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(71) Applicant: **Van Neerbos, Bart**
1231 LJ Loosdrecht (NL)

(72) Inventor: **Van Neerbos, Bart**
1231 LJ Loosdrecht (NL)

(74) Representative: **Uittenbogaart, Gustaaf Adolf**
Indeig B.V.
Bloemendaalseweg 277A,
P.O. Box 3
2050 AA Overveen (NL)

(54) **Offshore foundation**

(57) Foundation for a device placed in the sea, such as, inter alia, a wind generator, which foundation comprises a bottom part placed on the bottom and a utility part supported by the bottom part, which utility part projects above the water level and comprises an interior space situated under water and having an opening situated under water, for transporting goods from a ship equipped for transportation under water. According to the invention, the opening situated under water has dimensions that are such that the ship can sail into the interior space through the opening situated under water and can moor in the interior space.

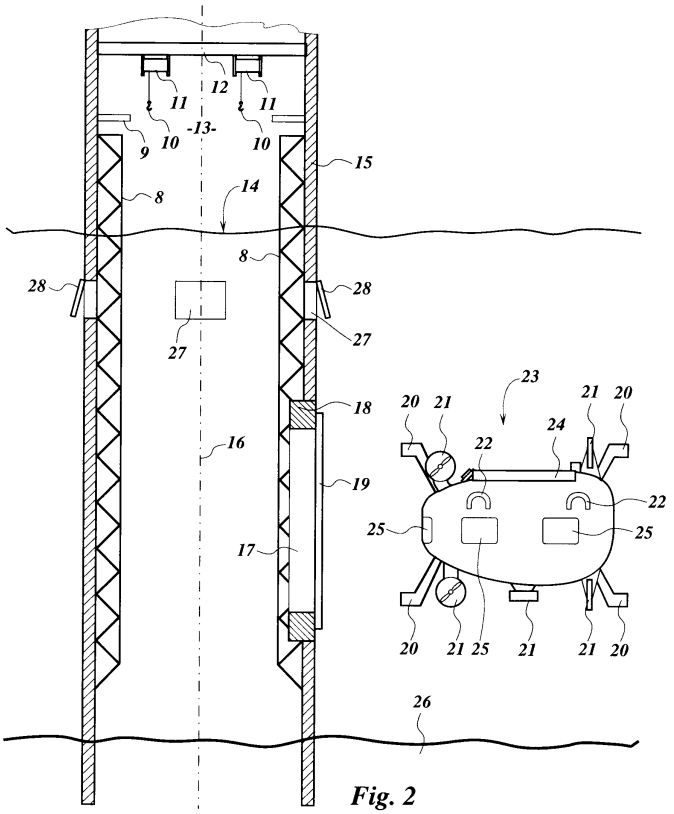

Fig. 2

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Description

[0001] The invention relates to a foundation according to the preamble of Claim 1. Such foundations are known, inter alia from EP A 1389581. The disadvantage of the known foundations is that mooring of the ship to the device placed in the sea is impeded by waves and currents occurring in the sea, in particular owing to the fact that the ship remains subject to the currents in the sea after it has moored. In practice, this means that the devices can be reached by a ship only on a limited number of days per year, so that carrying out preventive maintenance and repairs is seriously hampered.

[0002] In order to avoid this disadvantage, the foundation is designed according to Claim 1. Approaching the device placed in the sea with the ship and sailing through an underwater first opening in the interior space means that the ship is not subject, or is less subject, to movements and forces arising from wave action and currents. As a result of this, it is possible to moor at the construction on a greater number of days per year.

[0003] According to an exemplary embodiment, the foundation is designed according to Claim 2. As a result of this, the utility part has a simple design.

[0004] According to an exemplary embodiment, the foundation is designed according to Claim 3. As a result of this, the ship can sail into the interior space in a simple vertical rising movement.

[0005] According to an exemplary embodiment, the foundation is designed according to Claim 4. As a result of this, water is prevented from flowing through the first opening as a consequence of changing height of the water level in the interior space while the ship is sailing in, so that approaching the first opening and passing through it to the inside becomes easier.

[0006] According to an exemplary embodiment, the foundation is designed according to Claim 5. As a result of this, the changes in the water level inside the interior space are limited, with the result that currents through the first and/or second opening are limited further.

[0007] According to an exemplary embodiment, the foundation is designed according to Claim 6. As a result of this, the effect of waves while the ship is sailing in through the first opening is so little that unless there are exceptional weather conditions the device can always be approached.

[0008] According to an exemplary embodiment, the foundation is designed according to Claim 7. By making wind turbines easier to reach with a ship, maintenance and repairs can always be carried out on time, so that the profitable use of such turbines is increased.

[0009] According to an exemplary embodiment, the foundation is designed according to Claim 8. As a result of this, maintenance staff can be taken easily and quickly to a device on which maintenance has to be carried out.

[0010] According to an exemplary embodiment, the foundation is designed according to Claim 9. As a result of this, persons and materials can easily be flown in and then transported by ship to a device.

[0011] According to an exemplary embodiment, the foundation is designed according to Claim 10. In the case of this embodiment the ship can be raised out of the water. As a result of this, waves no longer have any effect on the movements of the ship, and maintenance can be carried out on the ship if necessary.

[0012] According to an exemplary embodiment, the foundation is designed according to Claim 11. As a result of this, the ship is protected from damage during the vertical movement to the water level.

[0013] According to an exemplary embodiment, the foundation is designed according to Claim 12. As a result of this, it is possible further to damp or to avoid the wave action in the interior space under water, so that loading and unloading of the ship is easily possible.

[0014] The invention is explained below on the basis of an exemplary embodiment with reference to a drawing. In the drawing:

Figure 1 shows a perspective view of an area with wind generators placed in the sea; and

Figure 2 shows a section of a foundation of a wind generator placed in the sea, with a ship that can sail into the foundation.

[0015] Figure 1 shows a number of wind turbines with a mast 1, a nacelle 2, and one or more vanes 3. The wind turbines shown have vanes 3 that rotate about a horizontal axis. There are a number of wind turbines placed together in one area, said wind turbines preferably being constructed of the same parts as far as possible, so that maintenance and repairs can be carried out as efficiently as possible. Figure 1 shows twelve wind turbines, but in practice scores of wind turbines or more are placed together.

[0016] For maintenance and repairs, a maintenance work area 5 is placed on a foundation 4 near the wind turbines. In the embodiment shown, the maintenance work area 5 is equipped with a helicopter deck 6 and crane 7 for lifting parts into and out of the work area. Such a maintenance work area 5 can also be provided with various other facilities for transportation of persons and equipment. It will be clear that, instead of a maintenance work area 5 placed on a separate foundation 4, it is also possible to connect the maintenance work area 5 to or fix it on the mast 1 of one of the wind turbines.

[0017] Figure 2 shows a facility for transportation of persons and equipment to a wind generator placed in the sea, having a tubular housing 15 with an axis 16. Said facility can be used both for the maintenance work area 5 and for the wind turbines. The tubular housing 15 is fixed on a seabed 26 and extends up to above a water level 14. In another embodiment (not shown) the tubular housing 15 extends from above the water level 14, and the tubular housing 15 ends some distance below the water level 14. In that case three or more supporting legs,

which rest on the seabed 26, are provided on the outside of the tubular housing 15.

[0018] The tubular housing 15 encloses an interior space 13. A jetty 9 is placed in the part of the interior space 13 lying above the water level 14, from which jetty a ship 23 can be boarded. There is also a hoisting device with a hoisting beam 12, one or more winches 11, and a hook 10 for raising the ship 23 above the water level 14. A bottom opening 17 is provided in the tubular housing 15 below the water level. For reinforcement, a flange 18 is provided around the opening 17. In order to damp the waves in the interior space 13, the bottom opening 17 can be closed by a hatch 19, if desired. The hatch 19 can possibly be designed in such a way that the bottom opening 17 can be closed in a more or less watertight manner, so that as and when circumstances arise, for example for maintenance, the water level in the interior space 13 can be lowered or the interior space 13 can be pumped out completely. The bottom opening 17 is provided at a depth under water that is such that there is no longer any wave movement taking place in front of the opening. The opening 17 is preferably more than 10 metres below the water level 14. This makes it possible to take a ship 23 sailing under water in front of the opening 17 and to sail it in through the opening 17, even if there are already waves at the water level 14 that would impede direct mooring at the construction.

[0019] It will be clear to the person skilled in the art that in the embodiment described above, in which the outer housing 15 does not extend all the way to the seabed 26, but extends to, for example, ten to twenty metres below the water level 14, a different construction is possible. It can be a construction in which the more or less horizontal underside of the outer housing 15 can form the opening 17. In order to take the ship 23 into the interior space 13, it is only necessary then to take the ship 23 below the opening 17 and subsequently allow it to rise in the outer housing 15.

[0020] In order to ensure that the changing water level 14 in the interior space 13, resulting from waves outside the tubular housing 15, does not result in strong currents through the bottom opening 17, two measures can be taken. First, the change in the water level 14 can be reduced by closing off the interior space 13 in an airtight manner, so that when the water level 14 rises the air pressure in the interior space rises, and when the water level 13 falls the air pressure in the interior space falls. This brings the highest and the lowest water levels closer together. Secondly, the currents through the bottom opening 17 can be reduced by providing one or more top openings 27 above the bottom opening 17. These openings may be closed by a hatch 28, if desired. By making the top openings 27 sufficiently large, it is ensured that all the water needed to enable the wave movement occurring outside the tubular housing 15 to occur also in the interior space 13 can flow towards the interior space 13, without currents occurring through the bottom opening 17. This makes it easier to sail the ship 23 through the bottom opening 17.

[0021] The ship 23 is made watertight in the known manner and is provided with ballast tanks (not shown), so that it can sail floating under water. Propellers 21 are provided on the outside of the hull, for propulsion, steering and moving up and down. Windows 25 are provided in the hull, and on the top side there is a hatch 24 through which crew and freight can be placed in the ship 23. There are also the usual means for permitting manoeuvring with the ship and for enabling sailing from the one construction placed in the water to the other.

[0022] On the outside, the ship 23 is also provided with spring-loaded arms 20, which can interact with the guide rail 8, which is provided parallel to the axis 16 and ensures that the ship 23 does not collide with the outer housing 15.

[0023] The ship 23 also has hoisting eyes 22, which are equipped to connect easily, and preferably automatically, to the hooks 10 of the winches 11. By means of the winches 11, the ship can be moved up and down quickly in the direction of the axis 16, so that submerging of the ship 23 and coming back up above water can be achieved simply and quickly.

[0024] The use of the ship 23 that sails under water means that persons and equipment can be transported between the maintenance area 5 and the wind turbines without experiencing a great deal of hindrance from the waves and other weather conditions.

[0025] In Figure 2 described above the construction placed in the sea is in the form of a tubular housing 15 which is placed on and/or partially in the seabed 16. The interior space 13 with the various openings and facilities can be designed in another way if desired. The interior space 13 can be produced at water level 14 as the underside of the mast 1 of the wind turbine. The interior space 13 can also form part of a foundation on which the mast 1 is placed. Another embodiment can be that the interior space 13 extends on for some distance under water as the cylindrical underside of the mast 1, and that a foundation fixed on the seabed 26 is fixed under water on the cylindrical underside. This foundation can then possibly be designed as supporting legs extending in three or more directions.

Claims

1. Foundation for a device placed in the sea, such as, inter alia, a wind generator, which foundation comprises a bottom part placed on the bottom and a utility part supported by the bottom part, which utility part projects above the water level and comprises an interior space (13) situated under water and having a first opening (17) situated under water, for transporting goods from a ship (23) equipped for transportation under water, **characterized in that** the first opening (17) situated under water has dimensions that are such that the ship (23) can sail into the interior space (13) through the opening situated under

water and can moor in the interior space.

2. Foundation according to Claim 1, in which the utility part comprises a vertical cylindrical housing which encloses the interior space.

3. Foundation according to Claim 2, in which on the underside the cylindrical housing ends in a horizontal face that forms the first opening (17) situated under water.

4. Foundation according to Claim 1, 2 or 3, in which above the first opening (17) situated under water the interior space is connected by means of second openings (27) to the surrounding sea.

5. Foundation according to one of the preceding claims, in which the interior space (13) situated inside the utility part above the water level (14) can be closed off in an airtight manner.

6. Foundation according to one of the preceding claims, in which the first opening (17) situated under water lies at least 10 metres below the water level (14).

7. Foundation according to one of the preceding claims, in which one of the devices placed in the sea is equipped as a wind turbine (1, 2, 3).

8. Foundation according to one of the preceding claims, in which one of the devices placed in the sea is equipped as a work area and/or accommodation area (5) for maintenance staff.

9. Foundation according to Claim 8, in which the work area and/or accommodation area (5) comprises a helicopter landing place (6).

10. Foundation according to one of the preceding claims, in which the interior space (13) comprises a hoisting device (10, 11, 12) for raising the ship (23) out of the water.

11. Foundation according to one of the preceding claims, in which the ship (23) has spring-loaded arms (20) for guiding the ship along guide tracks (8) during movement from the first opening (17) situated under water to the water level (14).

12. Foundation according to one of the preceding claims, in which the openings (17, 27) are provided with closure means (19, 28).

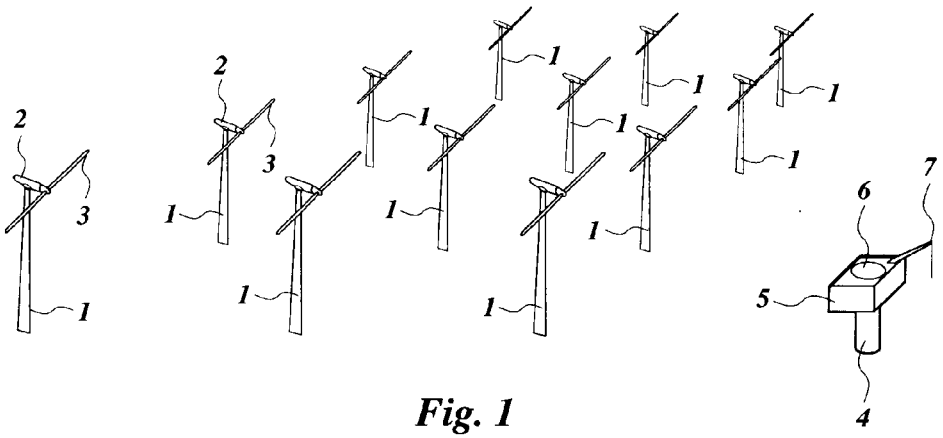
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Fig. 1

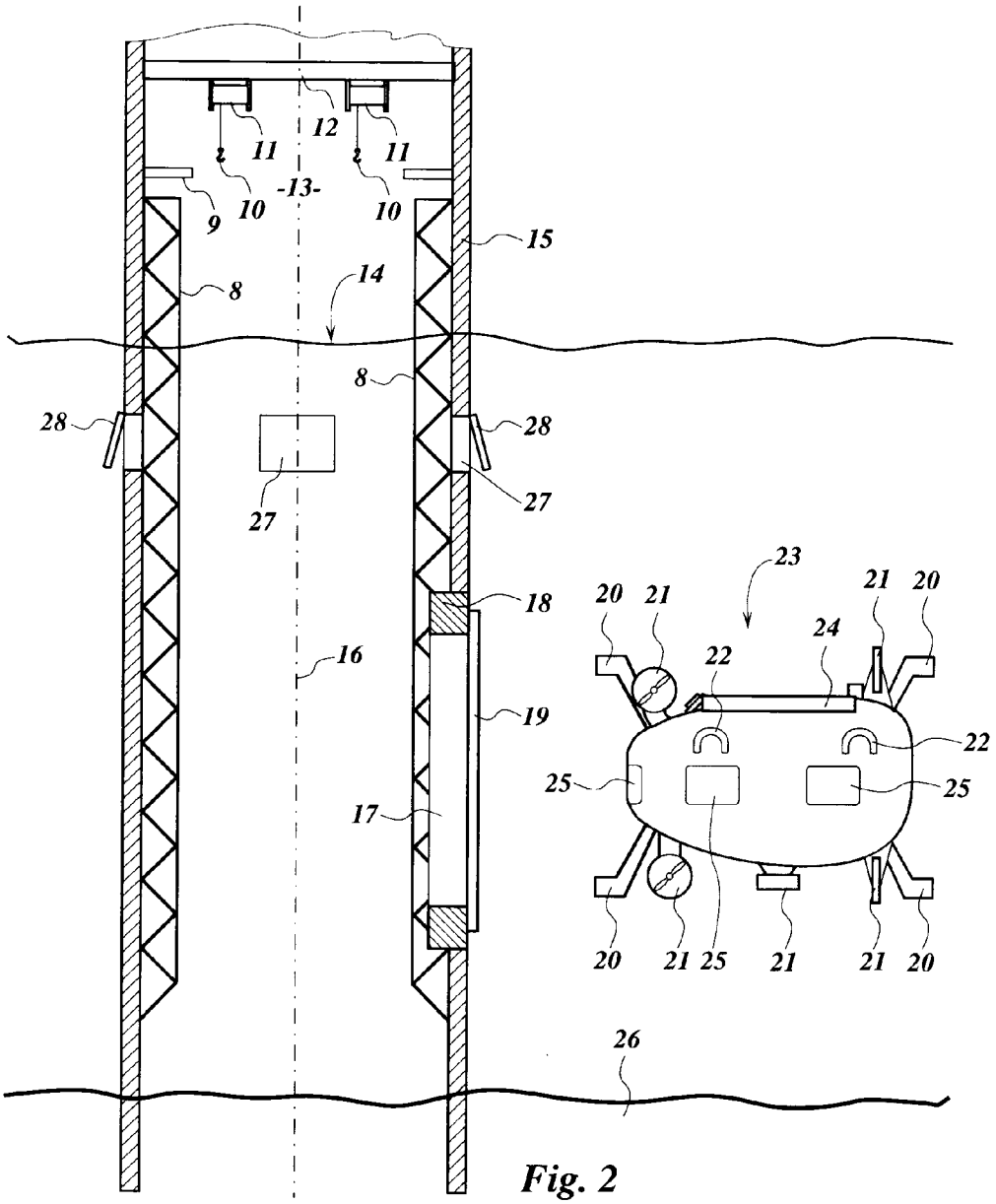
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Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 07 10 9962

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	DE 103 15 135 A1 (ZIELKE BERND [DE]) 21 October 2004 (2004-10-21) * paragraph [0016] - paragraph [0024]; figure 1 *	1-12	INV. E02D27/42
A	US 4 054 104 A (HASELTON FREDERICK R) 18 October 1977 (1977-10-18) * column 3, line 35 - column 8, line 16; figure 1 *	1-12	
A	DE 10 2004 033681 A1 (WOBBEN ALOYS [DE]) 9 February 2006 (2006-02-09) * paragraph [0050] - paragraph [0059]; figure 1 *	1-12	

TECHNICAL FIELDS SEARCHED (IPC)

E02D
B63G
B63B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 October 2007	Geiger, Harald

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 10315135 A1	21-10-2004	NONE	
US 4054104 A	18-10-1977	NONE	
DE 102004033681 A1	09-02-2006	AR 051189 A1 WO 2006005705 A1	27-12-2006 19-01-2006

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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Patent documents cited in the description

- EP 1389581 A **[0001]**