(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
20 January 2005 (20.01.2005)

PCT

(10) International Publication Number
WO 2005/005244 A1

(51) International Patent Classification[7]: B63B 22/16

(21) International Application Number:
PCT/KR2004/001679

(22) International Filing Date: 8 July 2004 (08.07.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10-2003-0046311 9 July 2003 (09.07.2003) KR

(71) Applicant and
(72) Inventor: **CHA, Bong-Ryeol** [KR/KR]; 1269, Sangyeok-2dong, Buk-gu, Daegu 704-833 (KR).

(74) Agent: **CHO, Jung-Hwan**; 1251, Bisan-7dong, Seo-gu, Daegu 703-047 (KR).

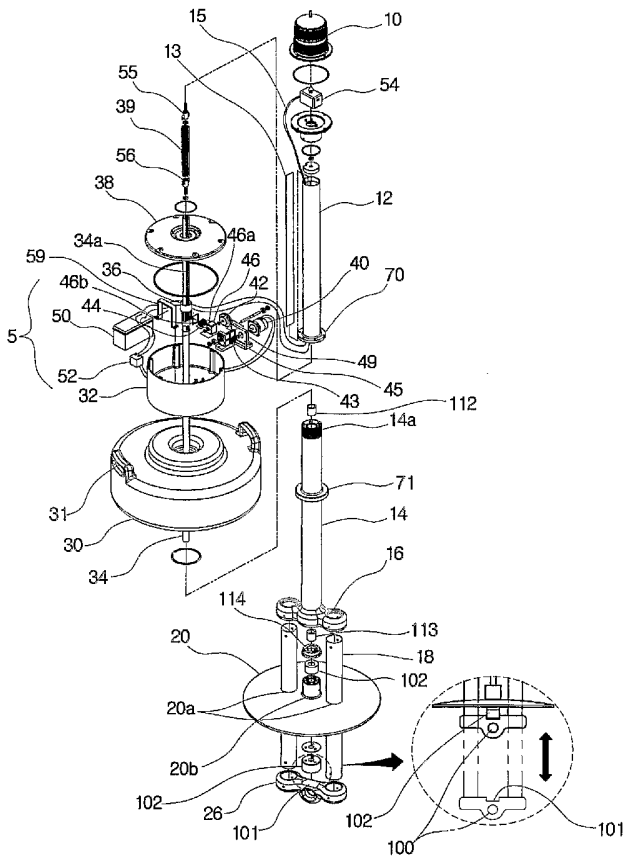
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

[Continued on next page]

(54) **Title:** MARKING BUOY DEVICE USING WAVE POWER GENERATION



(57) **Abstract:** Disclosed herein is a marking buoy device using wave power generation. The marking buoy device includes a support unit, a sustaining disc, an operation unit, a buoyancy unit and a flicker controller. In the support unit, upper and lower support rods and a pair of guide rods are vertically combined together and a marking lamp is mounted on the upper support rod. The sustaining disc allows the guide rods to move upward and downward. The operation means operates a generator using relative movement and charges a battery. The buoyancy unit watertightly accommodates the operation means in a separate space.

WO 2005/005244 A1

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

MARKING BUOY DEVICE USING WAVE POWER GENERATION

Technical Field

The present invention relates, in general, to a marking buoy device and, more particularly, to a marking buoy device using wave power generation, which is highly efficient in emitting light by converting wave energy into electric energy, allows the principal parts thereof to be operated without hindrance under rough sea weather conditions, and has improved durability.

Background Art

Generally, marking buoys are placed in the sea to emit light during the night. The marking buoys are utilized to prevent injury to humans and damage to materials by guiding ships through safe routes. Additionally, the marking buoys are effectively used to inform fishermen, who depend on sea farming for living due to the exhaustion of fish resources, of the positions of fishing nets. Accordingly, demands for the marking buoys has been increasing year after year.

If such marking buoys use batteries as operation power sources for emitting light, they are inconvenient in that the batteries must be frequently replaced and the maintenance of the batteries must be thoroughly performed,

so that the utility thereof is low or the inconvenience of maintenance is high. As a result, independent power generation means are required for the marking buoys. To meet this requirement, there have been proposed methods of providing wave power generators (using the kinetic energy of waves) and frequently charging batteries.

Meanwhile, the size and frequency of waves are not kept constant and the variations thereof are large according to regions and seasons, so that the efficiency of use of power through wave power generation is an important factor. The marking buoys must be carefully protected to allow wave power generators are operated without hindrance under bad weather accompanied with a strong wind and to prevent damage attributable to a collision or the infiltration of seawater. However, countermeasures against the above-described problems are not provided in the conventional marking buoys.

Disclosure of the Invention

Accordingly, the present invention has been made keeping in mind the above problems occurring in the prior art, and an object of the present invention is to provide a marking buoy device using wave power generation, which is highly efficient in emitting light by converting wave energy into electric energy, allows the principal parts thereof to be operated without hindrance under rough sea

weather conditions, and has improved durability.

In order to accomplish the above object, the present invention provides a marking buoy device using wave power generation, the marking buoy device generating power using waves, storing the power in a battery and powering a marking lamp, including a support unit in which upper and lower support rods and a pair of guide rods are vertically combined together and the marking lamp is mounted on a top of the upper support rod; a sustaining disc curved downward and adapted to allow the guide rods to move upward and downward; an operation means for operating a generator using relative movement of a shaft attached to the sustaining disc and a floating body and charging the battery through a battery charge controller; a buoyancy unit attached to the center of the support unit, cylindrically shaped to generate buoyancy, and adapted to watertightly accommodate the operation means in a separate space; and a flicker controller mounted on the upper support rod to operate the marking lamp at preset flicker periods.

Guide grooves are formed on an inside of the upper support rod, a partition wall is fitted into the guide grooves, and electric lines are accommodated in a space formed by the partition wall.

In an embodiment, the buoyancy unit has a gearbox protruded upward from the floating body, and watertightness is maintained in the gearbox through casings.

In another embodiment, the buoyancy unit has a gearbox placed in an upper portion of the floating body, and watertightness is maintained in the gearbox through casings.

Brief Description of the Drawings

The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is an exploded perspective view showing a marking buoy device in accordance with a preferred embodiment of the present invention in detail;

FIGS. 2a and 2b are front and plan views showing the assembled marking buoy device, respectively;

FIG. 2c is an enlarged perspective view showing the gearbox of the marking buoy device of FIG. 1;

FIGS. 3a to 3c are enlarged sectional views showing racks in accordance with various embodiments of the present invention;

FIG. 4 is an enlarged perspective view showing the upper support rod of the present invention with a side thereof being cut away;

FIG. 5 is an enlarged perspective view showing the spring and upper and lower spring adjusting bolts of the present invention;

FIG. 6 is an enlarged view showing the casings of the present invention;

FIGS. 7a to 7d are views showing various sustaining discs in accordance with various embodiments of the present invention;

FIG. 8 is a perspective view showing the electric construction of the present invention;

FIGS. 9a to 9c are views showing anchor cables in accordance with various embodiments of the present invention;

FIG. 10 is a diagram showing the operation of the marking buoy device of FIG. 1;

FIG. 11 is an exploded perspective view showing a marking buoy device in accordance with another embodiment of the present invention;

FIGS. 12a and 12b are front and plan views showing the assembled marking buoy device of FIG. 11, respectively; and

FIG. 12c is an enlarged view showing a gearbox of the device of FIG. 11.

Best Mode for Carrying Out the Invention

Reference should now be made to the drawings, in which the same reference numerals are used throughout the different drawings to designate the same or similar components.

FIG. 1 is an exploded perspective view showing a marking buoy device in accordance with a preferred embodiment of the present invention in detail. FIGS. 2a and 2b are front and plan views showing the assembled marking buoy device, respectively. FIG. 2c is an enlarged perspective view showing the gearbox of the marking buoy device of FIG. 1.

The present invention relates to a device for generating power through the use of the energy of waves, storing the power in a battery 50 and powering a marking lamp 10. The marking lamp 10 is a Direct Current (DC) power-operated lamp, and may be provided with a reflecting mirror. The battery 50 preferably is of a capacity ranging from DC 1.5 V~DC 24 V. A capacity of DC 12 V is most preferable. A capacity of DC 24 V used for marine engines can be desirably used.

The present invention employs a support unit in which upper and lower support rods 12 and 14 and a pair or guide rods 18 are vertically combined together. A marking lamp 10 is mounted on the top of the upper support rod 12, and a flange 70 is formed on the bottom of the upper support rod 12. The detailed construction of the upper support rod 12 is illustrated in FIG. 3. A threaded portion 14a is formed on the top of the lower support rod 14, a flange 71 is formed on the center of the lower support rod 71, and a glasses frame-shaped securing part 16 is integrally formed on the bottom of the lower support rod 14. The pair of

guide rods 18 are vertically and parallelly arranged below the lower support rod 14 with the assistance of the securing part 16 and the securing element 26. The guide rods 18 may not be composed of a pair of guide rods, but may be composed of three guide rods. The pair of guide rods 18 are parallelly supported by the glasses frame-shaped securing element 26 that is provided with a cable hole 100 and a shock absorbing depression 101. In more detail, the securing element 26 has the cable hole 100 for holding one end of an anchor cable 110, and the shock absorbing depression 101 for accommodating a damping element 102 attached to the bottom of the sustaining disc 20 to reduce the impact between the securing part 16 and the sustaining disc 20. The shock absorbing depression 101 and the damping element 102 are formed to provide for the case where the sustaining disc 102 abruptly collides with the securing element 26. The straight upper and lower support rods 12 and 14 and the guide rods 18 are all formed of hollow tubes. In particular, the guide rods 18 are made of steel material (stainless steel) having superior mechanical strength and anti-corrosive property.

The sustaining disc 20 is constructed to allow the guide rods 18 to be raised and lowered therethrough. Accordingly, the sustaining disc 20 functions to support the guide rods 18 while the guide rods 18 passing through both sides of the sustaining disc 20 are raised and lowered. In other words, as the floating body 30 is raised

by waves, the guide rods 18 are raised along with the floating body 30. At this time, the sustaining disc 20 is maintained at an original location by the balance of the pressure of seawater and buoyancy and a shaft 34 firmly attached to the sustaining disc 20 is also maintained at an immobile state. In contrast, the guide rods 18 connected to the floating body 30 are raised along with the floating body 30, so that power is generated by various elements within the gearbox 32. As the sustaining function of the sustaining disc 20 is increased, the raising of the guide rods 18 is increased. Hence, in view of the efficiency of power generation, it is preferable that the sustaining disc 20 is heavy and the floating body 30 is light. The sustaining disc 20 may be constructed to be curved downward or flat. Furthermore, a plurality of sustaining discs 20 may be provided. These will be described later in detail with reference to FIG. 6.

Furthermore, as shown in FIG. 2a, guide bushes 112 and 113 are mounted on the upper and lower portions of the lower support rod 14, and a guide bush securing bracket 114 is mounted below the lower guide bush 113. A tightening bolt 90 is tightened through the sustaining disc 20 into the lower end of the shaft 34 to firmly attach the sustaining disc 20 to the shaft 34, combining bolts 93 are fitted into nuts 94 with a stainless steel washer 91 and a bracket 92 put on the top and bottom of the sustaining disc 20, respectively, being interposed therebetween, a lateral

tightening bolt 95 is tightened through both sides of the bracket 92 extending through the shaft 34, and a buffering element 102 made of material, such as rubber, is placed above the lateral tightening bolt 95. Additionally, although there are many methods of firmly combining the sustaining disc 20 with the shaft 34, the operation and effect thereof are similar to those of the above-described example, so that the detailed descriptions thereof is omitted.

In accordance with the present invention, an operation means, in which the generator is operated by the relative movement of the shaft 34 and the floating body 30, and the battery 50 is charged through a battery charge controller 52, is employed. The shaft 34 having the rack 34a or 34a' is accommodated in the lower support rod 14, and is connected to the center of the floating body 30 at the lower end thereof and to the spring 39 at the upper end thereof. Although the mechanism, in which the generator 40 is operated by the rack/pinion operation that is performed by the engagement of the rack 34a or 34a' and the pinion 44, is identical with that of the prior art, the operation means of the present invention may further include a speed-up gear 42 and a driven gear 43 between the pinion 44 and the generator 40.

Furthermore, the operation means of the present invention further includes the battery charge controller 52 between the generator 40 and the battery 50. The battery

charge controller 52 performs the function a regulator for adjusting the magnitude of current using the magnitude of voltage, and a function of preventing overcharge when the battery 50 is fully charged at a preset voltage. Meanwhile, since the generator 40 of the present invention is operated in forward and reverse directions, the battery charge controller 52 performs a function of rectifying power output during the forward and reverse operations of the generator 40 first.

The present invention employs a buoyancy unit 4, which has a cylindrically shaped structure attached to the center portion of the support unit to generate buoyancy, and which watertightly accommodates the operation means in a separated space. In accordance with an embodiment of the present invention, the buoyancy unit 5 is provided with a gearbox 32 upwardly protruded from the top of the floating body 30, and watertightness is maintained using casings 36 and 46 within the gearbox 32. As shown in FIG. 2a, the upper flange 70 of the upper support rod 12 is attached to the cover 38 of the gearbox 32, the center flange 71 of the lower support rod 14 is attached to the bottom of the floating body 30, and the upper end of the lower support rod 14 is attached to the bottom of the gearbox 32. The first casing 36 is mounted in the gearbox 32 to be coaxial with the upper and lower support rods 12 and 14. The upper and lower rods 12 and 14 are not directly connected to each other, but are connected to each other through the first

casing 36. The casings 36 and 46 accommodate the rack 34a or 34a' of the shaft 34 and the pinion 44 that are engaged with each other, and are important parts for ensuring watertightness. The detailed construction thereof will be described with reference to FIG. 5

From FIG. 2b, it can be understood that the battery 50 and the generator 40 are arranged to be symmetrical with respect to the shaft 34, and the battery 50 is firmly secured by a battery fastening element 59. The battery 50 may be mounted at other locations other than a location within the gearbox 32. Although the rack 34a or 34a' and the pinion 44 is mounted within the casings 36 and 46 and the speed-up gear 42 and the driven gear 43 are mounted on a gearbox frame 45, they are operated in conjunction with each other. A stepping motor or something equivalent to or superior to the stepping motor is preferably used as the generator 40. The ratio of the rotation speed of the rack 34a or 34a' to the rotation speed of the speed-up gear 42 is preferably 1:1:1, and the ratio of the rotation speed of the speed-up gear 42 to the rotation speed of the driven gear 43 is preferably 1:3. However, the ratios can be suitably adjusted. The amount of power generation is proportional to the ratio of the rotation speed of the speed-up gear 42 to the rotation speed of the driven gear 43. The driven gear 43 is not indispensable, so that it may not be included to prevent overcharge when the energy of waves is high. In the opposite case, second and third

driven gears can be additionally installed.

In the gearbox 32, reference numerals 81 and 82 designate a speed-up gear shaft and a ball bearing, respectively, a reference numeral 83 designates a fastening bracket for fastening a speed-up gear shaft and the ball bearing, reference numeral 84 designates a driven gear shaft, reference numerals 85 and 86 designate a support rod for fastening a motor and a ball bearing, and reference numerals 87 and 88 designate another fastening bracket and a coupling. In the floating body 30, reference numerals 31 and 61 designate grips that allow a user to easily grip the device of the present invention when the user moves or lifts up the device.

In the meantime, the present invention includes a flicker controller 54 that is mounted on the upper support rod 12 so that the marking lamp 10 can is operated at preset flicker periods. A lamp 54a is placed above the flicker controller 54, and is inserted into the marking lamp 10. The flicker controller 54 may be formed of an Integrated Circuit (IC), or a timer relay. The on/off operation of the marking lamp 10 is switched by an adjusting knob (not shown). Furthermore, an illumination sensor 54b may be provided on a side of the flicker controller 54 to allow the marking lamp 10 to be operated only at night.

FIGS. 3a to 7 are sectional, perspective and plan views showing the principal parts of FIG. 1.

FIGS. 3a to 3c are enlarged sectional views showing racks in accordance with various embodiments of the present invention,

In the case of the shaft 34 shown in FIG. 2a, a rack 34a is directly formed on one side of the shaft 34 made of stainless steel material or material equivalent to or superior to the stainless steel material (capable of preventing corrosion). As shown in FIG. 3a, a small diameter stainless steel shaft 34b is inserted into the upper end portion of the shaft 34, the shaft 34b and the shaft 34 are welded at an initial contact location and secured by locking pins 34c, and then a rack 34a' made of Teflon resin is tightly fitted over the small diameter shaft 34b. In this case, the rack 34a' can be manufactured in an insert manner, together with the shaft 34b. Furthermore, as shown in FIG. 3b, a lower fastening block 140 is inserted into the inside of the upper end of the shaft 34, a small-diameter shaft 34b made of stainless steel is fitted on the lower fastening block 140, the shaft 34b and the lower fastening block 140 are welded at an initial contact location and secured by locking pins 34c, a rack 34a' made of hard resin is fitted over the outer surface of the shaft 34b having a small diameter, and a threaded upper fastening block 141 is fitted into the inside of the upper portion of the shaft 34b. Furthermore, as shown in FIG. 3c, a rack 34' made of hard resin can be

made to cover the outer surface of the upper portion of the shaft 34 that includes a lower portion having a large diameter and the upper portion having a small diameter. As described above, racks can be manufactured in various forms, but the embodiments of FIGS. 3b and 3c are preferable.

In the meantime, when the rack 34a' made of Teflon resin is engaged with a pinion 44 (which will be described later), the wear of the rack 34a' and the pinion 44 is not severe or the degrees of wear of the rack 34a' and the pinion 44 are the same because the pinion 44 is also made of Teflon resin even though they will have been used for a long period, so that the life spans thereof can be long. In contrast, if the rack 34a made of stainless steel is engaged with the pinion 44 made of Teflon resin, the degree of the wear of the pinion 44 may be higher than that of the rack 34a. Although it is preferable that the rack and the pinion are made of the same material, the shaft 34 should be made of stainless steel to prevent corrosion. When the rack and the pinion are made of different materials, the engagement structure thereof may vary from the above-described case. Lower spring adjusting bolts 56 are inserted into the tops of the shafts 34 and 34b, respectively, regardless of the engaging structures of the shafts 34 and 34b.

FIG. 4 is an enlarged perspective view showing the upper support rod of the present invention with a side

thereof being cut away

That is, guide grooves 12a are formed along the upper support rod 12 of the support unit, a partition wall 13 is fitted into the guide grooves 12a, electric lines 15 are accommodated in one compartment, and the spring 39 is accommodated in the other compartment. Since the spring 39 is moved upward and downward inside the upper support rod 12 and the electric lines 15 are influenced by the movement of the spring 39, a separate sealing space is preferably formed to protect the electric lines 15 connected from the battery 50 to the marking light 10.

FIG. 5 is a perspective view showing upper and lower spring adjusting bolts 55 and 56.

A plurality of holes 55 and 56 are formed in the upper and lower spring adjusting bolts 55 and 56. The upper and lower ends of the spring 39 are held by the holes 57. Accordingly, when the floating body 30 is lowered by waves, the spring 39 is extended by the weight of the floating body 30. When the floating body 30 is raised by waves, the spring 39 is restored to the original shape thereof and thus helps the heavy floating body 30 be raised. As a result, the floating body 30 can be easily raised and lowered, so that the efficiency of power generation can be increased. Furthermore, the upper and lower spring adjusting bolts 55 and 56 function to adjust the tensile force of the spring 39.

FIG. 6 is a perspective view showing the casings 36

and 46 in the gearbox 32.

In FIG. 6, a rectangular opening 36a is formed in one side of the first casing 36, and the rack 34a or 34a' of the shaft 34 is exposed through the opening 36a. A rectangular packing 46b is placed between the opening 46a of the box-shaped second casing 46 and the opening 36a of the first casing 36 to improve waterproof capability. The pinion 44 is accommodated in the second casing 46. The shaft of the pinion 44 is made watertight by a V-shaped ring 46d fitted into the opening 46c of the second casing 46, and the pinion 44 is connected to the generator 40 through the speed-up gear 42 and the driven gear 43. Accordingly, even though seawater infiltrates into the lower support rod 14 and reaches the rack 34a or 34a' and the pinion 44, watertightness is guaranteed by the casings 36 and 46. As a result, seawater does not infiltrate into the gearbox 32, so that principal electric elements, such as the generator 40 and the battery 50, are safe.

FIGS. 7a to 7d are views showing various sustaining discs in accordance with various embodiments of the present invention.

In FIGS. 7a and 7b, the sustaining disc 20 is a disc having a downward curvature. A boss 20b is formed on the center of the sustaining disc 20, and through holes 20a are formed in both sides of the sustaining disc 20. If the sustaining disc is shaped in the form of a disc without curvature or is shaped to have a downward curvature, dregs

may be easily accumulated thereon. In contrast, if the sustaining disc is constructed to have a disc shape as shown in the drawing, sustaining power is slightly weakened, but durability is increased. The lower end of the shaft 34 is attached to the boss 20b, and the guide rods 18 are inserted into the through holes 20a to slide upward and downward. A lattice-shaped bead portion 20c is formed on the bottom of the sustaining disc 20.

In FIG. 7c, another annular sustaining disc 21 is formed around a center sustaining disc 20 and the disc 21 is connected to the disc 20 with connecting shafts 22. In FIG. 6b, a plurality of sustaining discs 21 are arranged around a center sustaining disc 20 and the sustaining discs 21 are connected to the center sustaining disc 20 with a plurality of connecting shafts 22. When a plurality of sustaining discs are arranged as described above, the sustaining power of the sustaining discs are enhanced, so that the raising and lowering of the floating body 30 are actively performed, thus improving the amount of power generation. However, the amount of power generation is not necessarily proportional to the number of sustaining discs.

In the meantime, the buffering element 102 is mounted to provide buffering when the sustaining disc 20 collides with the securing part 16 and the securing element 26 while being raised and lowered as described above.

FIG. 8 is a perspective view showing the electric construction of the present invention.

The generator 40 is operated by the relative movement of the shaft 34 placed in the lower support rod 14 and the floating body 30. Once power is generated, the power charges the battery 50 through the battery charge controller 52. The electric line 15 is connected to the marking lamp 10 through the flicker controller 54. Even though independent power generation is achieved by the generator 40, the battery 50 can supply power for at least 25~30 days, but cannot power the marking light 10 without power generation thereafter. Accordingly, independent power generation using the raising and lowering of the floating body 30 is indispensable. Furthermore, as long as waves exist, the raising and lowering of the floating body 30 and the independent power generation of the generator 40 are guaranteed. Since the battery 50 is overloaded when the degree of charge is excessive, the battery charge controller 52 is provided to prevent overcharge. In the places where waves are weak, the battery charge controller 52 may be omitted.

FIGS. 9a to 9c are schematic diagrams showing anchor cables in accordance with various embodiments of the present invention.

In FIG. 9a, one end of an anchor cable 110 is tied to the cable hole 100 formed at the center of the glasses frame-shaped securing element 26, and the other end of the anchor cable 110 is tied to an anchor 111 brought into contact with the floor of the sea. In FIG. 9b, a weight

body 112 made of cement is connected to one end of an anchor cable 110, which is useful for the case where an anchor cannot perform the function thereof because the floor of the sea is covered with sand. FIG. 8c shows the case where one end of an anchor cable 110 is tied to a large-sized net 105 so that the free drifting of a floating body 30 can be prevented. As a result, as long as the free drift of the floating body 30 is prevented by the anchor cable 110, the floating body 30 can be raised and lowered, and therefore, power can be generated. The main reason why the guide rods 18 are placed on both sides of the sustaining disc 20 is to allow the guide rods 18 to be raised and lowered without twisting while the floating body 30 is raised and lowered in a zigzag manner. The anchor cable 110 may not be tied to the cable hole, but may be tied to the bottom of the sustaining disc 20 or a portion of the floating body 30. In the case where the anchor cable 110 is tied to the sustaining disc 20, the spring 39 may break off in heavy seas. In the case where the anchor cable 110 is tied to the floating body 30, the anchor cable 110 may be twisted by the floating body 30 that is being rotated by the power of waves. Consequently, the anchor cable 110 is preferably tied to the cable hole 100 of the securing element 26 from the above-described points of view.

FIG. 10 is a diagram showing the operation of the marking buoy device of FIG. 1.

Since the lower portion of the device including the sustaining disc 20 is weighty, the device is maintained in a roughly vertical position. The sustaining disc 20 is maintained at a constant height regardless of the raising and lowering of waves but the floating body 30 is raised and lowered by waves, so that relative movement is caused. Accordingly, as the floating body 30 is raised and lowered, the gears are operated in the order of the pinion 44, the speed-up gear 42 and the driven gear 43, thus operating the generator 40. The electricity generated by the generator 40 is stored in the battery 50 and powers the marking lamp 40 at preset flicker intervals through the flicker controller 54.

FIG. 11 is an exploded perspective view showing a marking buoy device in accordance with another embodiment of the present invention. FIGS. 12a and 12b are front and plan views showing the assembled marking buoy device of FIG. 11, respectively. FIG. 12c is an enlarged view showing a gearbox of the device of FIG. 11.

In another embodiment of the present invention, a floating body 60 is provided with a gearbox 62 so that the buoyancy unit 5 is contained in the upper portion of a floating body 60. A watertight space is formed within the gearbox 62 through the use of casings 36 and 46. To this end, the shapes of the floating body 60 and the gearbox 62 differ from those of the corresponding elements of the first embodiment. When the gearbox 62 is contained in the

floating body 60 as shown in FIG. 12a, the device is advantageous in that the device can be easily maintained in a vertical position because the center of gravity of the device is lowered, but is disadvantageous in that principal electric parts, including a generator 40 and a battery 50, must be watertight because they are brought close to the surface of the sea.

Most of the construction of FIG. 11 is identical with most of the construction of FIG. 1. When the location of the installation of the generator 40 is changed, a gearbox frame 65 instead of the gearbox frame 45 of FIG. 1 is necessary. To symmetrically arrange the generator 40 and the battery 50 in a balanced manner, the size of the gearbox frame 65 may be increased, as shown in FIGS. 12b and 12c. However, the construction and operation of the casings 36 and 46 are identical with those of FIG. 1.

Besides, in the embodiment of FIG. 11, the direction of the installation of a grip 61 formed on the top of the floating body 60 varies from that of FIG. 1, the shape of a cover 68 placed on the top of the gearbox 62 slightly varies from that of FIG. 1, and a lower support rod 14 is fastened by a plurality of bolts. Other elements are identical with the corresponding elements of FIG. 1, and the operation and effects thereof are identical with those of FIG. 1.

Industrial Applicability

As described above, the present invention provides the marking buoy device using wave power generation, which is highly efficient in emitting light by converting wave energy into electric energy, allows the principal parts thereof to be operated without hindrance under rough sea weather conditions, and has improved durability.

Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

Claims

1. A marking buoy device using wave power generation, the marking buoy device generating power using waves, storing the power in a battery and powering a marking lamp, comprising:

a support unit in which upper and lower support rods and a pair of guide rods are vertically combined together and the marking lamp is mounted on a top of the upper support rod;

a sustaining disc curved downward and adapted to allow the guide rods to move upward and downward;

operation means for operating a generator using relative movement of a shaft attached to the sustaining disc and a floating body and charging the battery through a battery charge controller;

a buoyancy unit attached to a center of the support unit, cylindrically shaped to generate buoyancy, and adapted to watertightly accommodate the operation means in a separate space; and

a flicker controller mounted on the upper support rod to operate the marking lamp at preset flicker periods.

2. The marking buoy device according to claim 1, wherein the buoyancy unit has a gearbox protruded upward from the floating body, and watertightness is maintained in the gearbox through casings.

3. The marking buoy device according to claim 1, wherein the buoyancy unit has a gearbox placed in an upper portion of the floating body, and watertightness is maintained in the gearbox through casings.

4. The marking buoy device according to claim 1, wherein guide grooves are formed on an inside of the upper support rod, a partition wall is fitted into the guide grooves, and electric lines are accommodated in a space formed by the partition wall.

5. The marking buoy device according to claim 1, wherein an upper spring adjusting bolt, a spring and a lower spring adjusting bolt are sequentially arranged inside the upper support rod, and upper and lower ends of the spring are attached to holes of the upper spring adjusting bolt and holes of the lower spring adjusting bolts, respectively.

6. The marking buoy device according to claim 1, wherein a rack is directly formed on a side of the shaft, a rack made of resin is fitted over an outer surface of an upper end of the shaft, or a small-diameter shaft is inserted into an upper end of the shaft and a rack made of resin is formed over an outer surface of the small-diameter shaft.

7. The marking buoy device according to claim 2 or 3, wherein the casings are constructed in such a way that a packing is interposed between an opening of a first casing and an opening of a second casing and a shaft of a pinion accommodated in the second casing is made airtight by a V-shaped ring fitted into the opening of the second casing.

8. The marking buoy device according to claim 2 or 3, wherein a speed-up gear and a driven gear are arranged within a gearbox frame of the gearbox to be connected to a pinion, and the driven gear is connected to the generator.

9. The marking buoy device according to claim 1, wherein another disc is placed around the sustaining disc or a plurality of discs are arranged around the sustaining disc, and the discs are connected to each other with connecting shafts.

10. The marking buoy device according to claim 1, wherein the battery is charged through a generator and a battery charge controller and the marking lamp is operated through a flicker controller, but the battery controller and/or the flicker controller may be omitted.

11. The marking buoy device according to claim 1, wherein the anchor cable is attached to the sustaining disc

or floating body except for the cable hole of the securing element.

Fig.1

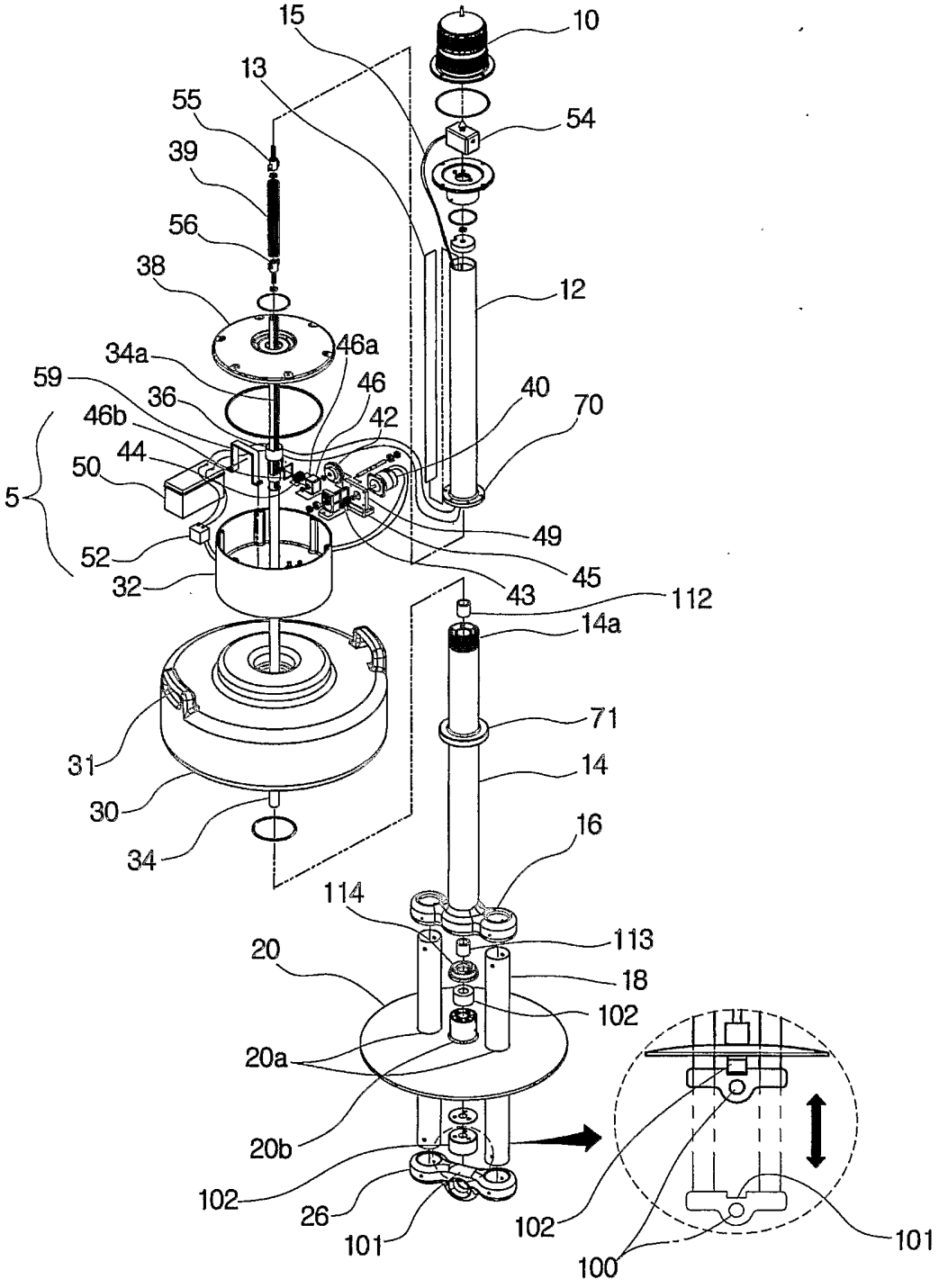

15
10
13
55
54
39
56
12
38
34a
46a
59
46
40
36
70
46b
42
44
50
5
49
52
45
32
43
112
14a
71
31
14
30
16
34
114
113
20
18
102
20a
20b
102
26
101
102
100
101

Fig.2a

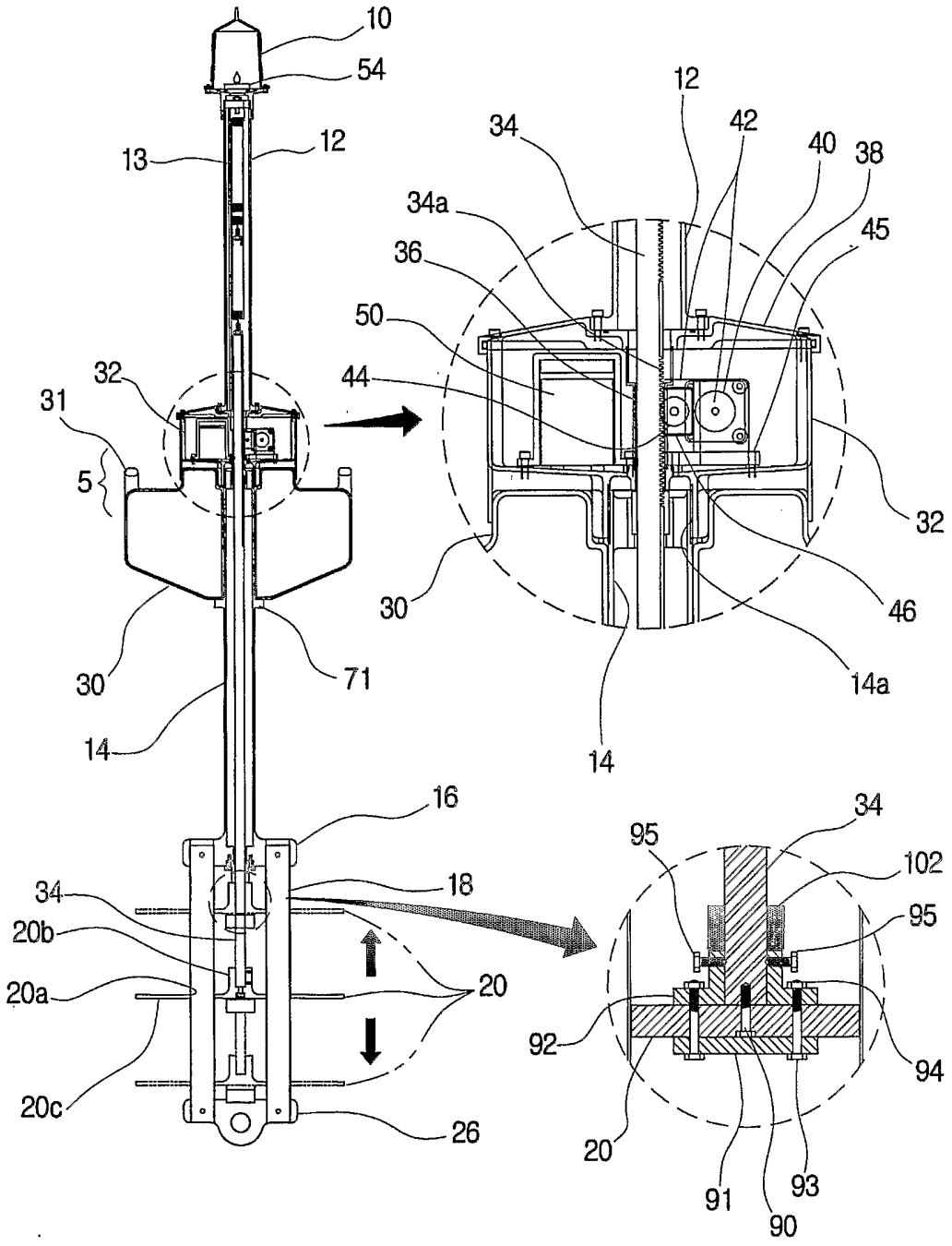

10
54
13
12
32
31
5
30
71
14
16
34
18
20b
20a
20
20c
26
12
34
42
40
38
34a
45
36
50
44
32
30
46
14a
14
34
95
102
95
92
94
20
91
90
93

Fig.2b

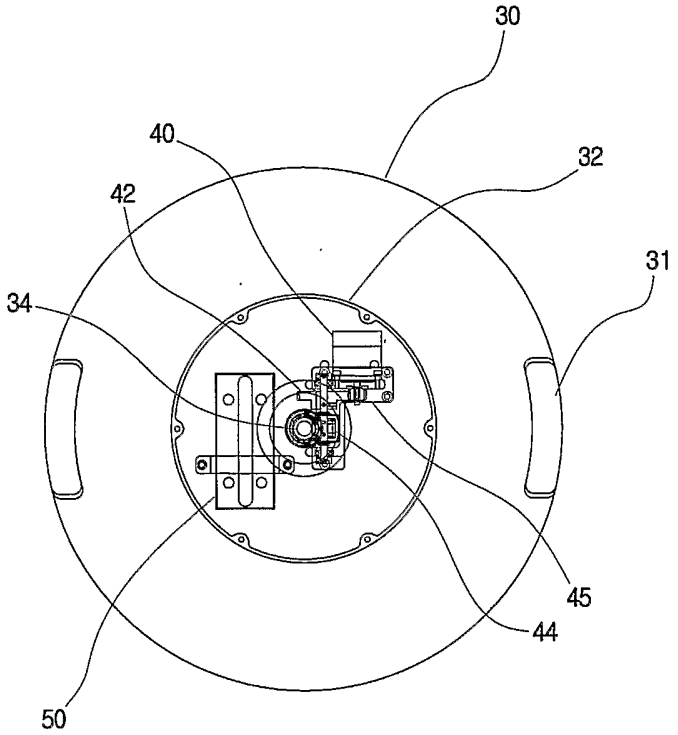

30
40
32
42
31
34
45
44
50

Fig.2c

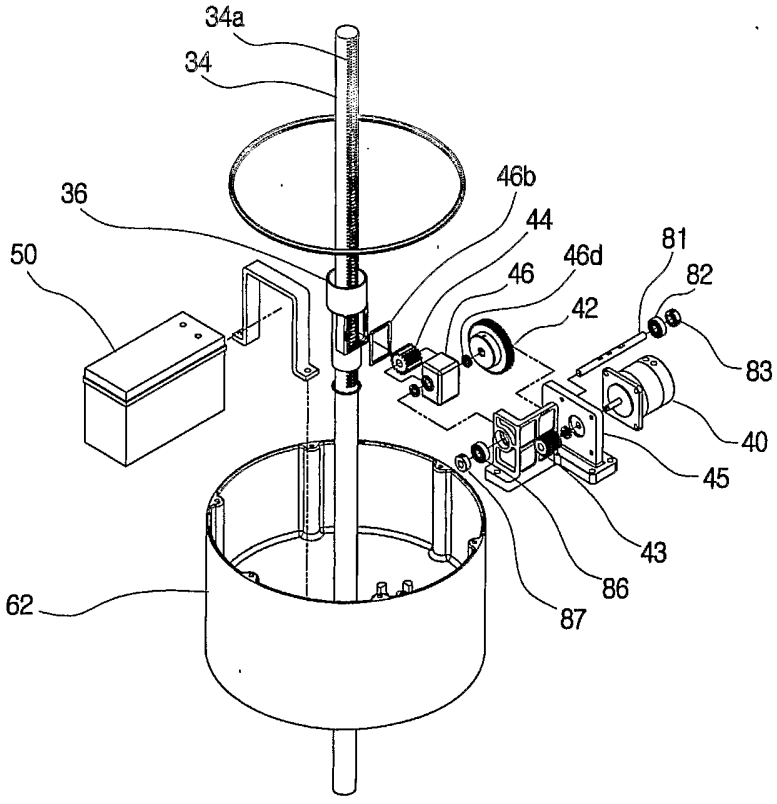

34a
34
36
46b
44
50
46d
46
81
82
42
83
40
45
43
86
62
87

Fig.3a

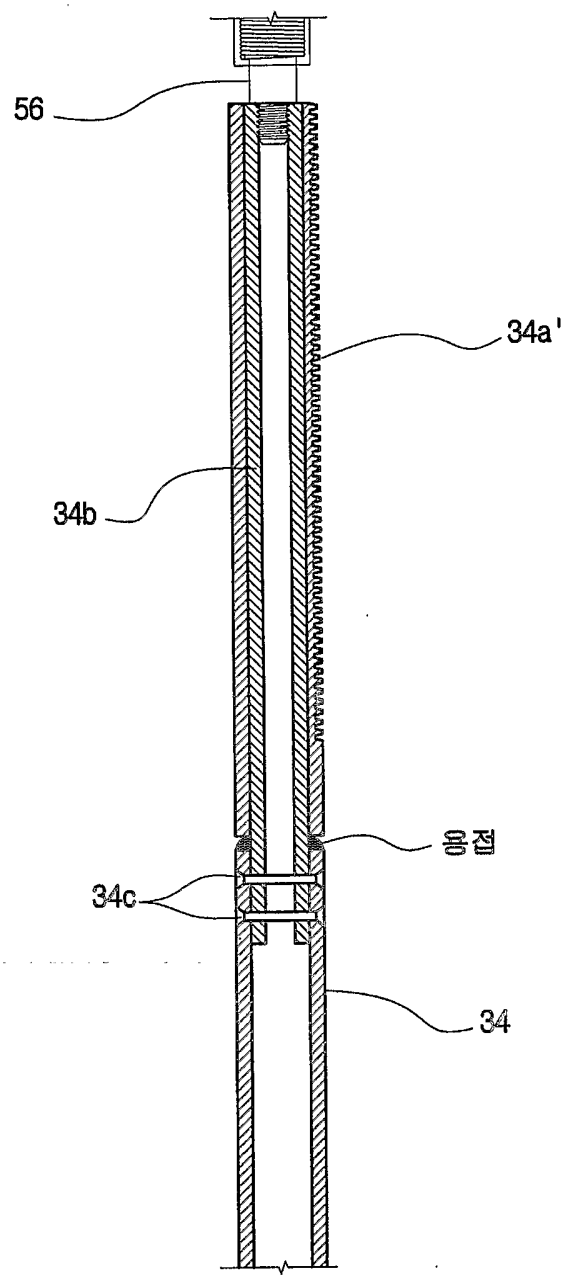


Fig.3b

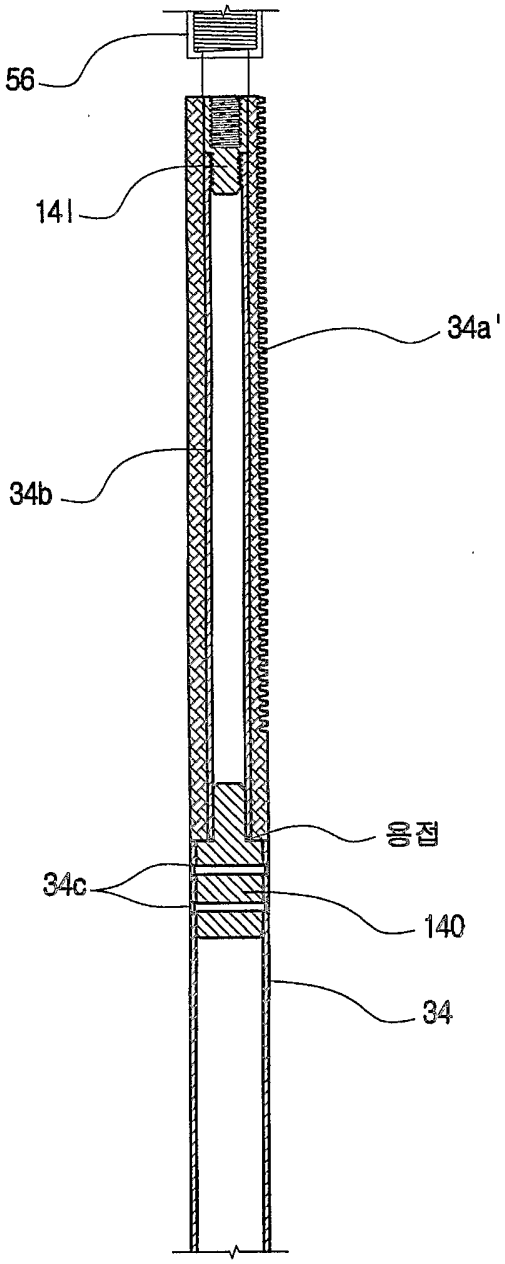


Fig.3c

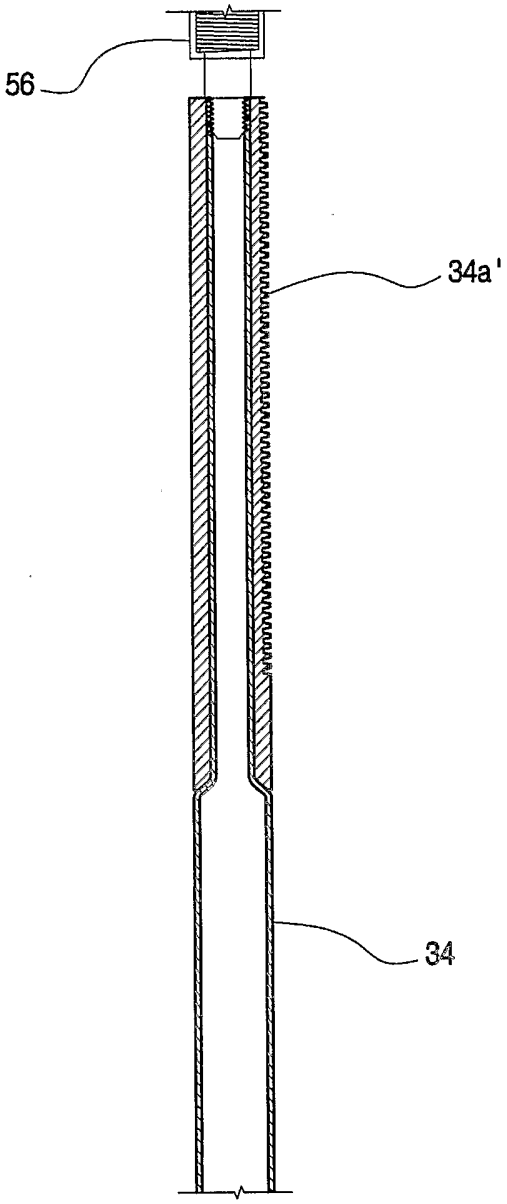


Fig.4

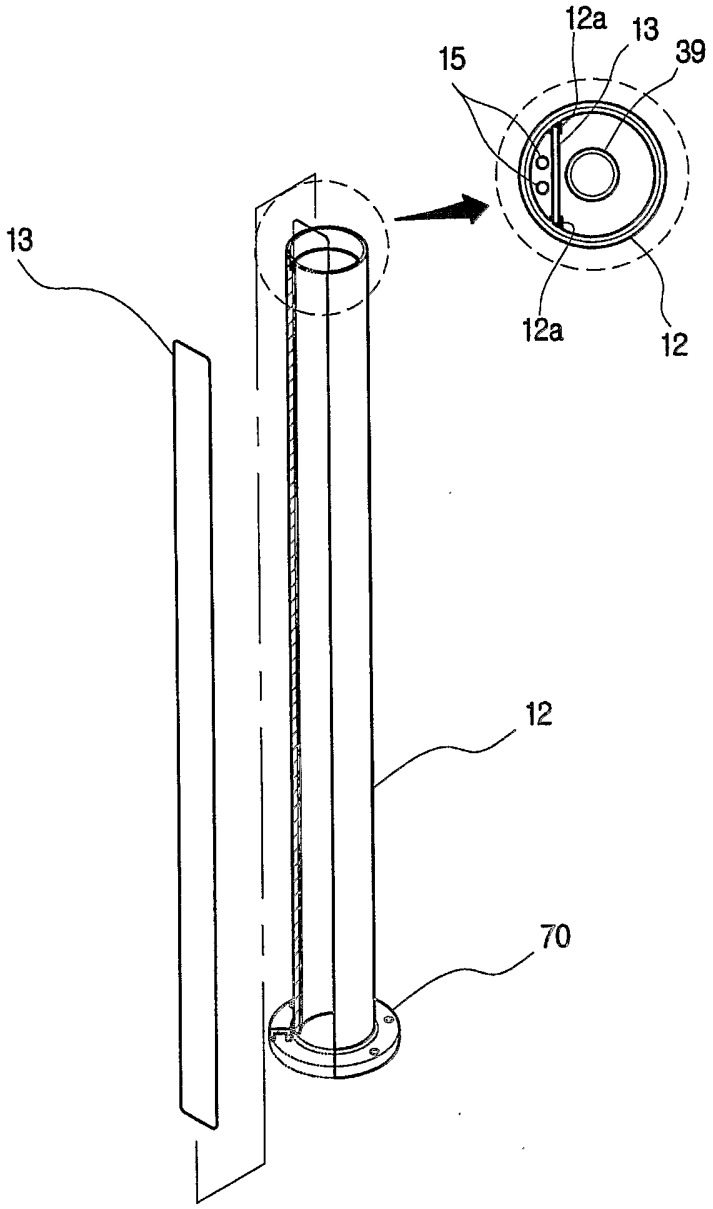


Fig.5

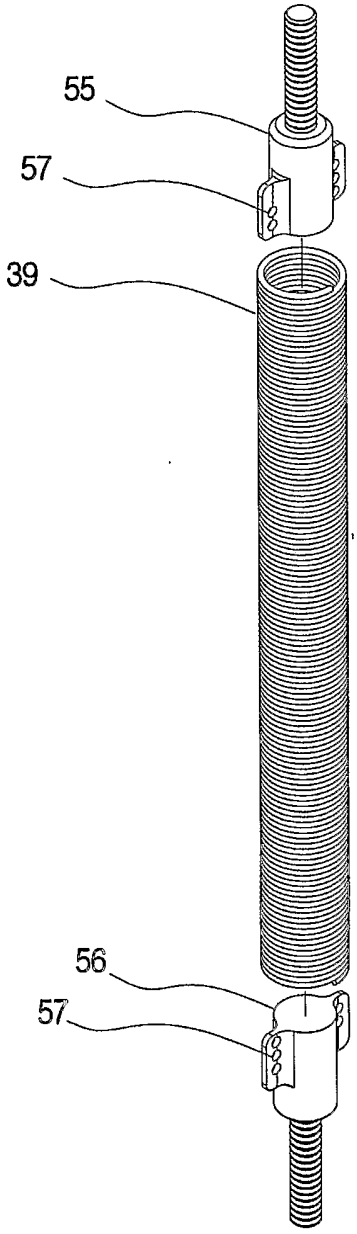


Fig.6

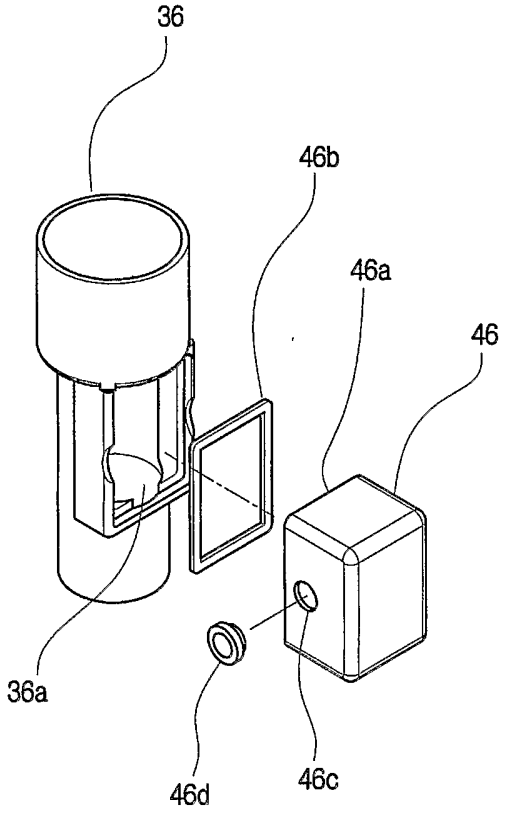


Fig.7a

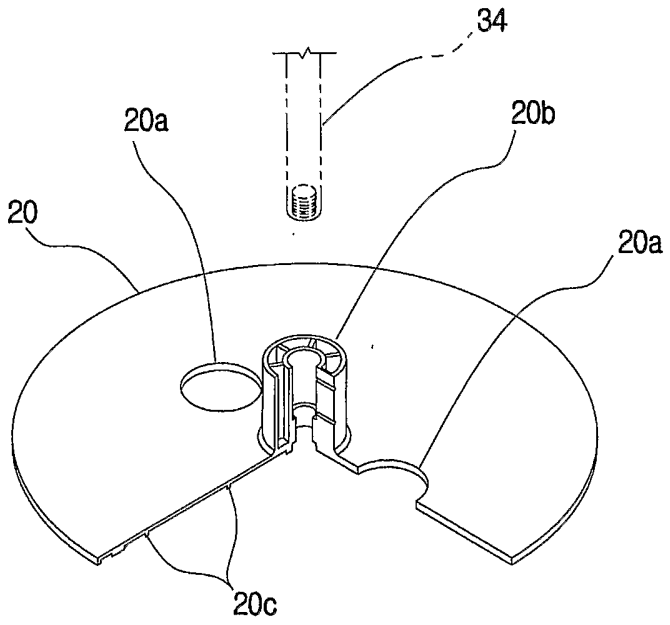


Fig.7b

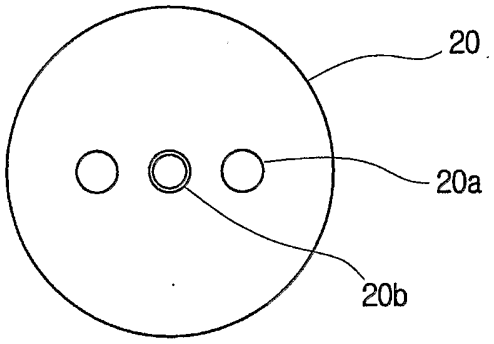


Fig.7c

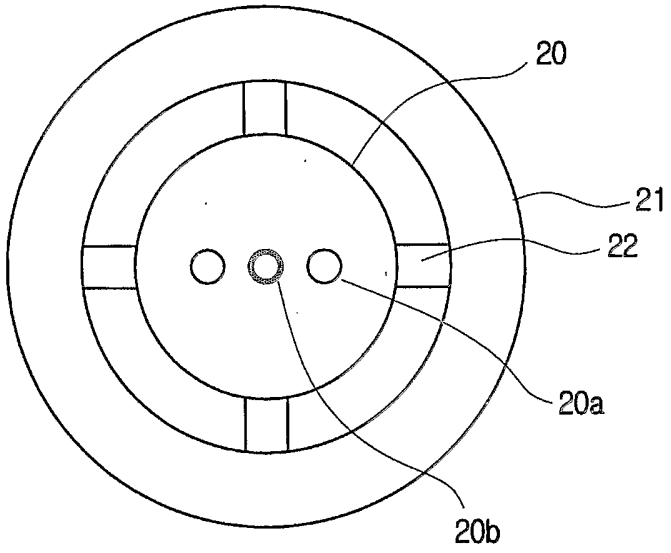


Fig.7d

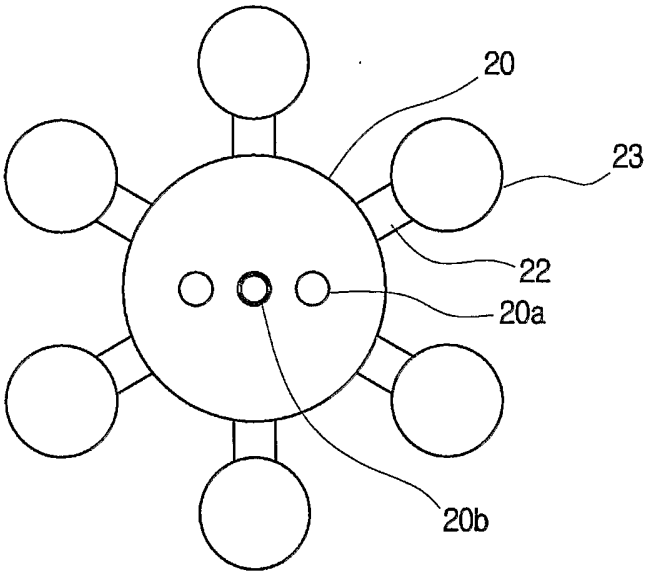


Fig.8

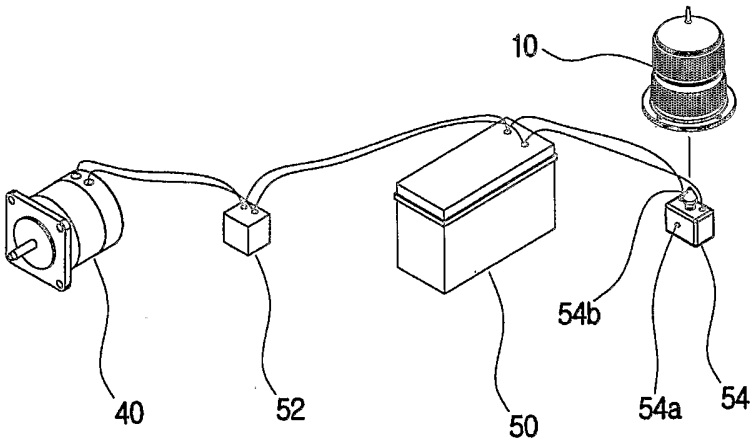


Fig.9a

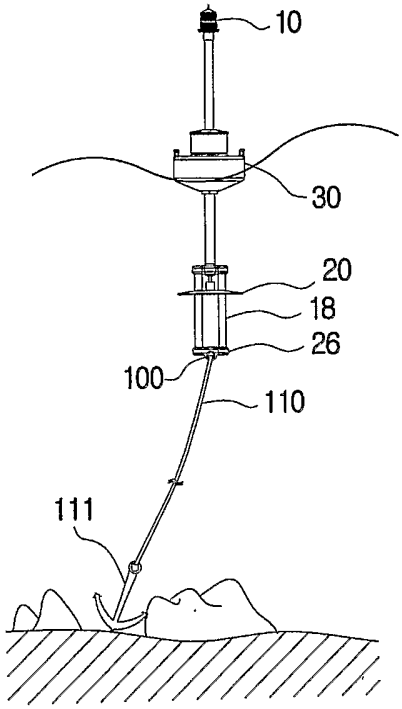


Fig.9b

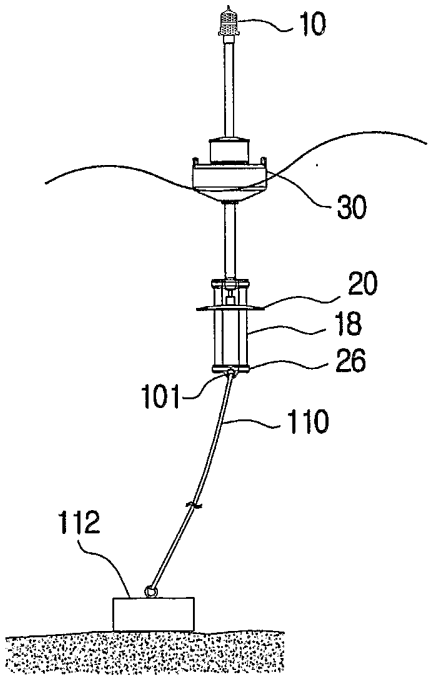


Fig.9c

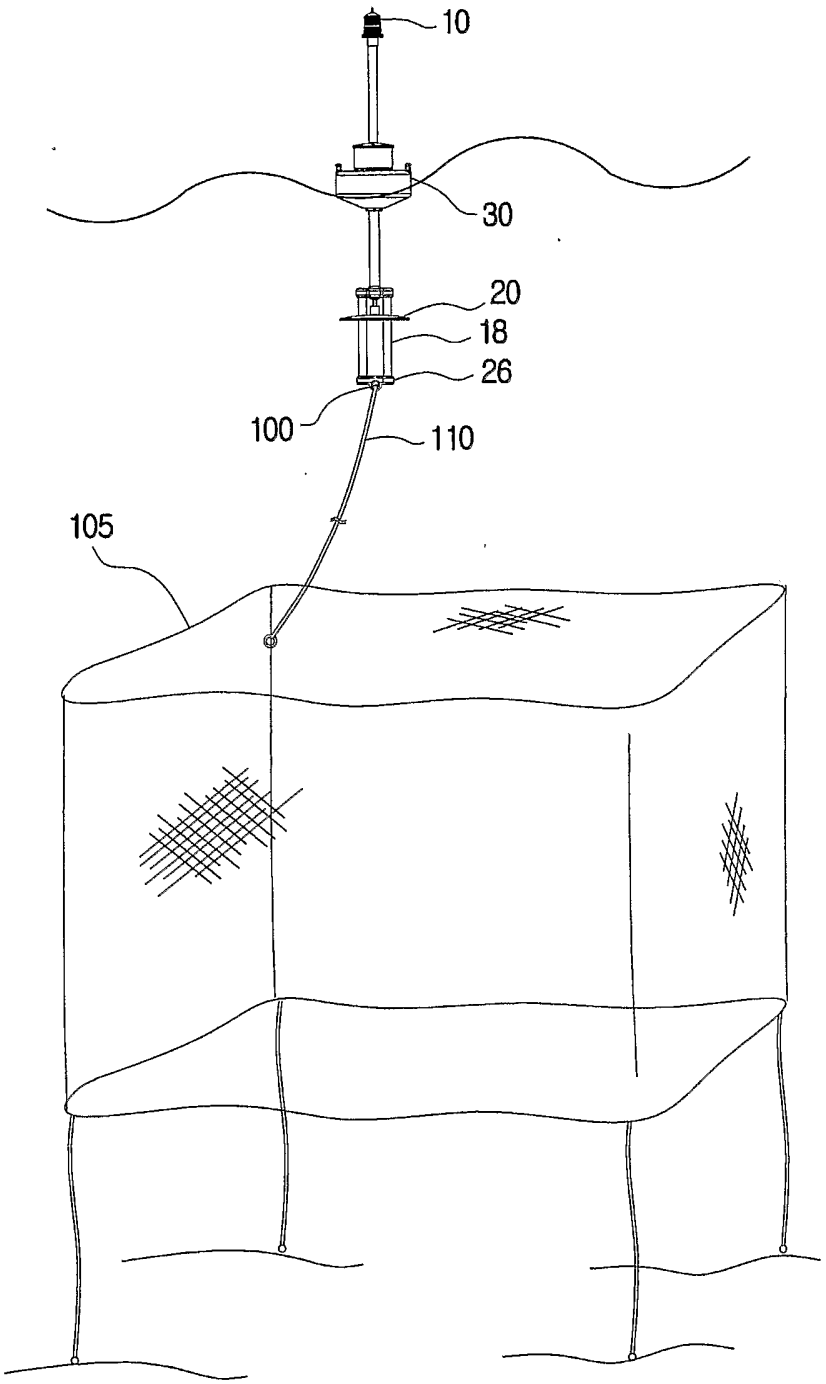


Fig.10

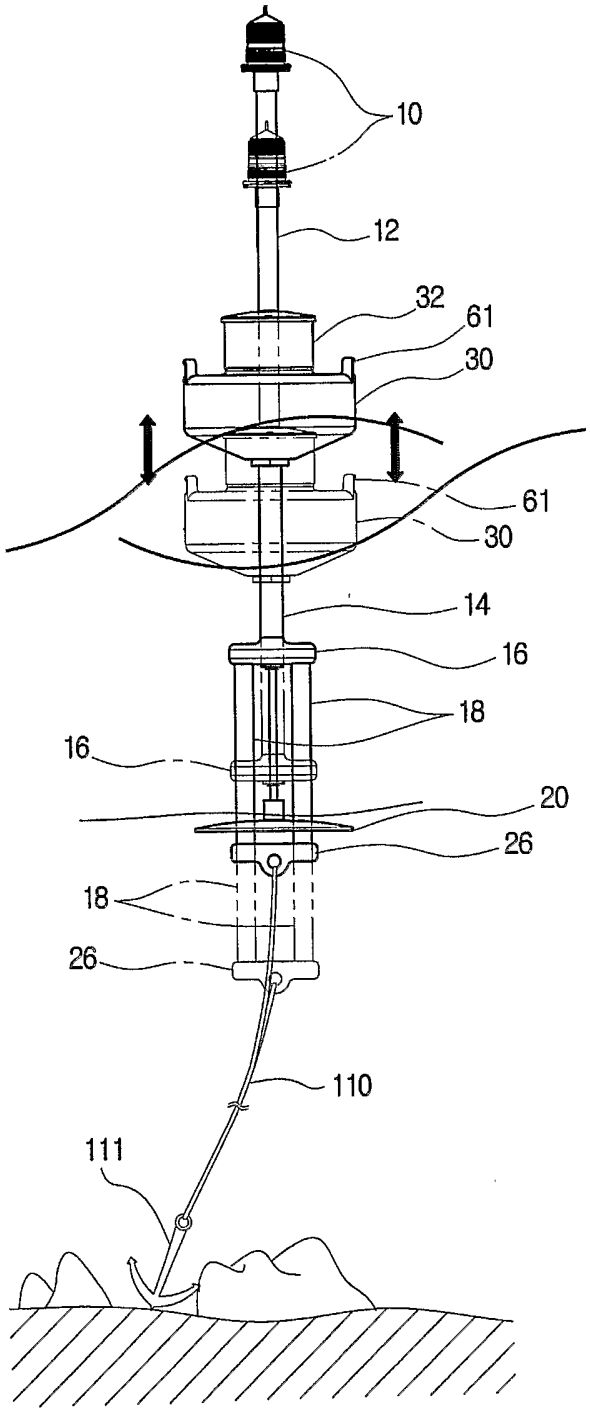


Fig.11

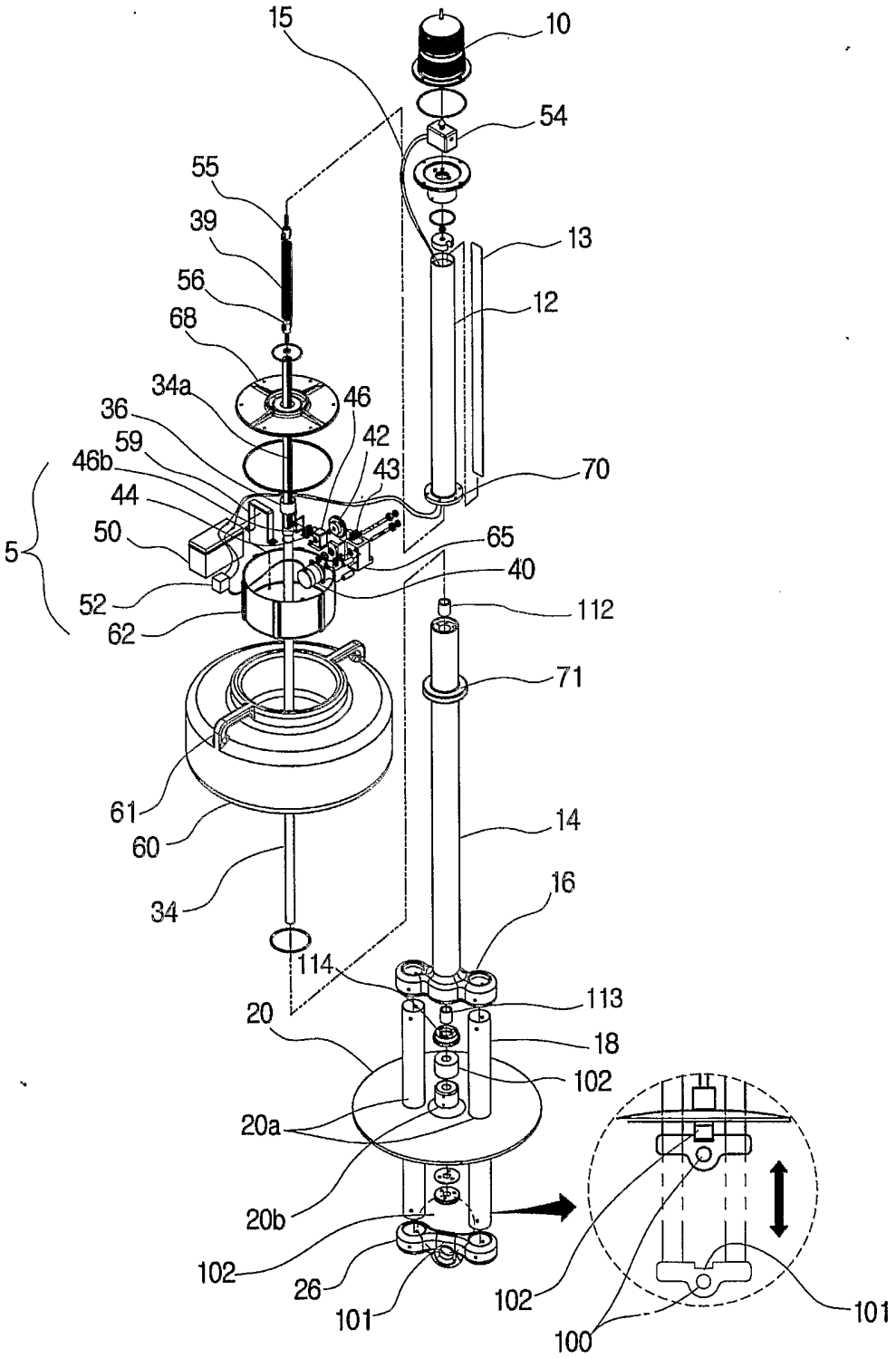

15
10
54
55
39
13
56
12
68
34a
46
36
42
59
43
70
46b
44
50
65
5
40
52
112
62
71
61
14
60
16
34
114
113
20
18
102
20a
20b
102
26
101
102
100
101

Fig.12a

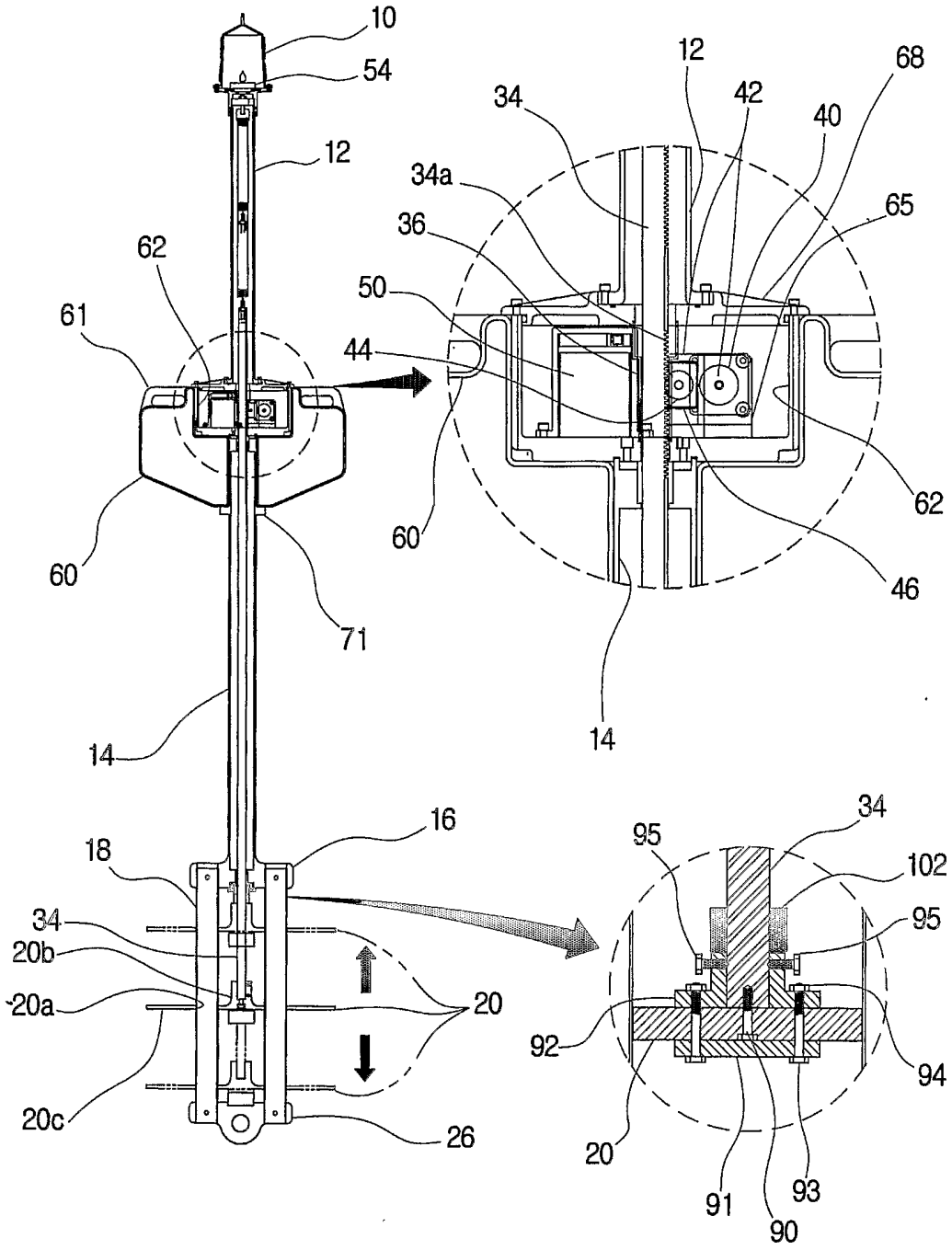

10
54
12
62
61
60
71
14
16
18
34
20b
20a
20c
20
26
34a
36
50
44
68
42
40
65
46
95
102
92
94
91
93
90

Fig.12b

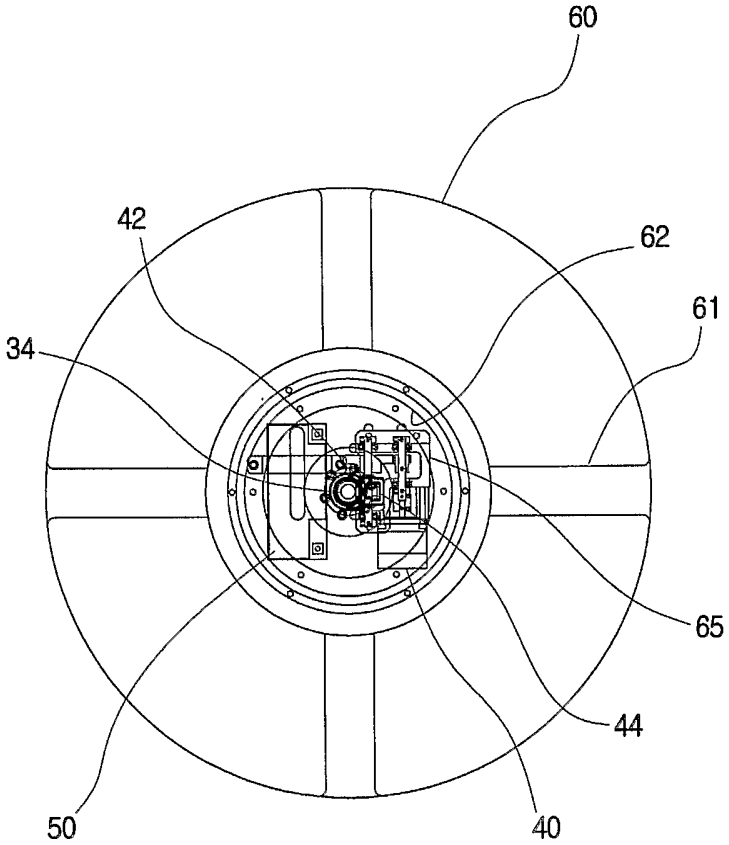
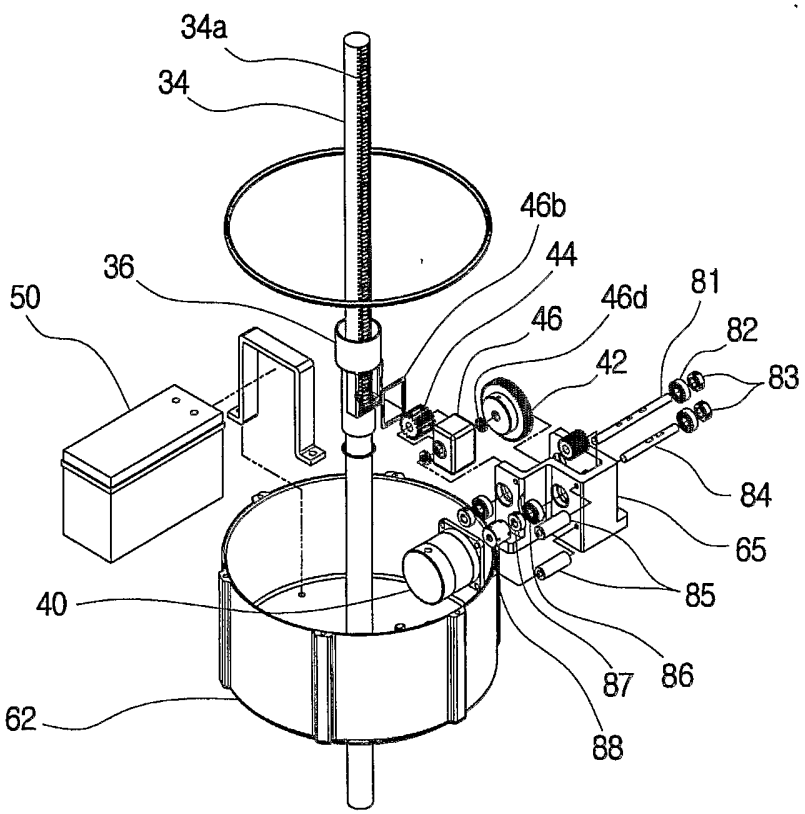


Fig.12c



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2004/001679

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 B63B 22/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B63B 22/00, B63B 22/16, F03B 13/14

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
KR: IPC as above

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)
KIPO NPS system : ""buoy", "self-generating", "wave power", "wave force", "wave motion", "wave energy" and "electric energy"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2002/0155767 A1 (Tae-Whan Sung) 24 OCTOBER 2002 See the whole documents	1, 6, 9, 10
Y	JP 6-171577 A (KUROISHITEKKOKK) 21 JUNE 1994 See the whole documents	1, 6, 9, 10
A	US 4107804 (Bunker Ramo Corporation) 22 AUGUST 1978 See the Abstract and Figures	1
A	US 4512886 (University of Delaware) 23 APRIL 1985 See the Abstract and Figures	11

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
"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
"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
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 OCTOBER 2004 (28.10.2004)	**29 OCTOBER 2004 (29.10.2004)**
Name and mailing address of the ISA/KR Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer PARK, SUNG WOO Telephone No. 82-42-481-8140

Form PCT/ISA/210 (second sheet) (January 2004)