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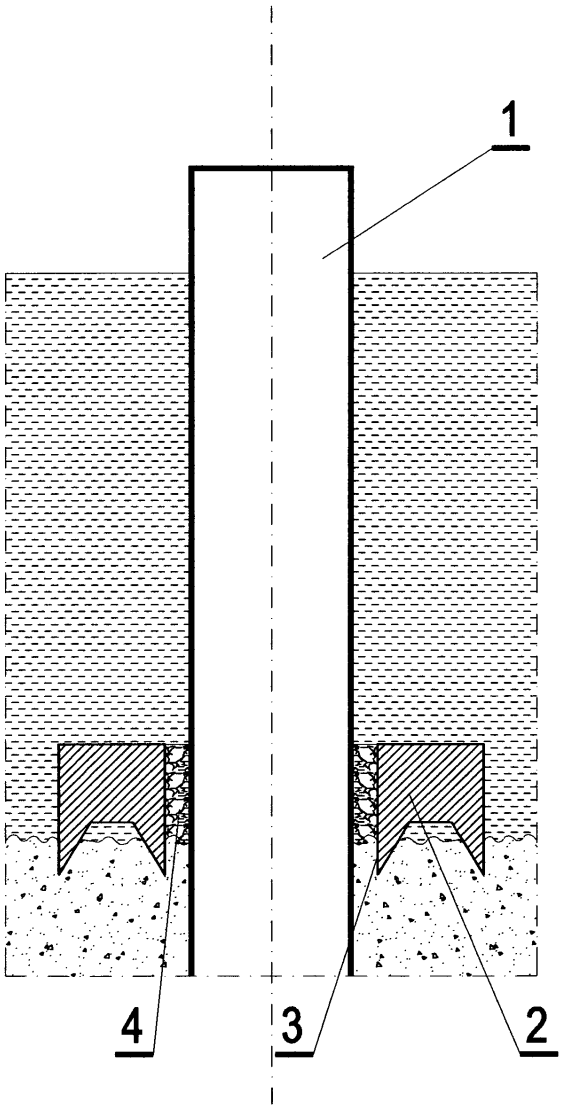
Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) Monopile foundation

(57) The monopile foundation, sunk into the bottom of a water area, which is designated for the purpose of fixing a wind power plant thereon, includes a foundation pile, resistance plate surrounding it (2), placed on the water area bottom, and gravel or other loose and hard material (4), put into the space between the external surface of the foundation pile and the internal surface of the resistance plate, which elements co-operate with each other.

The resistance plate has at its bottom side edges (3), situated on the external and internal perimeter of the plate, the blades of which are directed downwards, at the angle from 10° to 50°.



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Description

[0001] The subject of invention consists of a monopile foundation sunk into the bottom of a water area and designated for the purpose of fixing a wind power plant thereon.

[0002] A monopile foundation is commonly used in sea, offshore wind power farms, such as, for instance, the Horns Rev farm in Denmark, or the Burbo farm in the UK.

[0003] The Polish patent application no. P. 347733 features a wind turbine for electric power generation which has two rotors fixed firmly to the tower; the tower is placed on its foundation via bearings, thanks to which it may rotate, along with the rotors, perpendicularly to the wind direction, steered by a back rudder.

[0004] A disadvantage of such solutions consists in that, along with an increase in the rated power of a wind power plant, the force of the pressure exerted on the ground at the bottom of the water area where the monopile foundation is set increases as well, which, in turn, requires to increase the diameter of the foundation pile accordingly. For instance, the monopile foundation of a contemporary wind power plant of output 5 MW requires a pile having a diameter of over 5 metres; hammering or drilling such a thick pile into the bottom involves large engineering difficulties.

[0005] In the case of two generating sets having power output 5 MW each which are fixed on the tower of a wind power plant constructed according to the Polish patent application no. P. 347733, it would be extremely difficult to apply a traditional monopile foundation.

[0006] Disadvantages of the existing solutions have been removed by developing the monopile foundation, sunk into the bottom of a water area and designated for the purpose of fixing a wind power plant thereon, including a foundation pile which, according to the invention, is complete with a resistance plate surrounding it, placed on the water area bottom, and gravel or other loose and hard material, put into the space between the external surface of the foundation pile and the internal surface of the resistance plate, which elements co-operate with each other.

[0007] Advantageously, the resistance plate has at its bottom side edges situated on the external and internal perimeter of the plate, the blades of which are directed downwards, at the angle from 10° to 50°.

[0008] The subject of invention is illustrated, as sample of performance, by a drawing presenting rotary-wise a monopile foundation in an axial section.

[0009] The monopile foundation, sunk into the bottom of a water area and designated to fix a wind power plant thereon includes a foundation pile 1, a resistance plate surrounding it 2, placed on the water area bottom, and gravel or other loose and hard material 4, put into the space between the external surface of the foundation pile and the internal surface of the resistance plate, which elements co-operate with each other.

[0010] The resistance plate has at its bottom side edges 3, situated on the external and internal perimeter of the plate, the blades of which are directed downwards, at the angle from 10° to 50°.

[0011] The co-operation of individual elements of the device as per invention consists in that the pressure force of the wind on the wind turbine rotor causes reaction forces exerting pressure on the foundation.

[0012] One part of the above reaction forces consist in cutting forces in the ground around the foundation pile, whereas the second part of these reaction forces consist in friction force at the junction of the surface of the water area bottom with the bottom side of the resistance plate. The volume of such friction force depends on the weight of the resistance plate and a degree of roughness of its bottom part.

[0013] To increase the friction forces' effect, it is advantageous to use a material of large mass density to make the resistance plate, because the weight of such resistance plate submerged in the water is smaller than its weight in the air, by the weight of the amount of water displaced by it.

[0014] It is recommended that the resistance plate be made of heavy concrete the mass density of which is at least 3 g/cm^3.

[0015] A layer of gravel or other loose and hard material put into the space between the external surface of the foundation pile and the internal surface of the resistance plate ring is to transfer the horizontal force from the foundation pile to the resistance plate and, on the other hand, to ensure free settlement of the resistance plate on the bottom.

[0016] A considerable advantage of the invention consists in the possibility to apply a shorter monopile foundation of length equal to approximately one and a half of the height of the resistance plate, because the arm of the bending moment is reduced and at the same time the land around the monopile foundation gets denser, allowing to carry larger cutting forces.

[0017] Another large advantage of the invention consists in the possibility to apply a single pillar foundation of smaller diameter in the case of a shallow water area, allowing to save on steel consumption.

Claims

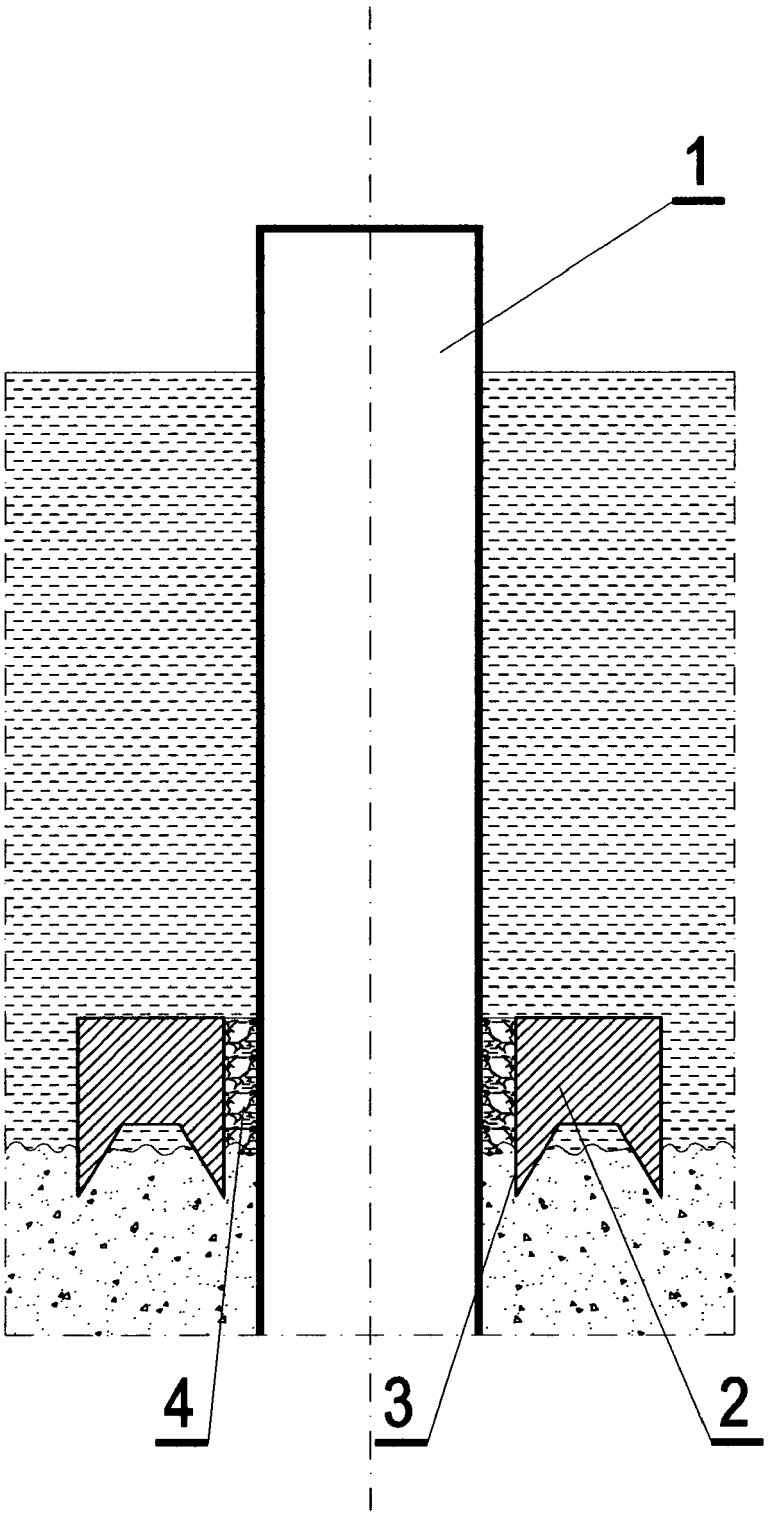
1. The monopile foundation, sunk into the bottom of a water area and designated for the purpose of fixing a wind power plant thereon, including a foundation pile **characterised in, that** it is complete with a resistance plate surrounding it (2), placed on the water area bottom, and gravel or other loose and hard material (4), put into the space between the external surface of the foundation pile and the internal surface of the resistance plate, which elements co-operate with each other.

2. The monopile foundation, according to claim 1, **characterised in, that** the resistance plate has at its bottom side edges (3), situated on the external and internal perimeter of the plate, the blades of which are directed downwards, at the angle from 10° to 50°.

Amended claims in accordance with Rule 137(2) EPC.

1. A monopile foundation sunk into the water and mounted in the sea bottom, designated for the purpose of fixing a wind power plant thereon, including a foundation pile (1) complete with a resistance plate surrounding it (2) **characterised in that** the resistance plate (2) rests on the sea bottom; that between the external surface of the foundation pile (1) and the internal surface of the resistance plate (2) there is a slit (4) of the width of less than 0.2 of the foundation pile's diameter, which is filled with gravel or other hard material (5) having grains of less than 30 cm thick; and that the resistance plate (2) may move vertically relative to the foundation pile (1).

2. The foundation according to claim 1 **characterised in that** the resistance plate (2) has at its bottom side edges (3) situated on the external and internal perimeter of the plate the blades of which are directed downwards, at the angle of less than 50°.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EUROPEAN SEARCH REPORT

Application Number
EP 07 46 0009

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	14 September 2007	Geiger, Harald

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

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14-09-2007

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REFERENCES CITED IN THE DESCRIPTION

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- PL P347733 **[0003] [0005]**