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Floating electricity distribution

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FLOATING ELECTRICITY DISTRIBUTION

ABSTRACT

This disclosure relates to a floatable electricity distribution platform comprising a semisubmersible hull having a plurality of columns supported by a pontoon structure and a deck supported by the columns.

DESCRIPTION

Generation and/or use of electric energy offshore is of growing importance in many parts of the world. For example, electrification of offshore petroleum industry or aquaculture installations requires distribution of large amounts of electric power, and the rapidly growing investments into offshore renewable energy generation, such as offshore wind or solar, also require offshore distribution networks to be established.

Such offshore electricity distribution can be costly to establish and technically challenging. Some components, such as cables, are usually arranged at the sea floor, however not all components are suitable for subsea arrangement. For example, many types of electrical switchgear or transformers may not be suitable for subsea arrangement, or such placement may involve increased costs. Further, regular access to the components may be required, for example for inspection and maintenance.

It is known to place offshore electricity distribution components on fixed or floating platforms. Subsea / sea floor cables may in such cases be routed to and from the platform, for example such that a voltage step-up can be done before electric energy is further distributed, e.g. to a shore-based grid via an export cable if the platform is used in conjunction with an offshore renewable energy plant. Such platforms can add significant cost to a project, and can be technically challenging, as various requirements in relation to, for example, mooring, accessibility, and costs need to be managed. Fixed platforms are only suitable for shallow waters, whereas floating units are otherwise required.

There is a need for further improved technology to enable cost-efficient, safe and reliable distribution of electric energy offshore. The present disclosure has the objective to provide such improvements, or at least to provide useful alternatives to existing technology.

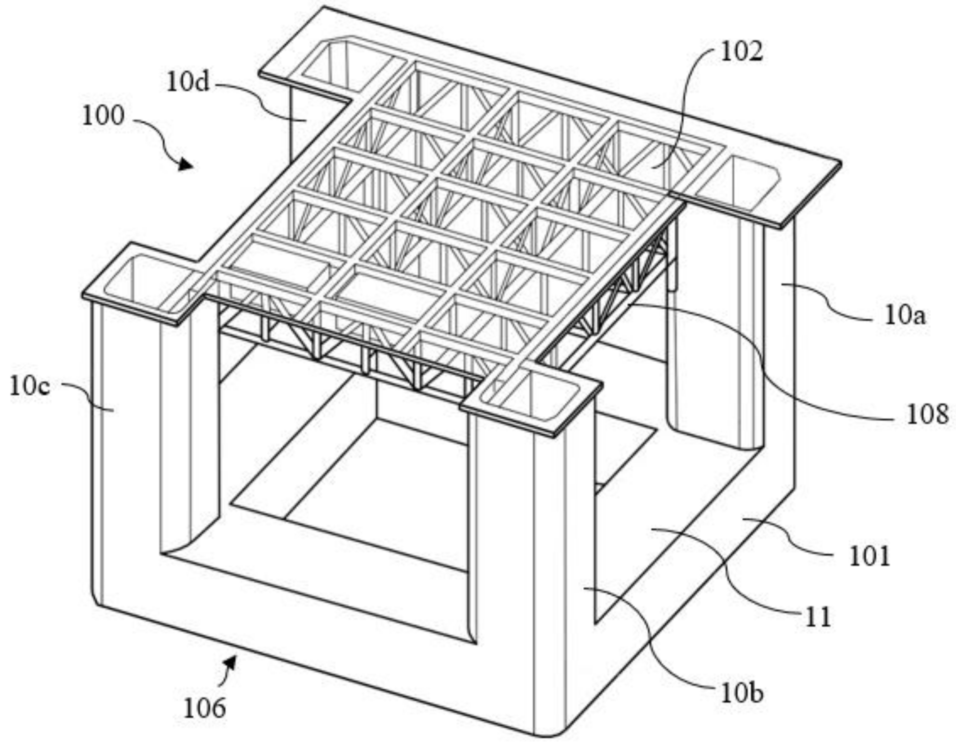

Fig. 1: Example of a floatable electricity distribution platform

Fig. 1 illustrates an example of a floatable electricity distribution platform 100. The platform 100 comprises a semisubmersible hull 101 having a plurality of columns 10a-d supported by pontoons 11. In these examples, the hull 101 has four columns, which may be a suitable configuration for any aspect and example described herein, however in some examples less than four or more than four columns may be used. For example, the hull 101 may have three columns or five columns. The columns 10a-d and pontoons 11 may, for example, be of circular, squared or another polygonal shape in their longitudinal cross-sections. The hull 101 can float on the columns 10a-d and on the pontoons 11. The pontoons 11 can be arranged between all columns 10a-d, or between two or more columns 10a-d. In the shown example, the pontoon structure 11 forms a continuous ring pontoon. Alternatively, the pontoon structure 11 may comprise several individual pontoon members, such as two pontoon members, and where each pontoon member interconnects two columns

10a-d. For example, the hull 101 shown in Fig. 1 may in another example have one pontoon member between columns 10a and 10b, and a separate pontoon member between columns 10c and 10d.

A deck 102 is supported on the columns 10a-d, such that the hull 101 carries the deck 102. The deck 102 is illustrated transparent in Fig. 1 to enable the reader to view through the deck 102 and view the parts underneath. A cut-in or shoulder may for example be provided in each of columns 10a-d, on which the deck 102 can rest, or the deck 102 can rest on and against a top surface of the columns 10a-d. Other ways of supporting the deck 102 onto the columns 10a-d may also be possible, for example dedicated hang-off points on the columns 10a-d. The deck 102 can extend horizontally both inwards towards the center and outwards exceeding the side of one or more column(s) 10a-d. The deck 102 may be flush with the outer perimeter of the hull 101 at one or more sides. In the shown example, the deck 102 is flush with the outer perimeter of the hull 101 at the front of the platform 100.

In some examples, the platform 100 may comprise a truss structure 108. In the illustrated example, the deck 102 is carried by a truss structure 108 fixed to the columns 10a-d. In some examples, the truss structure 108 may be a so-called “wet truss” which is designed for interaction with the sea at rough sea states. This provides advantages of lower build height, reduced center of gravity and hence reduced hull weight.

Cables may be arranged extending from the sea to the deck 102. In some examples, the cables may extend along one or more of the columns 10a-d. Optionally, the cables may be arranged in a direct hang-off from the deck, not interfering with the columns. The cables may, for example, be one or more inter-array cable(s) or one or more export cable(s), which can transport electric energy to and/or from the platform 100. The cables may be, or include, cables/pipes for auxiliary purposes (sea water, etc.). The cables may extend on or directly adjacent the column 10a-d, and may also be attached to dedicated points along the pontoon 11, the column 10a-d, and/or the deck 102.

In another example, at least one cable may be attached to the pontoon 11 and routed along the pontoon side/top towards the side of a column 10b, and further routed to the top of the column 10b and to the deck 102.

In some examples and embodiments, the cables may be arranged in guide tubes, with supports, protection members, or the like. Such items may be fixed to the hull 101 and/or to the cables themselves. The cables may for example be provided with bend stiffeners in the splash zone, i.e. where the cables enter the sea. Bend stiffeners may also be found at the bottom of pull tubes, in the cases where cables are routed up the sides of columns.

Electric equipment may be arranged on the deck 102. The electric equipment may comprise switchgear, transformers and further components such as shunt reactors and auxiliary equipment. The electric equipment 103 may for example be configured to receive electric power from an offshore wind turbine farm through inter-array cables, and process the electric power and transport it to a remote location (such as a shore-based grid) via an export cable. The equipment may be stick-built on the deck 102, be located on a container, a building or a module, all with either one or more levels. The platform 100 may also contain batteries for storage of energy arranged on the deck 102.

The deck 102 may advantageously extend above at least one of the columns 10a-d. The deck 102 may comprise a flush deck surface arranged above at least one of the columns 10a-d and above a space between the columns 10a-d. The deck 102 may alternatively be arranged entirely between the columns (or the vertical extension thereof), i.e. in the central region of the platform 100 (as seen in a horizontal plane), such that the deck 102 does not span any of the columns 10a-d. This configuration may be sufficient if deck space requirements can be met with the area available in the central part of the hull 101, between the columns 10a-d.

The deck 102 may extend outside the horizontal perimeter of the semisubmersible hull 101. Particularly, the deck 102 may extend outside the horizontal perimeter of the semisubmersible hull 101 at one or more of the columns 10a-d. The outer perimeter of the deck 102 may end inside the horizontal perimeter of the semisubmersible hull 101 between some or all the columns 10a-d, for example as illustrated in Fig. 1, where the deck 102 ends inside the horizontal perimeter of the semisubmersible hull 101 between columns 10a and 10b, between columns 10b and 10c, and between columns 10c and 10d.

In some examples, various equipment and installations may be arranged on the deck 102, for example:

- diesel generator set(s),
- walk-to-work landing platforms,
- storage/shelter containers,
- personnel access,
- auxiliaries room(s),
- pedestal crane,
- boom rest for the crane,
- storage space,
- coolers,
- shunt reactors,
- main transformers,
- auxiliary transformers,
- high-voltage gas isolated switchgear (GIS), and/or
- low-voltage gas isolated switchgear (GIS).

In some examples, the different electrical equipment can be arranged compartmentalized and segregated. Fig. 2. shows an example of arrangement of equipment on a floatable electricity distribution platform.

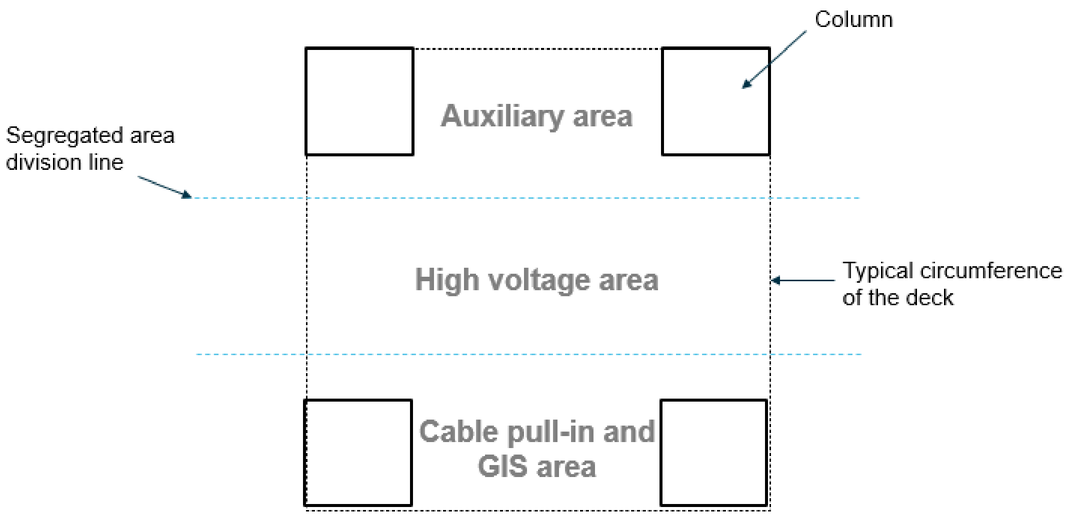

Fig. 2: Semisubmersible HVAC floater seen from above with area segregation (plan view).

In some examples, the platform 100 may comprise at least one drain tank arranged fully or partly below the deck 102. In some examples, the at least one drain tank may be arranged in the truss structure 108. This can save space on the deck 102 and/or on the platform 100.

In some examples, the crane may extend through the deck 102. In some examples, the crane may be fixed to or into the truss structure 108. This can provide a solid foundation for the crane.

In some examples, the hull 101 may be provided with no sea chests or through-hull connections, such that hull penetrations below the waterline are eliminated. All ballast water can be pumped in or out through external column top manifolds or connections only. This ensures that there is no possibility for inadvertent flooding of hull.

The four independent hull quadrants may have no bulkhead penetrations between them, and thereby no possibility for ballast water communication across hull quadrants. In some examples, there may be no machinery spaces in the hull 101, whereby no internal hull access is required during normal operations. The compartments in the hull 101 may be ballast tanks or dry void spaces. Pumps may be accessed externally from the column top(s), and there may optionally be no permanent utilities (e.g., air, electric power, storage/transfer systems) located in the hull 101.

In some examples, the platform 100 may comprise ballast tanks or other buoyancy means to selectively adjust the buoyancy of the floatable electricity distribution platform 100. In some examples, the ballast tanks or buoyancy means may be actively adjustable, i.e. they may comprise a pump or another means to adjust the weight of the buoyancy means and/or the volume of the buoyancy means, which is displacing the water of the sea, to adjust the buoyancy of the buoyancy means/ballast tanks. The weight of the buoyancy means may be adjusted e.g. by selectively filling the buoyancy means/ballast tanks with seawater or air. In some examples, the platform 100 may comprise at least one ballast tank with a pump, which enables to selectively fill the at least one ballast tank with seawater or air to adjust the buoyancy of the platform 100.

Equipment and modules arranged on the deck 102 may be protected by weather cladding, as required.

The hull 101 can, for example, be made of steel or concrete.

The platform 100 may be movable and re-usable at different locations. For example, a platform 100 according to examples described herein may serve as an electricity distribution platform at one location for a given number of months or years, then be re-located to serve at a different location. Optionally, this may involve maintenance, retrofits or redesigns of the onboard equipment. Advantageously, the design of the platform 100, particularly with respect to the flat top deck 102, eases such maintenance, retrofits or redesigns, for examine in the event that the new use has different requirements compared with the previous one.

The platform 100 may further comprise rooms/shelter for personnel, if/as required.

The skilled reader will understand that the term “floatable platform” as used herein refers to a platform, which is capable of floating in water (as opposed to resting on a sea floor). The floatable platform may nevertheless, in some circumstances and temporarily, be supported on a foundation, such as under construction or maintenance (e.g. in a dock).