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(54) Title: OFFSHORE SUBSTATION FOR A WIND FARM

(57) Abstract: Offshore substation for a wind farm, the substation having electricity receiving means (1) for receiving electricity generated by the wind farm (F), wherein the substation includes transformer means (T) for transforming the received electricity into high voltage electricity, wherein the transformer means (T) are connectable to high voltage electricity output means (3) for outputting the high voltage electricity, wherein the transformer means (T) include at least one gas insulated transformer (2).

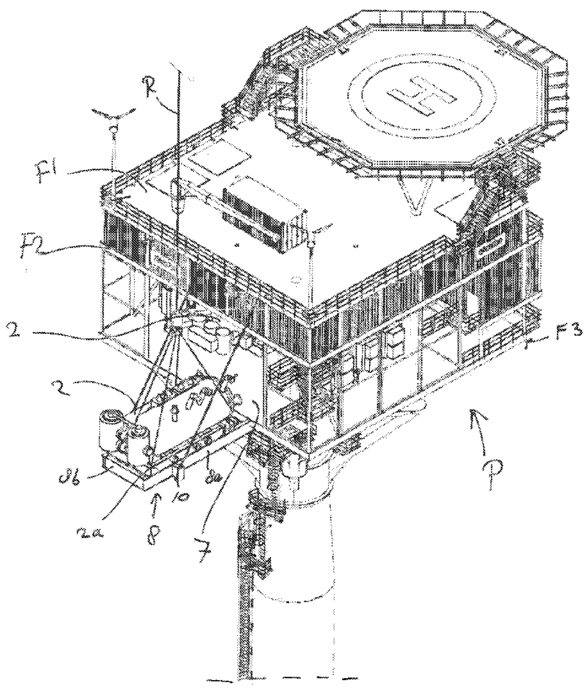

FIG. 1

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Title: Offshore substation for a wind farm

The present invention relates to an offshore substation for a wind farm, the substation having electricity receiving means for receiving electricity generated by the wind farm, wherein the substation includes transformer means for transforming the electricity into high voltage electricity, wherein the transformer means are connectable to high voltage electricity output means for outputting the high voltage electricity.

Such a substation is known from the prior art. The substation is connected to the wind farm, which usually comprises a plurality of wind driven wind turbines, to receive alternating current (AC) electricity therefrom. Usually, the wind energy is transported by suitable cables to the substation, for example at a voltage of about 33 kV. The substation's main purpose is to transform the generated wind energy into high voltage electricity, for example having a voltage higher than 100 kV. To that aim, the substation is usually provided with an array of oil insulated transformers. Such transformers have the advantage that they can operate at very high power levels, enabling a desired high electricity output over 100 MW (megawatts).

A disadvantage of the known substation is that the station is very heavy, usually having a mass of over 1000 tons (1 ton being 1000 kg), sometimes even more than 1700 tons, which makes them costly due to the needed strength and amount of steel that is usually required for a supporting foundation and a crane capacity required for lifting and installation (only a few cranes are capable of lifting such substations).

The present invention aims to provide an improved substation. Particularly, the present invention aims to overcome or alleviate the above-mentioned problems.

To this aim, the substation according to the invention is characterized by the features of claim 1.

Advantageously, according to an aspect of the invention, the transformer means include at least one gas insulated transformer.

It has been found that application of one or more gas insulated transformers instead of oil insulated transformers leads to a relatively light-weight, relatively compact substation. The resulting substation can have a mass lower than 1,000,000 kg, preferably lower than 750,000 kg, for example in the range of about 400,000 kg to 600,000 kg, for example such that more cranes become available (in view of lifting capacity) to lift the substation. The resulting platform can be installed in a relatively efficient manner, swiftly, and -as a result- with relatively low costs compared to installation costs of the known heavy and bulkier offshore substations.

High capacity gas insulated transformers as such are known, and sold by Toshiba (Toshiba Corporation) for providing power to sky scrapers and for underground substations.

Usually, the gas insulated transformer includes a housing having magnetically cooperating transformer coils, conducting the electric currents during operation, wherein a gas is applied for mutually insulating the coils, and for cooling the coils. For example, the insulating gas can be SF6 (Sulfur hexafluoride) and/or another suitable (non-flamable, electrically non-conductive) gas. Also, the gas insulated transformer can be connected to a gas circulation system, for example including a gas supply for supplying the insulating gas to the housing, and a gas exhaust for receiving gas from the housing. One or more pumps can be provided for circulating the insulating gas into and out of the transformer housing.

Generally, a non-flamable gas is used, so that a relatively safe operation of the gas insulated transformer can be achieved. Also, as a result, application of extensive, bulky and heavy oil fire fighting facilities (which is usually required in the known substation that has oil insulated transformers) is not necessary.

Furthermore, the substation does not require the use of a large amount of oil for operation of the transformer means (as is required for operating a high capacity oil insulated transformer), leading to a major weight reduction.

In a further embodiment, the substation includes a first support for supporting the at least one gas insulated transformer in the substation, wherein the substation further includes or is connectable to a second support for supporting the at least one gas insulated transformer next to the first support, wherein a transport system is provided for moving a said gas insulated transformer from the second support to the first support.

For example, the first support can be a floor or part thereof, located within the substation (for example below a roof of the substation).

Particularly, the first support can hold the gas insulated transformer in a final operating position. The second support can be used to hold the gas insulated transformer in a loading/unloading position, for example remote from a said operating position, particularly next to a said first support. The transport system for moving the gas insulated transformer between the first and second support can be configured in various ways, for example including a rails, a glide path, a motorized drive, a winch, a pneumatic or hydraulic drive, a conveyor, and/or other transport means. Also, the transport system can be part of or integrated with the substation, the second support, the gas insulated transformer, or a combination thereof.

In a preferred embodiment, the first support and second support are located at substantially the same horizontal level, particularly for supporting a said transformer at substantially the same horizontal level.

For example moving a gas insulated transformer from a loading/unloading position (on a second support) towards an operating position (on a first support) can be achieved in an efficient and safe manner, without substantially vertical movement of the transformer. More particularly, a final operating location can remain covered by a (top) floor or ceiling of the substation. Also, an area located above the final transformer position (for example on an aforementioned said floor or ceiling) can be used for locating other substation components. Thus, a further reduction in the overall size of the station can be achieved.

Besides, an aspect of the invention is characterized by the method according to claim 15.

Advantageously, there is provided a method for installing an offshore substation for a wind farm, for example a substation according to the invention, the substation after installation having electricity receiving means for receiving electricity generated by the wind farm, and transformer means for transforming the electricity into high voltage electricity, the transformer means being connectable to high voltage electricity output means for outputting the high voltage electricity,
wherein the method includes, in an arbitrary order:

-building at least part of the substation, and locating the built substation part at an operational offshore site; and

-providing the substation with at least one gas insulated transformer as a said transformer means.

Thus, above-mentioned advantages can be achieved.

Preferably, the at least one gas insulated transformer can be placed onto a second support, wherein the transformer is moved in a substantially horizontal direction from the second support into the substation, particularly towards an operational position on a first support. Also, preferably, said gas insulated transformer can be placed onto the second support from a vertical level that is located above the second support, for example by a crane. For example, the said gas insulated transformer can be moved through a lateral side of the substation, from an exterior of the substation to its interior (for loading the transformer into the substation) and/or vice versa (for unloading).

Advantageously, the second support can be repositioned or removed with respect to the substation, after the gas insulated transformer has been moved into the substation.

In yet a further embodiment, the entire substation can be lifted by a single crane onto a substation support, for example a supporting column, that is already positioned at the desired operational offshore site.

Another advantageous aspect of the present invention is characterized by the features of independent claims 21, 22. Thus, also, an offshore platform utilizing one or more oil insulated transformers can be installed in an advantageous manner, particularly making use of the transport system (and preferably utilizing a substantially horizontal transport of the oil insulated transformer into and/or out of the substation).

Further advantageous embodiments are described in the dependent claims. The invention will now be further elucidated by a non-limiting embodiment, depicted in the drawings. Therein shows:

Figure 1 a perspective view of an embodiment of the invention;

Figure 2 a side view of the example shown in Fig. 1;

Figure 3 a detail of Fig. 2; and

Figure 4 schematically a wind farm including an embodiment of the invention.

Corresponding or similar features are denoted by corresponding or similar reference signs in this application.

The drawings depict an example of an offshore substation P for a wind farm, the substation P is configured to receive electricity generated by the wind farm F. Referring to Fig. 4, the wind farm F can include a number of wind driven generators, connected to the substation P by one or more power cables K located below sea level L, for example on or in a seabed. During operating, electricity that is generated by the wind farm F is transported via those cables K to electricity receiving means 1 of the substation P.

The substation P includes transformer means T that are operatively connected to the electricity receiving means 1 for transforming the generated electricity into high voltage electricity. For example, the electricity receiving means 1 can be part of the transformer means T. Also, the transformer means T can be connected to (or provided with) high voltage electricity output means 3, for outputting the high voltage electricity to one or more power output cables N. The output cable(s) N can be connected to an electricity distribution network (not shown), to supply the network with the high voltage electricity that is output by the substation P during operation. The substation P can be supported on a substation support B (for example a vertical column). Particularly, the substation P can be a fixed (stationary) offshore structure. In the example, sections of the electricity transport cables K, N run through the support B for the input and output of the electricity, to and from the transformer means T.

Figures 1-3 show the substation P in more detail. In a preferred embodiment, the station P has transformer means T that include at least one gas insulated transformer 2. The gas insulated transformer 2 is configured to hold a gas for electrically isolating transformer components (particularly transformer coils).

In the present example, the substation P is provided with two such gas insulated transformers 2 (see Fig. 2). One of the gas insulated transformers is already located in an operating position, in the substation (below an intermediate floor F2 and below a top level or roof F1). The other gas insulated transformer 2 is located at a loading/unloading position, outside the station P.

In a further embodiment, each of the gas insulated transformers 2 is configured to transform wind farm generated electricity (for example electricity having a voltage lower than 100 kV) into high voltage electricity having a voltage higher than about 100 kV.

Preferably, each said gas insulated transformer 2 can have a capacity of at least 100 MW, particularly at least 150 MW, for example about 180 MW. Thus, in case of application of two such transformers, the total capacity of the substation P can be at least 200 MW, particularly at least 300 MW, for example about 360 MW.

Also, in a preferred embodiment, the mass of the each said gas insulated transformer 2 is about 160,000 kg or lower.

The gas insulated transformers 2 as such may be transformers supplied by Toshiba (Toshiba Corporation) . The gas insulated transformers 2 as such are known to the skilled person. The transformer 2 can include a transformer core, as well as transformer coils, magnetically cooperating via the core, for conducting the electric currents during operation. The coils and core can be located in a housing, and are electrically insulated by gas during use, for example SF6 (Sulfur hexafluoride).

As follows from Fig. 3, the substation P is provided with gas circulating systems G, for example including one or more gas pumps, gas lines, gas treatment means, for example one or more filters and one or more cooling means. The gas supply systems G are connectable to the transformers 2 when they are in their operational positions (in the station P). During use, the gas supply system G can feed the respective transformer 2 with (preferably cooled) insulating gas. Also, in a further example, the system G can receive exhaust insulating gas from the transformer 2, for example for cooling that gas.

The use of the gas insulated transformers 2 leads to a relatively light-weight and compact substation P. The total mass of the substation P (i.e. the total mass after assembly and during operation) can be lower than 1,000,000 kg, preferably lower than 750,000 kg, for example in the range of about 400,000 kg to 600,000 kg. Thus, when the substation P is to be installed, or repositioned, it can be lifted by a single crane onto or from the substation support B (positioned at a predetermined offshore location).

It has been found that the application of relatively compact and light-weight gas insulated transformers 2 provides the additional advantage of a very efficient loading and unloading of the transformer, using substantially horizontal transport towards (or away from) respective operating positions.

Particularly, to that aim, the present substation P includes a first support 7 for carrying the gas insulated transformers 2 within the substation P (i.e. within a space that is substantially enclosed or defined by a substation bottom level F3, the substation top level F1, and a lateral outer side of the substation that extends between the bottom level and the top level).

For example, the first support 7 can be an integral part of the substation; in the embodiment, the first support 7 is a horizontal floor or horizontal floor part of the substation P (the floor or floor part extending in parallel with the top level/top floor F1 and the optional intermediate floor level F2).

Also, the substation P includes or is connectable to a second support 8 for supporting the at least one gas insulated transformer 2 next to the first support P, i.e. externally with respect to the interior of the substation P. One or more transport systems are provided for moving each gas insulated transformer 2 from the second support 8 to the first support 7, through an opening in the lateral side of the substation P.

As has been mentioned before, a transformer transport system (for example a transformer conveyor) can be configured in various ways

For example, each of the transformers 2 can be carried on a respective carrier frame 2a, for example a rigid frame of steel frame elements. The carrier frame 2a can provide part of said transformer transport system. The carrier frame 2a can be movable over a supporting floor surface or glide track, for example slidable. In case of a slidable configuration, the carrier frame 2a is preferably provided with glide elements having smooth glide surfaces for gliding over a supporting surface.

Also, in the example, part of the transport system can be provided by the first and second support 7, 8 as such. The supports 7, 8 are configured to provide a smooth glide path for gliding the carrier frame 2a of the respective gas insulated transformer 2 between the (loading/unloading) position on the second support 8 to the operating position on the first support 7.

It therefore follows that each of the present gas insulated transformers 2 is carried by a respective carrier frame 2a which is slidable from the second support 8 to the first support 7 and/or from the first support 7 to the second support 8. It should be observed that such horizontal movement of the transformers 2 can also be achieved in a different manner, for example using rails and/or guide wheels.

Further, from the drawings it follows that the first support 7 and second support 8 are located at substantially the same horizontal level, particularly for supporting the transformer 2 at substantially the same horizontal level.

The second support 8 extends in an area that is substantially uncovered at a top side of the substation, in this case externally with respect to a remaining part of the substation P. When the second support 8 is located in such a loading/unloading position, it is accessible from above for a lifting means, for example a lifting part R of a crane, for loading or unloading a transformer thereon or therefrom, respectively.

The present second support 8 includes a rigid frame 8a, 8b, including elongate frame elements 8a and one or more traverse frame elements 8b. The second support 8 is connected to a main frame (in the example to a frame part of the first support 7) of the substation P, in a respective loading/unloading position (protruding from the substation P, as in the drawings). The second support 8 is positioned next to an opening, i.e. a passage for passing a transformer 2, in the lateral side of the substation P.

The second support 8 can be made of or include steel elements 8a, 8b, or differently. Advantageously, the frame includes two parallel elongate I-beams 8a, interconnected by other frame parts (such as one or more traverse elements 8b).

Connection of the second support 8 to the substation P can be achieved in various ways, for example using suitable connectors, bolting means, suspension means, welding, hook up connection, or in a different manner.

In the example, a first end of the second support 8 is connected to the first support 7 when the second support 8 is in the respective loading/unloading position. Suspension means 9 are provided, for example metal or steel chains 9, linking/suspending the second support 8 to/from substation connection points that are located above the level of the first support 7. In the example, these connection points are located at or near the top level F1. Several groups of connection points can be provided, for holding a second support 8 at different locations next to the first support 7.

The suspension means 9 are connected to the second support 8 via coupling members 10 that are spaced-apart from the first end of that support 8, for example near an opposite second end of the support 8. In the example, the coupling members 10 are integral parts of the elongate elements 8a.

In a further embodiment, the second support 8 is movable from a first position, i.e. the loading/unloading position (in which position the support 8 can carry a said transformer 2 at the location next to the first support 7), to a second, idle, position. For example, the second support 8 may be detachable connected to the remaining part of the substation P in a respective loading/unloading position. After detachment, the second support

8 can be stored at a suitable location in or on the substation P, or at another location.

Also, optionally, the second support 8 can be pivotally connected to the substation P (for example with a substantially horizontal pivot axis), for pivoting the support between said first position and idle position.

Installation of the substation P can be carried out in an efficient manner, relatively swiftly, reliably and safe. It can include (in an arbitrary order): building at least part of the substation, and locating the built substation part at an operational offshore site, and providing the substation P with at least one gas insulated transformer 2 as a said transformer means.

Loading a transformer (in this embodiment a gas insulated transformer 2) into the substation P can be achieved by installing the second support 8 in its respective first position. Then, a transformer 2 can be placed onto the second support 8, after which the transformer 2 can be moved (for example by sliding) through the lateral side of the substation P, in a substantially horizontal direction, from the second support 2 into the substation P, and towards the operational position on the first support 7. During loading, the transformer 2 can simply be placed onto the second support 8 from a vertical level that is located above the second support 8, without having to open up a top floor F1 of the substation P. Unloading a transformer 2 from the substation P can be achieved in a similar manner, carrying out the above in reverse order.

After the transformers 2 have been placed in their operating positions, the second support 8 can be removed. The loaded gas insulated transformers 2 can be connected to their gas supply systems G and power cables for operation. It should be noted that a gas insulated transformer 2 does not yet have to be provided with the insulation gas during the loading process. Also, the installed transformers 2 can be electrically connected with the power cables K, N for input and output of electrical power during use.

Although the illustrative embodiments of the present invention have been described in greater detail with reference to the accompanying drawings, it will be understood that the invention is not limited to those embodiments. Various changes or modifications may be effected by one skilled in the art without departing from the scope or the spirit of the invention as defined in the claims.

It is to be understood that in the present application, the term "comprising" does not exclude other elements or steps. Also, each of the terms "a" and "an" does not exclude a plurality. Any reference sign(s) in the claims shall not be construed as limiting the scope of the claims.

For example, the advantageous system and method for loading and unloading the transformer can also be applied on one or more oil insulated transformers (instead of the above-mentioned gas-insulated transformers 2). Naturally, in that case, an above-described circulating system G is to replaced by an oil circulation system, for example including one or more oil pumps, oil lines, oil treatment means, for example one or more oil filters and one or more oil cooling means, to be connected to the respective oil insulated transformer(s) for operation. It should be noted that the oil insulated transformer does not yet have to be provided with the insulation oil during the loading process (i.e. when the oil insulated transformer is moved into and out of the substation.

CLAIMS

1. Offshore substation for a wind farm, the substation having electricity receiving means (1) for receiving electricity generated by the wind farm (F), wherein the substation includes transformer means (T) for transforming the received electricity into high voltage electricity, wherein the transformer means (T) are connectable to high voltage electricity output means (3, N) for outputting the high voltage electricity, characterized in that the transformer means (T) include at least one gas insulated transformer (2).

2. Offshore substation according to claim 1, wherein the at least one gas insulated transformer (2) is configured to transform wind farm generated electricity into high voltage electricity having a voltage higher than about 100 kV.

3. Offshore substation according to any of the preceding claims, wherein each said gas insulated transformer (2) has a capacity of at least 100 MW, particularly at least 150 MW, for example about 180 MW.

4 Offshore substation according to any of the preceding claims, wherein the mass of the each said gas insulated transformer (2) is about 160,000 kg or lower.

5. Offshore substation according to any of the preceding claims, wherein the total mass of the substation (P) is lower than 1000,000 kg, preferably lower than 750,000 kg, for example in the range of about 400,000 kg to 600,000 kg.

6. Offshore substation according to any of the preceding claims, wherein the transformer means include at least two gas insulated transformers (2), for example only two such transformers (2).

7. Offshore substation according to any of the preceding claims, including a first support (7) for supporting the at least one gas insulated

transformer (2) in the substation (P), wherein the substation (P) further includes or is connectable to a second support (8) for supporting the at least one gas insulated transformer (2) next to the first support (P), wherein a transport system is provided for moving a said gas insulated transformer (2) from the second support to the first support.

8. Offshore substation according to claim 7, wherein the first support (7) and second support (8) are located at substantially the same horizontal level, particularly for supporting a said transformer (2) at substantially the same horizontal level.

9. Offshore substation according to claim 7 or 8, wherein the second support (8) is movable from a first position, in which position the support (8) can carry a said transformer (2) at a location next to the first support (7), to a second, idle, position.

10. Offshore substation according to any of claims 7-9, wherein the second support is removable from the substation.

11. Offshore substation according to any of claims 7-10, wherein the second support (8) at least partly extends in an area that is substantially uncovered at a top side of the substation, for example substantially externally with respect to a remaining part of the substation P.

12. Offshore substation according to any of claims 7-11, wherein the second support (8) includes a frame (8a, 8b) that is connected or connectable to a main frame of the substation (P).

13. Offshore substation according to any of claims 7-12, wherein the second support (8) includes a rigid frame (8a, 8b) that is connected or connectable to a main frame of the substation (P).

14. Offshore substation according to any of claims 7-13, wherein the gas insulated transformer (2) is carried by a carrier frame (2a) which is movable from the second support (8) to the first support (7) and/or from the first support (7) to the second support (8).

15. A method for installing an offshore substation for a wind farm, for example a substation according to any of the preceding claims, the substation after installation having electricity receiving means (1) for receiving electricity generated by the wind farm (F), and transformer means (T) for transforming the electricity into high voltage electricity, the transformer means (T) being connectable to high voltage electricity output means (3, N) for outputting the high voltage electricity,
wherein the method includes, in an arbitrary order:

-building at least part of the substation, and locating the built substation part at an operational offshore site; and

-providing the substation with at least one gas insulated transformer (2) as a said transformer means.

16. The method according to claim 15, wherein the at least one gas insulated transformer (2) is placed onto a second support (8), wherein the transformer (2) is moved in a substantially horizontal direction from the second support (2) into the substation (P), particularly towards an operational position on a first support (7).

17. The method according to claim 16, wherein a said gas insulated transformer (2) is placed onto the second support (8) from a vertical level that is located above the second support (8), for example by a crane.

18. The method according to claim 16 or 17, wherein the second support (8) is repositioned or removed with respect to the substation, after the gas insulated transformer (2) has been moved into the substation (P).

19. The method according to any of claims 16-18, wherein a said gas insulated transformer (2) is moved through a lateral side of the substation.

20. The method according to any of claims 15-19, wherein the substation (P) is lifted by a single crane onto a substation support, for example a supporting column, that is already positioned at the desired operational offshore site.

21. Offshore substation for a wind farm, the substation having electricity receiving means (1) for receiving electricity generated by the wind farm (F), wherein the substation includes transformer means (T) for transforming the received electricity into high voltage electricity, wherein the transformer means (T) are connectable to high voltage electricity output means (3, N) for outputting the high voltage electricity, wherein the transformer means (T) include at least one oil insulated transformer, characterized in that the substation includes a first support (7) for supporting the at least one oil insulated transformer in the substation (P), wherein the substation (P) further includes or is connectable to a second support (8) for supporting the at least one oil insulated transformer next to the first support (P), wherein a transport system is provided for moving a said oil insulated transformer from the second support to the first support.

22. A method for installing an offshore substation for a wind farm, for example a substation according to claim 21, the substation after installation having electricity receiving means (1) for receiving electricity generated by the wind farm (F), and transformer means (T) for transforming the electricity into high voltage electricity, the transformer means (T) being connectable to high voltage electricity output means (3, N) for outputting the high voltage electricity,

wherein the method includes, in an arbitrary order:

-building at least part of the substation, and locating the built substation part at an operational offshore site; and

-providing the substation with at least one oil insulated transformer as a said transformer means,

wherein the at least one oil insulated transformer is placed onto a second support (8), wherein the transformer is moved in a substantially horizontal direction from the second support into the substation (P), particularly towards an operational position on a first support (7).

23. The method according to claim 22, wherein a said oil insulated transformer is placed onto the second support (8) from a vertical level that is located above the second support (8), for example by a crane.

24. The method according to claim 22 or 23, wherein the second support (8) is repositioned or removed with respect to the substation, after the oil insulated transformer has been moved into the substation (P).

25. The method according to any of claims 22-24, wherein a said oil insulated transformer is moved through a lateral side of the substation.

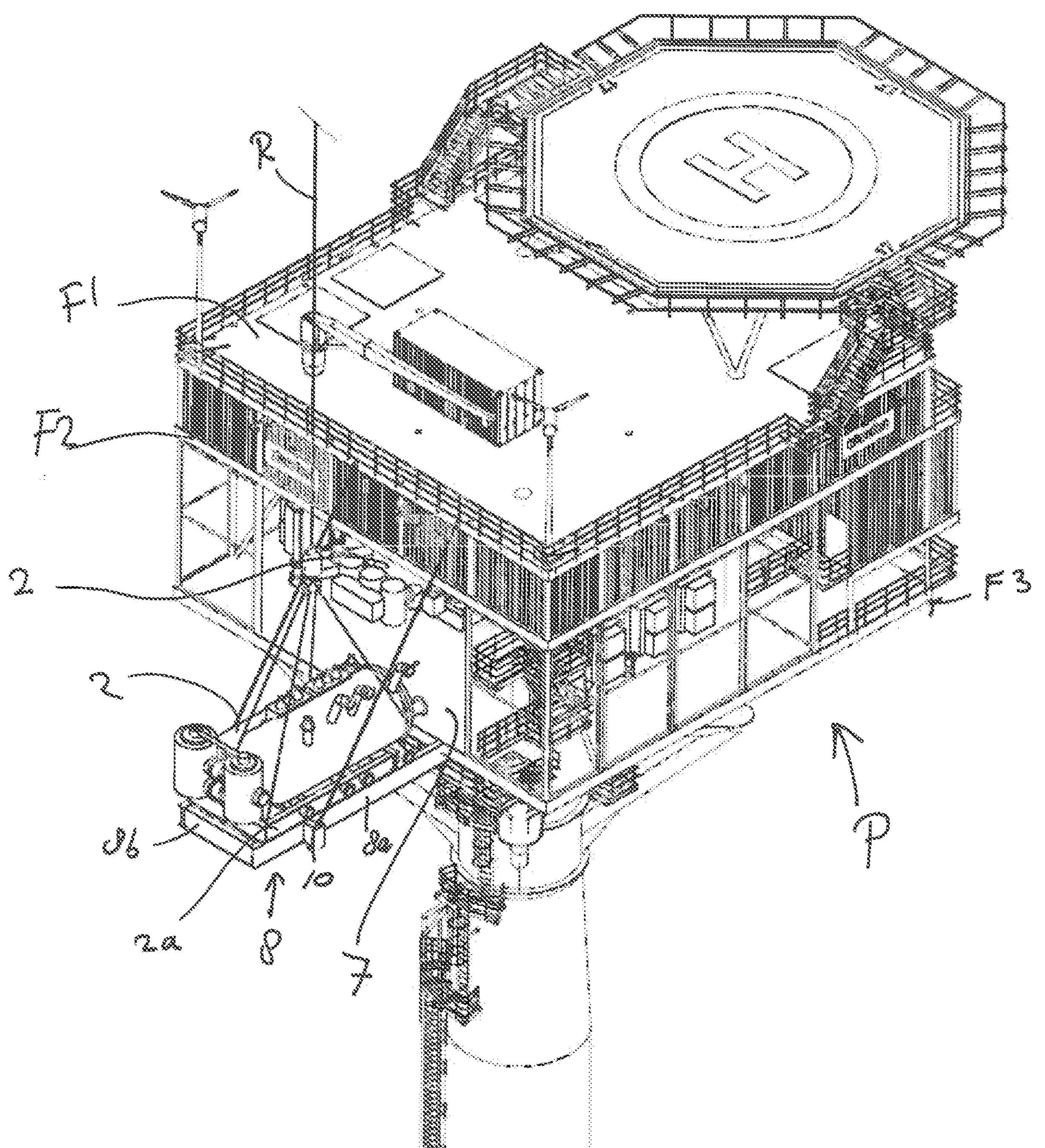

FIG. 1

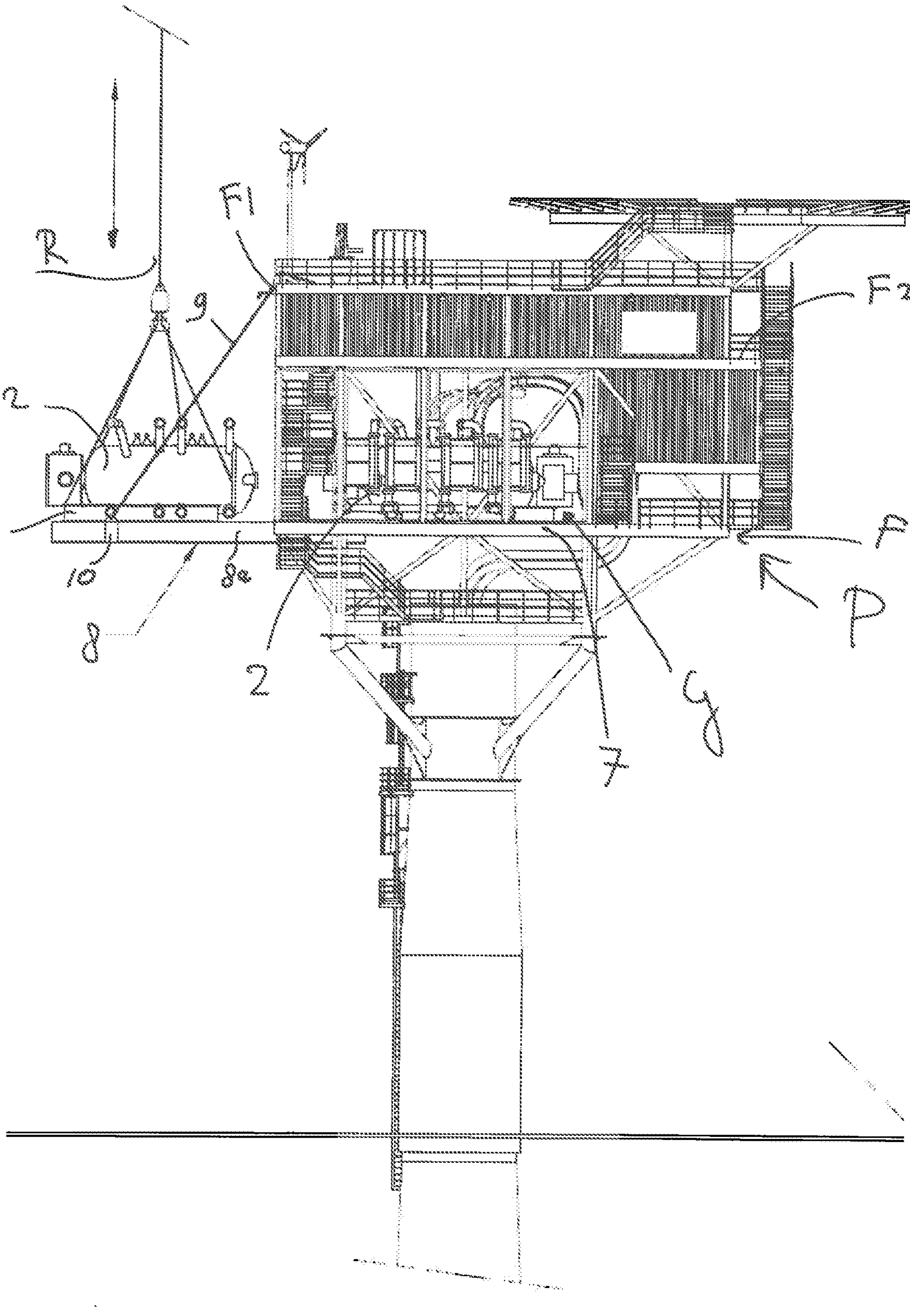

FIG. 2

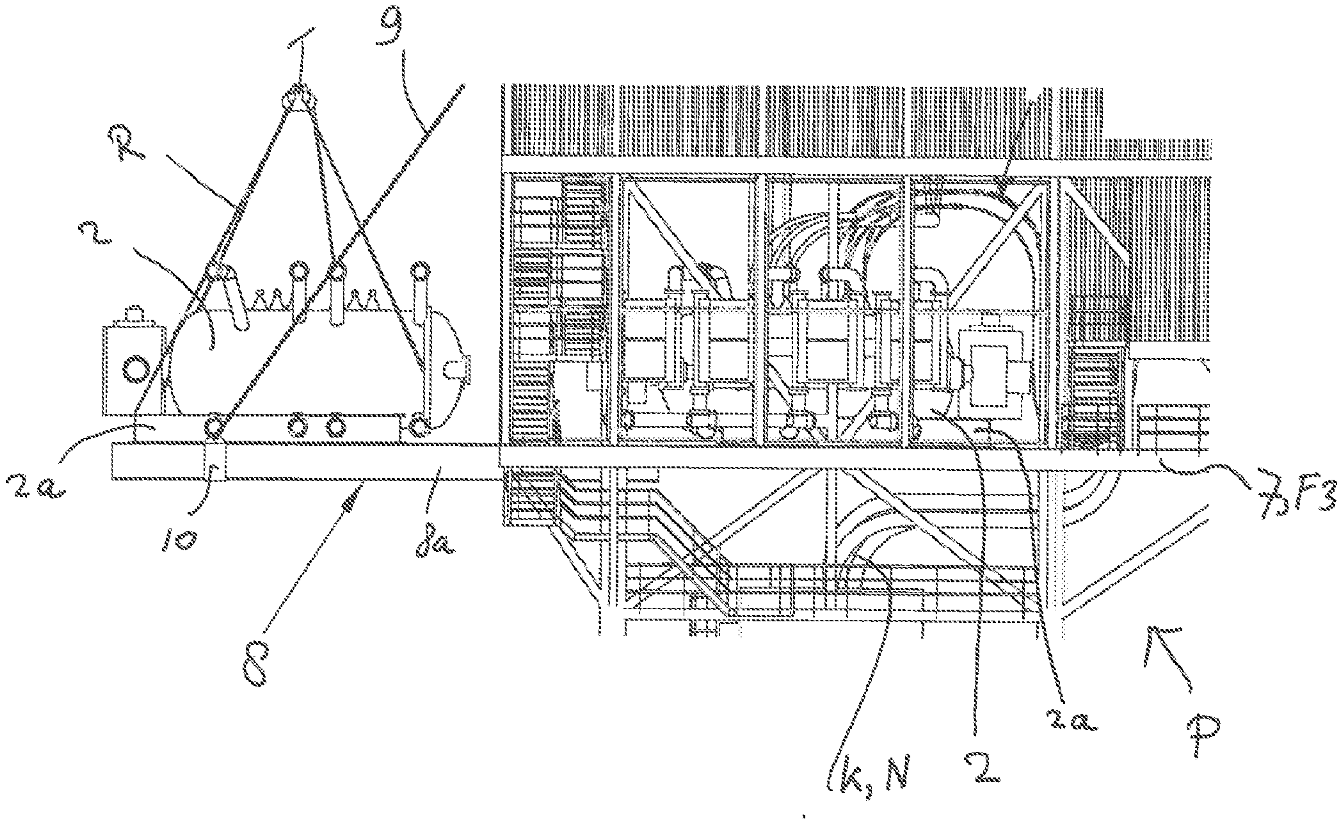

FIG. 3

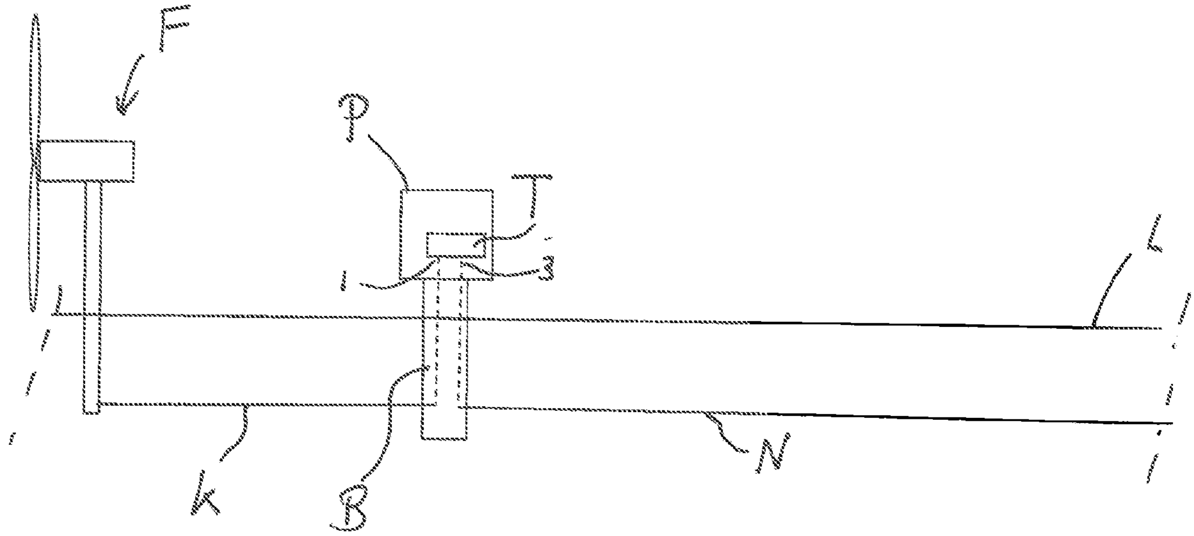

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2011/050265

A. CLASSIFICATION OF SUBJECT MATTER
INV. F03D1/00 F03D11/00
ADD.

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)
H02B F03D H01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 10 2008 028476 A1 (FALKENHAGEN JOACHIM [DE]) 17 December 2009 (2009-12-17) paragraph [0045] - paragraph [0046]; figures 1,2,4 -----	1-20
A	JP 3 101114 A (TOSHIBA CORP) 25 April 1991 (1991-04-25) abstract -----	1-20
A	CN 100 437 845 C (TAN YONG [CN] YONG TAN [CN]) 26 November 2008 (2008-11-26) abstract -----	1-20
	-/--	

[X] Further documents are listed in the continuation of Box C.

[X] 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 document 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 another 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 February 2012	07/03/2012

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Król, Marcin

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INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2011/050265

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01/83290 A1 (AERODYN ENG GMBH [DE]; SIEGFRIEDSEN SOENKE [DE]) 8 November 2001 (2001-11-08)	21
A	figures 6-9 page 8, paragraph 3 page 10, paragraph 5 - page 11, paragraph 2 -----	22-25
A	WO 01/46583 A2 (AERODYN ENG GMBH [DE]; SIEGFRIEDSEN SOENKE [DE]) 28 June 2001 (2001-06-28) claim 1; figures 1,4,5 page 2, paragraph 2 page 4, paragraph 4 - page 5, paragraph 1 -----	21-25
A	US 2010/084925 A1 (DRAPER MARK R [GB] ET AL) 8 April 2010 (2010-04-08) abstract; figure 4 -----	21-25

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INTERNATIONAL SEARCH REPORT	International application No. PCT/NL2011/050265

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

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

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
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. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

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

see additional sheet

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

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ 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 claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-20

   off-shore substation with gas insulated transformers

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2. claims: 21-25

   positioning a transformer

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/NL2011/050265

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
DE 102008028476	A1	17-12-2009	NONE			
JP 3101114	A	25-04-1991	NONE			
CN 100437845	C	26-11-2008	NONE			
WO 0183290	A1	08-11-2001	AU	5461601	A	12-11-2001
			DE	10021163	A1	08-11-2001
			WO	0183290	A1	08-11-2001
WO 0146583	A2	28-06-2001	AT	278104	T	15-10-2004
			AU	3151301	A	03-07-2001
			DE	19962453	C1	12-07-2001
			EP	1240426	A2	18-09-2002
			WO	0146583	A2	28-06-2001
US 2010084925	A1	08-04-2010	NONE			