

25 Further, buoys having a complex mechanism or a large number of moving parts are prone to failure, adding to repair or replacement costs and leading to the likely loss of a valuable item. Buoys mostly are used in a sea water environment which can be extremely harsh, and likely

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to cause corrosion, salt encrustment and the like, increasing the likelihood of failure of a complex mechanism. Specifically, the use of sophisticated electronics, finely detailed parts, or simply a large
5 number of moving parts, increases the likelihood of failure, and may result in a submersible buoy being permanently submerged and subsequently irretrievable.

It is an object of the present invention to alleviate or at least partly obviate the above noted
10 disadvantages of known devices for indicating the location of a submerged body.

The present invention provides a retrievable and submersible buoy which is adapted to be retained below the surface of a mass of water, and to be subsequently
15 released to allow ascent to the surface, while being tethered to an underwater mooring. The buoy comprises a body having positive buoyancy such that, when below the surface, the buoyancy urges the buoy towards the surface. The buoy also comprises a spool capable of having at least
20 a portion of the length of the tether wound thereon, and a releasable holding mechanism capable of preventing the tether from unwinding from the spool while the buoy is restrained below the surface, while also being capable of allowing the tether to unwind from the spool at a
25 predetermined time for ascent of the buoy to the surface. The buoy may then be retrieved from the surface, and if desired the underwater mooring may be raised by raising the tether.

Preferably, the releasable holding mechanism is

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capable of preventing the tether from unwinding past a restraining point which is fixed, or which is capable of being fixed, in relation to the spool. In this way, when the releasable holding mechanism is engaged, the tether
5 cannot pass the restraining point and thus cannot unwind from the spool. Then, when the releasable holding mechanism is disengaged, the positive buoyancy of the body of the buoy acts to cause the tether to pass the restraining point and unwind from the spool, allowing the
10 buoy to rise to the surface.

The releasable holding mechanism may comprise a restraining member. Preferably, the restraining member is elongate and is capable of being attached to the body of the buoy at two points, one of which is releasable, such
15 that the restraining member itself defines the restraining point referred to above. In this form, the restraining member engages the body such that the tether passes between the two points, and is retained between the two points by the restraining member and the body of the
20 buoy. In the most preferred form, the restraining member is a flexible cord rigidly secured at one end, and releasably secured at the other.

The releasable holding mechanism may also comprise means for engaging, and subsequently disengaging
25 and releasing, the restraining member. Preferably, the engaging means is actuated by a timing mechanism so that the release of the restraining member may be effected at a predetermined time.

In a preferred form, the engaging means is

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arranged so as at least a part thereof communicates with
the restraining member to engage and disengage. The
engaging means is preferably urged away from its engaging
position by biasing means, and is capable of being held in
5 its engaging position by a movable abutment. Thus, at
said predetermined time the timing mechanism actuates the
movable abutment away from the engaging means, and the
biasing means acts to move the engaging means away from
its engaging position to disengage and release the
10 restraining member and hence the tether.

Preferably, the timing mechanism is a wind-up
clock, although any type of timing mechanism may be used
which is capable of functioning as above. However, the
advantage of a wind-up clock lies in the ability to reset
15 the clock by winding, without having to replace a power
source such as a battery or the like.

The releasable holding mechanism, including the
engaging means, the timing mechanism, the movable
abutment, and the biasing means, is preferably adapted to
20 be located within the buoy. This may include being within
either or both of the spool and the body of the buoy.

The term "positively buoyant" is used throughout
the specification to include any material or shape which,
either by its nature or by its construction, is
25 permanently buoyant. The term does not include situations
where a material or shape is potentially buoyant, and thus
will become buoyant as a result of an action whilst in
place below the surface, such as by the release of
compressed air to inflate air bags or the like.

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Suitable materials for the body of the buoy may thus be foam, plastics, woods, or the like, or may be at least partially comprised of such buoyant materials to provide overall positive buoyancy. Alternatively, the
5 body may include chambers or the like, filled with a gas such as air to provide the positive buoyancy.

In the most preferred form of the present invention, the buoy has a dumbbell-like shape having enlarged end sections and a comparatively narrow middle
10 section. The enlarged end sections form the body of the buoy, and are positively buoyant, while the narrow middle section forms the spool. Thus, the buoy winds and unwinds similar to the winding and unwinding of a yo-yo. This allows for ease of unwinding and thus return to the
15 surface, without a large risk of the tether fouling or tangling while below the surface. A further advantage is that the buoy need not be dismantled in order to rewind the tether prior to re-use. Further due to the preferred shape, the axis of the spool (and thus the buoy) will
20 remain substantially horizontal while surfacing, allowing the smooth unwinding of the tether from the spool as the spool rotates about that axis.

The buoy of the present invention provides further advantages over known buoys. Due to its simple
25 mechanism the buoy is cheaper to manufacture, and is easy to seal or insulate from a harsh sea-water environment. Indeed, if materials are used which are not conducive to salt encrustment or corrosion there is no need for any such sealing, while generally the only part of the buoy

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that may otherwise require sealing might be the timing mechanism. Further, due to the simple configuration of the releasable holding mechanism, and the small number of moving parts required, the failure rate of the buoy is low
5 insofar as failure below the surface (and thus irretrievability) is concerned. Further still, it is not necessary to provide a source of power to operate the releasable holding mechanism, such as a battery or the like, which may require periodic replacement. The buoy is
10 suitable for use with a simple mechanism such as a wind-up clock or the like which simply requires rewinding.

For assistance in arriving at an understanding of the present invention, two examples of a retrievable and submersible buoy according to the present invention are
15 illustrated in the attached drawings. However, the following description of the drawings is not to be understood to limit the generality of the above description.

In the drawings:

20 Figure 1 is a diagrammatic representation of an in-use retrievable and submersible buoy according to a first preferred embodiment of the present invention;

Figure 2 is a cross-section of the buoy of Figure 1;

25 Figure 3 is a cross-section of the internal mechanism of the buoy of Figure 1;

Figure 4 is a side-view of a retrievable and submersible buoy according to a second preferred embodiment of the present invention; and

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Figure 5 is a side-view of a retrievable and submersible buoy according to a third preferred embodiment of the present invention.

Illustrated in Figure 1 is a retrievable and submersible buoy 10 able to be retained at a submerged location below the surface of a water mass, such as on the sea bed 12, by a mooring member. The buoy 10 has enlarged end sections 16, 17 constructed from a positively buoyant material, and has a relatively narrow middle section 18 to provide an overall dumbbell like shape. The middle section 18 defines a spool section 19 on which a tether 20 is wound. The tether 20 secures the buoy 10 to an underwater mooring member 22.

The buoy 10 also comprises a restraining member in the form of an elongate cord 24. One end 26 of cord 24 is secured to one section 16 of buoy 10 while its other end 28 is releasably engaged with the other section 17. A release mechanism, for disengaging end 28 of cord 24 is provided within the buoy, and is illustrated in Figures 2 and 3.

When the loop 29 at end 28 of cord 24 is engaged, the tether 20 is constrained by the spool section 19, each end section 16, 17 of the buoy, and the cord 24, and thereby is prevented from unwinding from the spool section. The buoy is positively buoyant, and thus is urged towards the surface by that buoyancy. Therefore, with the tether 20 secured to the underwater mooring member 22, and with the cord 24 engaged, the buoy 10 is tethered to the underwater mooring 22 and is retained at

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the submerged location.

When the cord 24 is released at end 28, the tether 20 is no longer constrained and is free to unwind from the spool section by rotation of the buoy 10 about its longitudinal axis X-X, and the buoy thus is able to rise to the surface. Of course, the buoy 10 must have sufficient buoyancy to be able to travel all the way to the surface, but must not be so buoyant that the weight of the underwater mooring is not sufficient to take the buoy down to the submerged location.

The underwater mooring member 22 may be any type of mooring. A preferred use of the present invention is in the fishing industry, and in particular fishing for crayfish. The underwater mooring 22 may be a crayfish-pot, if necessary with attached weights, which would be despatched from a vessel with the buoy tethered thereto. After the crayfish-pot has been at the submerged location for a time determined as being sufficient to catch cray-fish, the buoy is required to rise to the surface so that both the buoy and the crayfish-pot and its catch can be recovered by the vessel. In this way, the vessel may leave the area without fear of the crayfish-pot being stolen by a poacher, as the buoy at its submerged location will not be visible from the surface. The vessel can simply return at the predetermined time.

Figure 2 illustrates the buoy 10 in partial cross-section to schematically show the arrangement of the internal release mechanism in relation to the buoy body. A cylindrical insert 32 containing the internal

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mechanism of the buoy (better illustrated in Figure 3) is located within the body of the buoy. The cord 24 which acts as the restraining member for the tether 20 is shown fixed to the buoy at end 26, and is shown releasably
5 secured at end 28 by engaging means 34.

The cylindrical insert 32 has side-wall 36 and end-walls 38 and 39, is and encloses a timing mechanism 40 and engaging means 34. Engaging means 34 is a rod 42 adapted for sliding movement along its longitudinal axis,
10 having a collar 44 fixed thereto and a biasing means in the form of a spring 46 about at least a portion thereof.

The timing mechanism 40 preferably includes a clock-type mechanism therewith (not shown) which may be wound-up by rod 48 and which may be set for a particular
15 time by rod 50. Rods 48 and 50 are capable of rotation for these purposes within support flanges 52 and 53, and end wall 38. The timing mechanism 40 is such that at a predetermined set time, arm 51 is released to release the engaging means 34 as described below.

20 The engaging means 34 is illustrated in Figure 3 in its engaging position. Spring 46 abuts support flange 52 to urge collar 44, and thus rod 42, towards the right-hand side of the page, and thus away from the engaging position. However, an abutment 54 on the pivotal
25 arm 56 engages the shoulder 58 of collar 44 to retain engaging means 34 in its engaging position. Abutment 54 is held in engagement with collar 44 by the arm 51 of the timing mechanism, while being urged away therefrom by a spring 60. Thus, when the arm 51 of the timing mechanism

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is withdrawn at a predetermined time, spring 60 causes pivotal arm 56 to pivot about point 62 moving abutment 54 away from shoulder 58, allowing the spring 46 to urge the collar 44 towards the right-hand side of the page, thus
5 also moving the rod 42. The rod 42 then retreats from the loop 29 (not shown) at the end of cord 24, thus releasing that cord, and allowing the tether 20 to unwind from the spool 18 as the buoy rises to the surface.

The buoy may then be retrieved, the tether
10 rewound on the spool, and the cord 24 may be returned so that the loop thereof is aligned with rod 42. By pushing rod 42 from the right-hand side of the page back towards the left-hand side, rod 42 re-engages the loop in the cord. As this happens, shoulder 64 on collar 44 abuts the
15 inclined surface 66 of pivotal arm 56, causing pivotal movement thereof so that the end 68 of pivotal arm 56 is lowered to engage the arm 51 of the timing mechanism, while abutment 54 is raised to engage shoulder 58 of the collar 44 to hold the collar, and thus the rod 42, in its
20 engaging position.

The cylindrical insert is preferably sealed to avoid contact of the internal mechanism with the water environment in which the buoy is being used. Thus rods 42, 48, and 50 project through water-proof seals in
25 respective end-walls 38 and 39.

The timing mechanism may be set to provide a time interval from 0 to 24 hours in increments of both hours and minutes. Of course, a timing mechanism which provides daily or even weekly increments may also be used. In an

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alternative form, the mechanical timing mechanism described above may be replaced by an electronic version, or any other device which is capable of being set to actuate pivotal arm 56 at a predetermined time.

- 5 The tether 20 may be of any material which provides sufficient strength, flexibility, and durability, and may be in the form of rope, chain, wire, or cable and the like. Suitable materials may include metal, plastics, polymers, terylene, Kevlar, or a combination of these.
- 10 The shape, size, material, and indeed the length, will vary according to the location, the nature of the underwater mooring, the water conditions, and the time interval required.

 Two alternative buoy shapes are illustrated in

15 Figures 4 and 5. Figure 4 shows enlarged end-sections 70, 72 which are each hemi-spherical, while Figure 5 shows a buoy with a single short cylindrical body 74 having the spool 76 integral and coaxial therebelow. In this form, the tether, when released, will unwind from the spool

20 while the buoy is upright as illustrated. Each of the variations illustrated in Figures 4 and 5 are adapted to include a releasable holding mechanism 78, 80 such as that described above, with minor alterations where necessary.

 It should be appreciated that various

25 modifications and alterations may be made to the above described construction and arrangement of parts without departing from the ambit of the present invention.

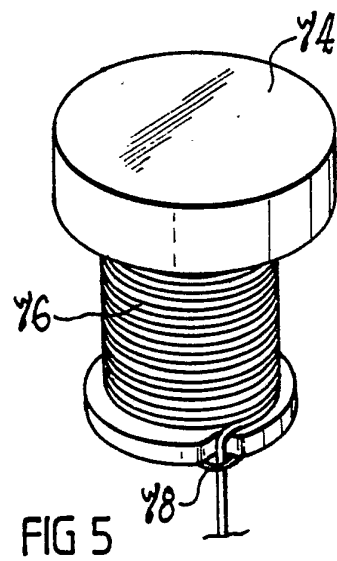
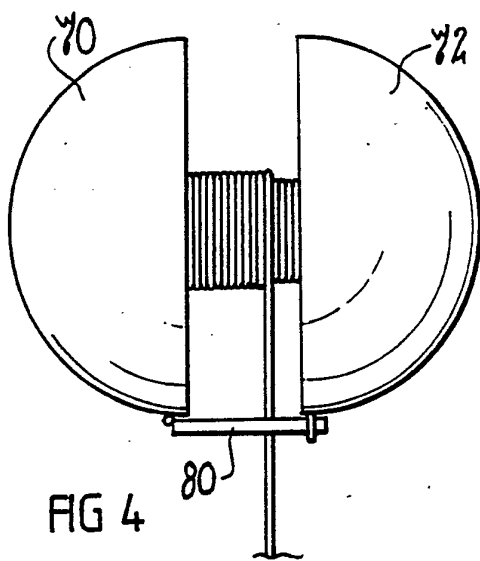
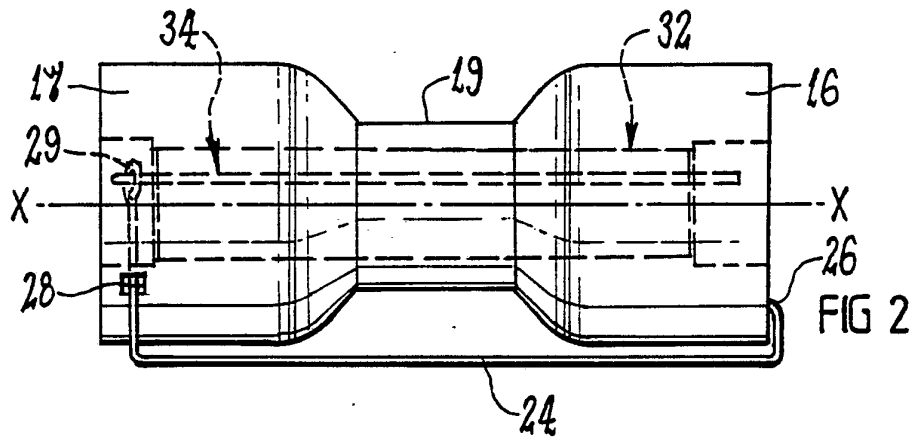
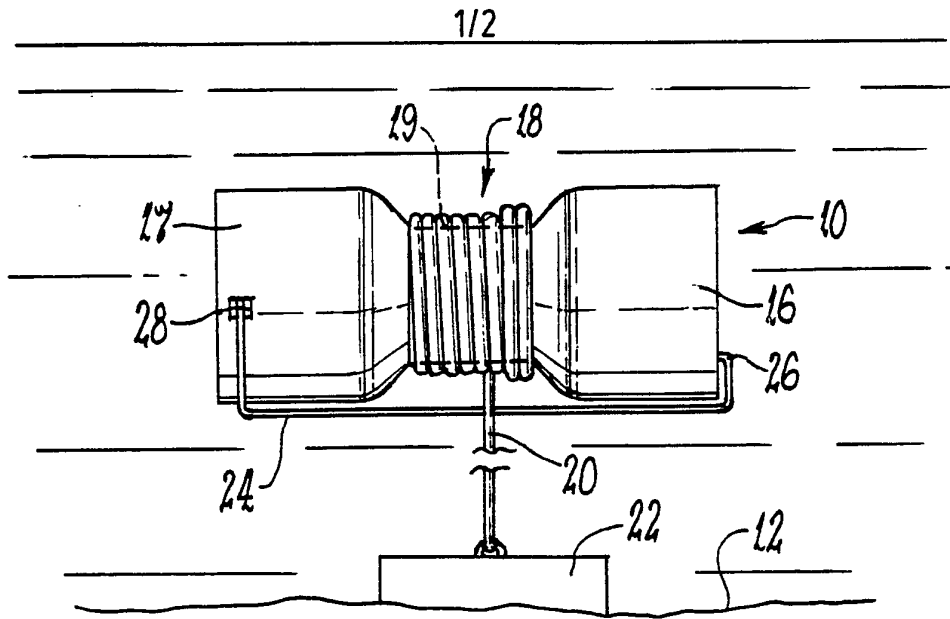
- 12 -

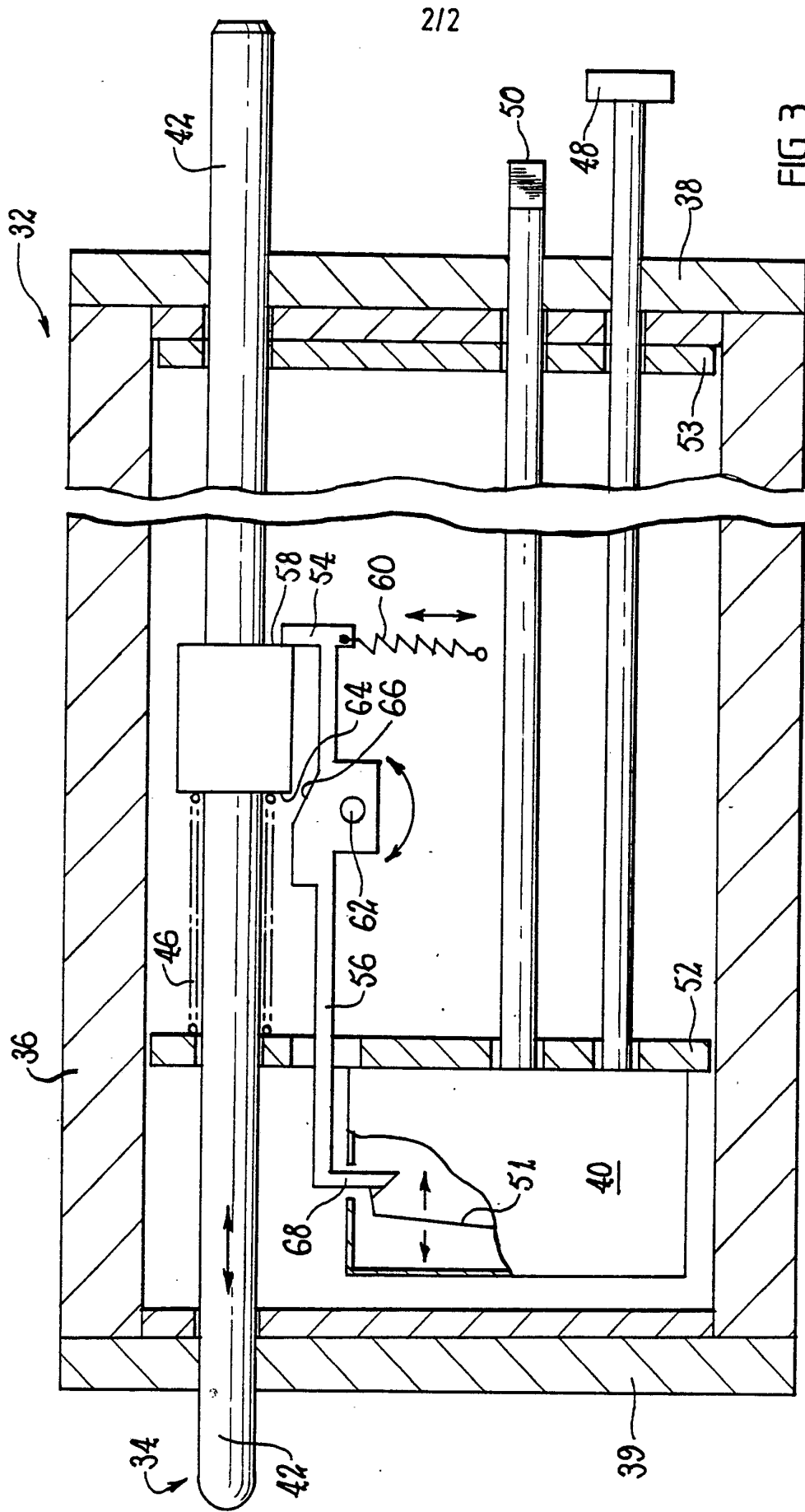
1. A retrievable and submersible buoy which is adapted to be retained below the surface of a water mass and to be subsequently released to allow ascent to the surface while being continuously tethered to an underwater
5 mooring, wherein said buoy comprises a positively buoyant body such that, when retained below the surface, the positive buoyancy urges the buoy towards the surface, a spool capable of having at least a portion of the length of the tether wound thereon, and a releasable holding
10 mechanism capable of preventing the tether from unwinding from the spool while the buoy is retained below the surface, while also being capable of allowing the tether to unwind from the spool at a predetermined time for said ascent of the buoy to the surface.
- 15 2. A buoy according to claim 1 wherein the releasable holding mechanism comprises a restraining member which is capable of preventing the tether from unwinding past a restraining point, said restraining point being fixed, or capable of being fixed, relative to the
20 spool.
3. A buoy according to claim 2 wherein the releasable holding mechanism further comprises means for engaging, and subsequently disengaging and releasing, the restraining member.
- 25 4. A buoy according to claim 3 wherein the engaging means is actuated by a timing mechanism so that the release of the restraining member may be effected at a predetermined time.
5. A buoy according to claim 4 wherein the engaging

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means and the timing mechanism are substantially enclosed in a water-proof insert which is locatable within the body of the buoy, and which is capable of being removed therefrom for repair and maintenance.

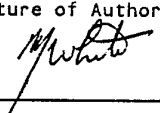
- 5 6. A buoy according to any one of claims 1 to 5 wherein the body of the buoy has a dumbbell-like shape having enlarged end sections and a comparatively narrow middle section.
7. A buoy according to claim 6, wherein the enlarged
10 end sections are positively buoyant, and the narrow middle section forms the spool.
8. A buoy according to claims 6 or 7 wherein the enlarged end sections are each substantially hemispherical in shape.
- 15 9. A buoy according to any one of claims 6 to 8 when either directly or indirectly appended to claim 5, wherein the enlarged end sections and the middle section define a bore in which the water-proof insert is locatable to be secured to the buoy.
- 20 10. A buoy according to claim 1 substantially as herein described with reference to the accompanying drawings.





INTERNATIONAL SEARCH REPORT

International Application No. PCT/AU 90/00368

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) 6		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int. Cl. ⁵ B63B 22/06		
II. FIELDS SEARCHED		
Minimum Documentation Searched 7		
Classification System	Classification Symbols	
IPC	B63B 22/06	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched 8		
AU : IPC as above		
III. DOCUMENTS CONSIDERED TO BE RELEVANT 9		
Category*	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages 12	Relevant to Claim No 13
X	US,A, 2722019 (BROCK) 1 November 1955 (01.11.55) See column 5 line 16 to column 6 line 22	(1,2,3)
X	US,A, 3871044 (WEDRALL) 18 March 1975 (18.03.75) See column 4 line 8 to column 5 line 8	(1)
X	US,A, 3858166 (HAMMOND) 31 December 1974 (31.12.74) See column 3 line 57 to column 4 line 48 & Fig.1	(1)
Y	US,A, 4262379 (JANKIEWICZ) 21 April 1981 (21.04.81) See column 2 line 24 to column 4 line 50	(1,2,6,7)
Y	US,A, 4074380 (PARKER) 21 February 1978 (21.02.78) See column 2 line 1 to column 3 line 2	(1,2,6,7)
(continued)		
* Special categories of cited documents: 10	"T" Later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step	
"E" earlier document but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.	
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family	
"O" document referring to an oral disclosure, use, exhibition or other means		
"P" document published prior to the international filing date but later than the priority date claimed		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
12 October 1990 (12.10.90)	15 October 1990	
International Searching Authority	Signature of Authorized Officer	
Australian Patent Office		P.J. WHITE

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

Y	US,A, 4238864 (KEALOHA) 16 December 1980 (16.12.80) See column 2 lines 7 to 25	(1,2,6,7,8)
A	US,A, 4535430 (COCHRANE, Jr et al) 13 August 1985 (13.08.85)	
A	US,A, 4 601126 (KLOCKSIEB) 22 July 1986 (22.07.86)	
A	US,A, 4544364 (BANKSTON) 1 October 1985 (01.10.85)	

V. [] OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE 1

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. [] Claim numbers ..., because they relate to subject matter not required to be searched by this Authority, namely:

2. [] Claim numbers , because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. [] Claim numbers ..., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4 (a):

VI. [] OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING 2

This International Searching Authority found multiple inventions in this international application as follows:

1. [] As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. [] As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. [] No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. [] As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

[] The additional search fees were accompanied by applicant's protest.

[] No protest accompanied the payment of additional search fees.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON
INTERNATIONAL APPLICATION NO. PCT/AU 90/00368

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document
Cited in Search
Report

Patent Family Members

US 3871044 US 3934865

US 3858166

US 4262379

US 4074380

US 4238864

US 4535430 US 4839873

US 4601126 CA 1219124 US 4516349

US 4544364

END OF ANNEX