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(73) Octrooihouder(s):
Delft Offshore Turbine B.V. te Delft

(72) Uitvinder(s):
Andrey Vladimirovich Metrikine te Delft
Jan van der Tempel te Delft

(74) Gemachtigde:
ir. H.A. Witmans c.s. te Den Haag

(54) **System for transporting an offshore structure**

(57) System for transporting an offshore structure, the system comprising: a transport apparatus, in particular a vessel or a vehicle, which is configured to receive an offshore structure and to form a slip joint with a slip joint section of a received offshore structure, wherein the system is configured to enter a releasable state, from a fixing state, wherein, in the releasable state, the slip joint formed by the transport apparatus and the offshore structure is smaller than that force in the fixing state.

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Title: System for transporting an offshore structure

The invention concerns a system for transporting an offshore structure.

Offshore structures may need to be transported, e.g. from an onshore location to an offshore location or vice versa. This can pose challenges as the structures can be substantially large and heavy, for example relative to a transport apparatus, e.g. a ship, on which the structure is transported. To enable stable transportation it is generally necessary to substantially fix or fasten the offshore structure to such a transport apparatus. This is especially critical when the offshore structure's center of gravity is substantially far away from where it is supported by the transport apparatus, e.g. in the case of offshore wind turbines which are transported on a ship in an upright orientation. Upon arrival, e.g. at the offshore location, the offshore structure needs to be released from the transport apparatus, which generally requires that the fastening be undone or reversed.

In known solutions for fastening an offshore structure to a transport apparatus, many nuts and bolts are used to tightly connect the offshore structure to the transport apparatus, which nuts and bolts later need to be undone to release the offshore structure. This is very labor intensive and time consuming, during receiving and fastening as well as during releasing. Moreover, with this solution, the transport apparatus needs to be specifically configured to accommodate the particular size and configuration (e.g. including positions of holes for bolts) of the offshore structure.

It is an object of the present invention to provide an improved system for transporting an offshore structure, in particular to overcome at least one of the above mentioned problems. Further objects of the invention

are to provide: an improved method for transporting an offshore structure; an improved transport apparatus; and an improved offshore structure.

An aspect of the invention provides a system for transporting an offshore structure, the system being characterized by the features of claim 1.

The system comprises a transport apparatus, in particular a vessel or a vehicle, which is configured to receive an offshore structure and to form a slip joint with a slip joint section of a received offshore structure.

The system is configured to enter a releasable state, from a fixing state, wherein, in the releasable state, the slip joint force of the slip joint formed by the transport apparatus and the offshore structure is smaller than that force in the fixing state.

The slip joint can provide safe and efficient means for substantially quickly fastening the offshore structure to the transport apparatus. For example, the slip joint can be formed and/or maintained under influence of the self weight of the offshore structure. Moreover, in this way, offshore structures of various dimensions can be interchangeably accommodated on the transport apparatus substantially without requiring specific modification of the transport apparatus. By being configured to enter the releasable state, the system can provide safe and efficient means for substantially quickly releasing the offshore structure from the transport apparatus.

In an embodiment, in the fixing state, the offshore structure is fixed to the transport apparatus, wherein, in the releasable state, the offshore structure is releasable from the transport apparatus, e.g. using a lifting means.

Thus, by the system entering the releasable state, from the fixing state, the offshore structure can be brought from a state wherein the structure is fixed to the transport apparatus (e.g. for stable and secure transportation) to a state wherein the structure can be released (e.g. for delivering the offshore structure at a delivery location).

In an embodiment, the system further comprises a vibration generator for vibrating the transport apparatus and the offshore structure with respect to each other, in particular for reducing the slip joint force.

It has been found that such a vibration generator can provide effective means for reducing the slip joint force.

In an embodiment, the vibration is generated substantially at one or more predetermined resonance frequencies.

It has been found that vibrations at such frequencies can be especially effective in reducing the slip joint force.

In an embodiment, the system further comprises a separation system, for example including one or more mechanical force generators (e.g. jacks), configured to exert a separating force between the offshore structure and the transport apparatus.

Such a separation system can advantageously provide means to aid in the reduction of the slip joint force, for example complementary to the vibration generator, as well as to substantially separate the offshore structure from the transport apparatus while the slip joint force is reduced. Separating the offshore structure from the transport apparatus in this way can help to prevent that the slip joint force can increase again after having been reduced, for example under influence of the offshore structure's self weight and/or in response to handling of the offshore structure, e.g. by lifting means.

In an embodiment, the system, preferably the transport apparatus, comprises a clamping device in addition to the slip joint, for clamping the offshore structure and the transport apparatus to each other,

wherein, in the fixing state, compared to the releasable state, the offshore structure and the transport apparatus are substantially clamped to each other by the clamping device,

wherein the clamping device is preferably configured to press, e.g. hydraulically, one or more, for example two, clamping elements, preferably

in respective one or more clamping directions which extend towards the transport apparatus and/or the offshore structure.

The clamping device can provide complementary means for efficiently and quickly fastening and releasing the offshore structure.

In an embodiment, the transport apparatus and the offshore structure each include a respective sloping surface section, for example a conical surface or a frusto-conical surface, preferably mating surfaces, wherein the respective sloping surface sections are configured to form the slip joint with each other, in particular when they are positioned onto each other.

Such respective surfaces can provide effective means for forming the slip joint. Moreover, they can provide means for offshore structures of various dimensions to be interchangeably accommodated on the transport apparatus substantially without requiring specific modification of the transport apparatus. For example, various sizes of frusto-conical surfaces of offshore structure sections can be accommodated by lowering them down to respective various levels of a frusto-conical surface section of the transport apparatus.

In an embodiment, the transport apparatus is configured to receive the offshore structure in a receiving direction, in particular to form the slip joint with the slip joint section of the offshore structure, wherein the receiving direction substantially coincides with a direction of a force of gravity acting on the offshore structure, the receiving direction being in particular a substantially downward direction.

Advantageously, the slip joint can thus be formed and/or maintained under influence of the self weight of the offshore structure.

In an embodiment, the system further comprises a lifting device, e.g. a crane or the like, which is configured to lift the offshore structure and preferably to position the offshore structure, in particular with respect to

the transport apparatus and/or with respect to another structure, e.g. a loading location base structure and/or a delivery location base structure.

Such a lifting device can provide means for releasing the offshore structure from the transport apparatus, in particular when the system is in the releasable state. The same or similar lifting device can be used for formation of the slip joint, e.g. by lowering the offshore structure onto the transport apparatus.

In an embodiment, the system is configured for transporting the offshore structure from a loading location, wherein the system further comprises a loading location base structure, for example a foundation, at the loading location, the loading location base structure e.g. being configured to form a slip joint with the offshore structure,

wherein the system is configured to enter a loading base releasable state, from a loading base fixing state, wherein, in the loading base releasable state, the slip joint force of a slip joint formed by the loading location base structure and the offshore structure is smaller than that force in the loading base fixing state.

In this way, the offshore structure can be loaded safely, efficiently and quickly at the loading location. For example, the slip joint with the loading location base structure can thus be formed and released similarly compared to the slip joint with the transport apparatus.

In an embodiment, the system comprises a vibration generator for vibrating the loading location base structure and the offshore structure with respect to each other, in particular for reducing the slip joint force of the slip joint formed by said structures, wherein the vibration is preferably generated substantially at one or more predetermined resonance frequencies.

Such a vibration generator can provide analogous advantages, *mutatis mutandis*, compared to the earlier described vibration generator for

vibrating the transport apparatus and the offshore structure with respect to each other.

In an embodiment, the system further comprises a loading base separation system, for example including one or more mechanical force generators, configured to exert a separating force between the offshore structure and the loading location base structure.

Such a loading base separation system can provide analogous advantages, *mutatis mutandis*, compared to the earlier described separation system for exerting a separating force between the offshore structure and the transport apparatus. The separating force may be significantly smaller than a weight of the offshore structure, wherein the separating force can provide for at least partly reaching said releasable state of the offshore structure. Alternatively, the separating force may be equal to or greater than the weight of the offshore structure.

In an embodiment, the system is configured for transporting the offshore structure to a delivery location, wherein the system further comprises a delivery location base structure, for example a foundation, at the delivery location, the delivery location base structure being configured to receive the offshore structure and to form a slip joint with the slip joint section of the offshore structure.

In this way, the offshore structure can be delivered safely, efficiently and quickly at the delivery location. For example, the slip joint with the delivery location base structure can thus be formed similarly compared to the slip joint with the transport apparatus.

In an embodiment, the transport apparatus is configured to receive a plurality of offshore structures and to form a respective slip joint with the slip joint section of each received offshore structure,

wherein the system is configured, for each received offshore structure, to enter a respective releasable state, from a respective fixing state, wherein, in the releasable state, the slip joint force of a slip joint

formed by the transport apparatus and the offshore structure is smaller than that force in the fixing state.

Such a system can advantageously provide that multiple offshore structures can be transported simultaneously with benefit of the above mentioned advantages.

In an embodiment, the offshore structure includes one or more wind turbines and/or one or more wind turbine, for example a pile and/or a nacelle, and/or one or more multi member offshore structures such as jackets, tripods and/or topsides.

Also, for example, in an embodiment, a single offshore structure can be configured to be supported by a plurality (e.g. two, three, four or more) slip joints. In that case, preferably, the system is configured to enter a releasable state, from a fixing state, wherein, in the releasable state, each slip joint force of each of the plurality of slip joints formed by the transport apparatus and the offshore structure is smaller than the respective force in the fixing state.

In an embodiment, the offshore structure has a mass which is larger than fifty thousand kg.

Such a large mass can advantageously aid in forming a slip joint under influence of the self weight of the offshore structure.

A further aspect of the invention provides a method for transporting an offshore structure. The method comprises receiving an offshore structure on a transport apparatus and forming a slip joint between the transport apparatus and the received offshore structure. The method further comprises: reducing a slip joint force of the slip joint; and releasing the offshore structure from the transport apparatus after reducing the slip joint force.

Such a method can provide the above mentioned advantages.

In an embodiment, the method further comprises generating a vibration of the offshore structure and/or the transport apparatus,

preferably substantially at one or more predetermined resonance frequencies, thereby reducing the slip joint force of the slip joint.

In an embodiment, the method further comprises exerting a separating force between the offshore structure and the transport apparatus.

In an embodiment, the separating force is exerted before the vibration is generated.

It has been found that this can enhance the effectiveness of the vibrations in reducing the slip joint force.

In an embodiment, the separating force is exerted while the vibration is generated.

In this way the offshore structure can be separated from the transport apparatus, in particular stably and in a well-controlled manner.

In an embodiment, the method further comprises: measuring a displacement of the offshore structure with respect to the transport apparatus and/or measuring a pressure between the offshore structure and the transport apparatus; and releasing the offshore structure from the transport apparatus depending on the measured displacement and/or pressure.

In this way the offshore structure can be released from the transport apparatus is a smooth, safe and efficient manner. For example, the offshore structure may be released after the displacement is measured to be larger than a predetermined threshold displacement and/or a pressure is measured to be smaller than a predetermined threshold pressure.

In an embodiment, the method further comprises using active heave compensation, in particular during the releasing.

It has been found that transporting, in particular releasing, the offshore structure can be more stable and/or well-controlled with the use of active heave compensation.

A further aspect of the invention provides a transport apparatus, in particular of a system according to the invention, in particular a vessel or a vehicle, wherein the transport apparatus is configured to receive an offshore structure and to form a slip joint with a slip joint section of a received offshore structure.

Such a transport apparatus can provide the above mentioned advantages, in particular in combination with an offshore structure.

In an embodiment, the transport apparatus is provided with a vibration generator for vibrating the transport apparatus and an offshore structure received on the transport apparatus with respect to each other, in particular for reducing the slip joint force of the slip joint.

In an embodiment, the transport apparatus is provided with a separation system, for example including one or more mechanical force generators, configured to exert a separating force between the offshore structure and the transport apparatus.

A further aspect of the invention provides an offshore structure, in particular of a system according to the invention, in particular including a wind turbine and/or one or more wind turbine components and/or one or more multi member offshore structures, wherein the offshore structure has at least one slip joint section configured to form a slip joint with a respective slip joint section of a transport apparatus, e.g. a transport apparatus according to the invention, in particular for fixing the offshore structure to the transport apparatus.

Such an offshore structure can provide the above mentioned advantages, in particular in combination with the transport apparatus.

In an embodiment, the offshore structure is provided with a vibration generator for vibrating a transport apparatus on which the offshore structure is received and the offshore structure with respect to each other, in particular for reducing the slip joint force of the slip joint.

In an embodiment, the offshore structure is provided with a separation system, for example including one or more mechanical force generators, configured to exert a separating force between a transport apparatus and the offshore structure.

In the following, the invention will be further explained using exemplary embodiments and drawings. In the drawings:

Fig. 1a shows a cross section view of a system according to an embodiment;

Fig. 1b shows a cross section view of a system according to a further embodiment;

Fig. 2a shows a cross section view of a system according to an embodiment, wherein a lifting device is provided, wherein the lifting device is in a substantially unloaded state;

Fig. 2b shows a cross section view of the system of Fig. 2a, wherein the lifting device is in a substantially loaded state;

Fig. 2c shows a cross section view of the system of Figs. 2a-2b, wherein an offshore structure is lifted by the lifting device;

Fig. 3a shows a cross section view of a system according to yet a further embodiment, wherein the system comprises a clamping device in addition to the slip joint;

Fig. 3b shows a cross section view of a system according to yet a further embodiment, wherein multiple offshore structures are received on a transport apparatus;

Fig. 4a shows a cross section view of a loading location base structure provided with an offshore structure according to an embodiment;

Fig. 4b shows a cross section view of a destination location base structure provided with an offshore structure according to an embodiment; and

Fig. 5 shows a perspective exploded view of a slip joint section of an offshore structure and a respective slip joint section of a transport apparatus.

The drawings are schematic. In the drawings, similar or corresponding elements have been provided with similar or corresponding reference signs.

Fig. 1a shows a system according to an embodiment for transporting an offshore structure. The system comprises a transport apparatus 1, in particular a vessel or a vehicle, which is configured to receive an offshore structure 2 and to form a slip joint JT with a slip joint section 9 (see Figs. 2c and 5) of a received offshore structure 2. In this example, a single slip joint JT is formed between the transport apparatus 1 and a slip joint section 8 of the offshore structure 2. Alternatively, the transport apparatus 1 and offshore structure 2 can be configured to form a plurality of slip joints JT there-between (in particular in case the offshore structure 2 is provided with a plurality of slip joint sections, wherein the transport apparatus 1 can have a plurality of slip joint sections 8 to receive the offshore structure 2 and to form a plurality of slip joints JT with the slip joint sections 9 of that structure 2). Providing a plurality of slip joints to transport a single structure can e.g. be implemented in case of transporting a multi-member offshore structure such as a jacket, tripod or topside, as will be appreciated by the skilled person.

The present system is configured to enter a releasable state, from a fixing state, wherein, in the releasable state, the slip joint force of the slip joint JT formed by the transport apparatus 1 and the offshore structure 2 is smaller than that force in the fixing state.

The slip joint JT can provide safe and efficient means for substantially quickly fastening the offshore structure 2 to the transport apparatus 1. For example, the slip joint JT can be formed and/or maintained under influence of the self weight of the offshore structure 2. Moreover, in

this way, offshore structures of various dimensions can be interchangeably accommodated on the transport apparatus 1 substantially without requiring specific modification of the transport apparatus 1. See Fig. 3b for relevant examples of offshore structures 302, 302', 302" of various dimensions. By being configured to enter the releasable state, the system can provide safe and efficient means for substantially quickly releasing the offshore structure 2 from the transport apparatus 1.

In an embodiment, in the fixing state, the offshore structure 2 is fixed to the transport apparatus 1, wherein, in the releasable state, the offshore structure 2 is releasable from the transport apparatus 1, e.g. using a lifting means (e.g. as shown in Fig. 2c, lifting means 10).

Thus, by the system entering the releasable state, from the fixing state, the offshore structure 2 can be brought from a state wherein the structure is fixed to the transport apparatus 1 (e.g. for stable and secure transportation) to a state wherein the structure 2 can be released (e.g. for delivering the offshore structure 2 at a delivery location).

In an embodiment, with further reference to Fig. 1a, the system further comprises a vibration generator 3 for vibrating the transport apparatus 1 and the offshore structure 2 with respect to each other, in particular for reducing the slip joint force.

It has been found that such a vibration generator 3 can provide effective means for reducing the slip joint force. In Fig. 1a the vibration generator, e.g. including one or more vibration motors, is attached to the transport apparatus 1. In other embodiments, e.g. as shown in Fig. 1b, the vibration generator 103 may be attached to the offshore structure 102. It will be appreciated that combinations and variations of these options are also possible.

The vibration is preferably generated substantially at one or more predetermined resonance frequencies.

It has been found that vibrations at such frequencies can be especially effective in reducing the slip joint force.

In an embodiment, the system further or alternatively comprises a separation system 4, for example including one or more mechanical force generators (e.g. one or more hydraulic jacks) 5, configured to exert a separating force FS between the offshore structure 2 and the transport apparatus 1. For example, such a mechanical force generator 5 can include mutually displaceable elements (e.g. being hydraulically and/or electrically powered), for generating said separation force between the structure 2 and transport apparatus 1. As follows from the drawing, the separation force FS preferably is directed in parallel with a gravity force direction (i.e. aimed at countering gravity). Said one or more mechanical force generators 5 can e.g. be configured to deliver a total maximum force that is significantly smaller (e.g. at least 10 times smaller) than the weight of the offshore structure 2 to be separated. Further, the separation system 4 is separate from an external lifting means 10 that can be used to lift the offshore structure 2 when the releasable state has been achieved (the lifting means 10 being capable of providing a lifting force that overcomes the weight of the offshore structure 2).

Such a separation system 4 can advantageously provide means to aid in the reduction of the slip joint force, for example complementary to the vibration generator 3, as well as to assist in separating the offshore structure 2 from the transport apparatus 1 while the slip joint force is reduced. Separating the offshore structure 2 from the transport apparatus 1 in this way can help to prevent that the slip joint force can increase again after having been reduced, for example under influence of the offshore structure's self weight and/or in response to handling of the offshore structure 2, e.g. by an external lifting means 10 (see Fig. 2c).

Figs. 1a and 1b show different options of the separation system 4: Fig. 1a shows mechanical force generators 5 mounted to an internal surface

of the offshore structure 2, configured to push substantially downwards against a top section of the transport apparatus 1; Fig. 1b shows mechanical force generators 5 mounted to the transport apparatus 1, configured to push substantially upwards against a bottom section of the offshore structure 2.

It will be appreciated that combinations and variations of these options are also possible. While both the vibration generator 103 and the separating system 104 shown in Fig. 1b differ from those shown in Fig. 1a, it will also be appreciated that these variations are not necessarily interdependent.

With reference to Fig. 3a, in an embodiment the system, preferably the transport apparatus 201, comprises a clamping device 206 in addition to the slip joint JT, for clamping the offshore structure 202 and the transport apparatus 201 to each other,

wherein, in the fixing state, compared to the releasable state, the offshore structure 202 and the transport apparatus 201 are substantially clamped to each other by the clamping device 206.

The clamping device 206 can provide complementary means for efficiently and quickly fastening and releasing the offshore structure 202.

The clamping device 206 is preferably configured to press, e.g. hydraulically, one or more, for example two, clamping elements 207, preferably in respective one or more clamping directions C which extend towards the transport apparatus 201 and/or the offshore structure 202.

As shown in Figs 2c and 5, in an embodiment, the transport apparatus 1 and the offshore structure 2 each include a respective slip joint section 8, 9, e.g. a sloping surface for example a conical surface or a frusto-conical surface, preferably mating surfaces, wherein the respective sections 8, 9 are configured to form the slip joint JT with each other, in particular when they are positioned onto each other, e.g. in a receiving direction R (see Fig. 5).

Such respective sections 8, 9 can provide effective means for forming the slip joint JT. Moreover, they can provide means for offshore

structures of various dimensions to be interchangeably accommodated on the transport apparatus substantially without requiring specific modification of the transport apparatus. For example, as shown in Fig. 2b, sections having various sizes of frusto-conical surfaces of offshore structures 302, 302', 302" can be accommodated by lowering them down to respective sections of various levels of a frusto-conical surface of the transport apparatus.

It will be appreciated that the offshore structure 2 may be only partially shown in the schematic drawing of Fig. 5.

In an embodiment, as shown in Figs. 2c and 5, the slip joint section 8 of the transport apparatus 1 is configured to receive the offshore structure 2 in a receiving direction R, in particular to form the slip joint JT (see e.g. Fig. 2a) with the slip joint section 9 of the offshore structure 2,

wherein the receiving direction R substantially coincides with a direction of a force of gravity acting on the offshore structure 2, the receiving direction R being in particular a substantially downward direction.

Advantageously, the slip joint JT can thus be formed and/or maintained under influence of the self weight of the offshore structure 2.

As shown in Figs. 2a-2c, in an embodiment, the system further comprises a lifting device 10, e.g. a crane or the like, which is configured to lift the offshore structure 2 and preferably to position the offshore structure 2, in particular with respect to the transport apparatus 1 and/or with respect to another structure, e.g. a loading location base structure 11 (see Fig. 4a) and/or a delivery location base structure 12 (see Fig. 4b).

Such a lifting device 10 can provide means for releasing the offshore structure 2 from the transport apparatus 1, in particular when the system is in the releasable state. The same or similar lifting device 10 can be used for formation of the slip joint JT, e.g. by lowering the offshore structure 2 onto the transport apparatus 1 (e.g. in the receiving direction R, see Fig. 2c).

Fig. 2a shows the lifting device 10 in a substantially unloaded state, while the slip joint JT is formed. Upon the system entering the releasable state, the lifting device 10 may be brought to a loaded state, as shown in Fig. 2b, followed by a lifting of the offshore structure 2 by the lifting device 10, see Fig. 2c, wherein the offshore structure 2 is released from the transport apparatus 1. Figs. 2b and 2c show a direction FL of the lifting device force of the lifting device 10.

In an embodiment, the system is configured for transporting the offshore structure 2 from a loading location, wherein the system further comprises a loading location base structure 11 (see Fig. 4a), for example a foundation, at the loading location, the loading location base structure 11 e.g. being configured to form a slip joint JL with the offshore structure 2,

wherein the system is configured to enter a loading base releasable state, from a loading base fixing state, wherein, in the loading base releasable state, the slip joint force of a slip joint JL formed by the loading location base structure 11 and the offshore structure 2 is smaller than that force in the loading base fixing state.

In this way, the offshore structure 2 can be loaded safely, efficiently and quickly at the loading location. For example, the slip joint JL with the loading location base structure 11 can thus be formed and released similarly compared to the slip joint JT with the transport apparatus 1.

In an embodiment, with further reference to Fig. 4a, the system comprises a vibration generator 3 for vibrating the loading location base structure 11 and the offshore structure 2 with respect to each other, in particular for reducing the slip joint force of the slip joint JL formed by said structures, wherein the vibration is preferably generated substantially at one or more predetermined resonance frequencies.

Such a vibration generator can provide analogous advantages (*mutatis mutandis*) compared to the earlier described vibration generator for vibrating the transport apparatus and the offshore structure with

respect to each other. In some embodiments, the vibration generator can be substantially the same as the earlier described vibration generator, for example when the vibration generator 3 is substantially included in the offshore structure 2. Alternatively, for example, as shown in Fig. 4a, the vibration generator may be a loading base vibration generator 410 which is attached to the loading location base structure 411.

In an embodiment, with further reference to Fig. 4a, the system comprises a loading base separation system 13, for example including one or more mechanical force generators 5, configured to exert a separating force FS between the offshore structure 2 and the loading location base structure 11.

Such a loading base separation system can provide analogous advantages (*mutatis mutandis*) compared to the earlier described separation system for exerting a separating force between the offshore structure and the transport apparatus. In some embodiments, the loading base separation system 13 can be substantially the same as or be included in the earlier described separation system 4, for example when the separation system 4 is substantially included in the offshore structure.

In an embodiment, with reference to Fig. 4b, the system is configured for transporting the offshore structure 2 to a delivery location, wherein the system further comprises a delivery location base structure 12, for example a foundation, at the delivery location, the delivery location base structure 12 being configured to receive the offshore structure 2 and to form a slip joint JD with the slip joint section 9 of the offshore structure 2.

In this way, the offshore structure 2 can be delivered safely, efficiently and quickly at the delivery location. For example, the slip joint JD with the delivery location base structure 12 can thus be formed similarly compared to the slip joint JT with the transport apparatus 1.

In an embodiment, as shown in Fig. 3b, the transport apparatus 1 is configured to receive a plurality of offshore structures 302, 302', 302" and

to form a respective slip joint JT, JT', JT" with the slip joint section 9 of each received offshore structure 302, 302', 302",

wherein the system is configured, for each received offshore structure 2, to enter a respective releasable state, from a respective fixing state, wherein, in the releasable state, the slip joint force of a slip joint JT formed by the transport apparatus 1 and the offshore structure 2 is smaller than that force in the fixing state.

Such a system can advantageously provide that multiple offshore structures can be transported simultaneously with benefit of the above mentioned advantages. It will be appreciated that the system may be configured to receive more or less than the number of offshore structures shown in Fig. 3b and that the relative positions of the received multiple offshore structures with respect to each other and with respect to the transport apparatus may be different from the configuration shown in Fig. 3b. For example, the offshore structures may be positioned according to a matrix structure. It will also be appreciated that the multiple offshore structures may or may not be each of the same type and/or dimensions.

In an embodiment, the offshore structure 2 includes one or more wind turbines 2 and/or one or more wind turbine components, for example a pile 14 and/or a nacelle 15 (see Fig. 4b). In other examples, the offshore structure 2 may include a jacket or a topside.

In an embodiment, the offshore structure 2 has a mass which is larger than fifty thousand kg.

Such a large mass can advantageously aid in forming a slip joint under influence of the self weight of the offshore structure.

A method for transporting an offshore structure comprises:

receiving an offshore structure 2 on a transport apparatus 1 and forming a slip joint JT between the transport apparatus 1 and the received offshore structure 2; reducing a slip joint force of the slip joint JT; and releasing (see

e.g. Fig. 2c) the offshore structure 2 from the transport apparatus 1 after reducing the slip joint force.

In an embodiment, the method further comprises generating a vibration of the offshore structure 2 and/or the transport apparatus 1, preferably substantially at one or more predetermined resonance frequencies, thereby reducing the slip joint force of the slip joint JT.

In an embodiment, the method further comprises exerting a separating force FS between the offshore structure 2 and the transport apparatus 1.

In an embodiment, the separating force FS is exerted before the vibration is generated.

It has been found that this can enhance the effectiveness of the vibrations in reducing the slip joint force.

In an embodiment, the separating force FS is exerted while the vibration is generated.

In this way the offshore structure 2 can be separated from the transport apparatus 1, in particular stably and in a well-controlled manner.

In an embodiment, the method further comprises: measuring a displacement of the offshore structure 2 with respect to the transport apparatus 1 and/or measuring a pressure between the offshore structure 2 and the transport apparatus 1; and releasing the offshore structure 2 from the transport apparatus 1 depending on the measured displacement and/or pressure.

In this way the offshore structure 2 can be released from the transport apparatus 1 is a smooth, safe and efficient manner. For example, the offshore structure 2 may be released after the displacement is measured to be larger than a predetermined threshold displacement and/or a pressure is measured to be smaller than a predetermined threshold pressure.

For measuring the displacement and/or pressure, the separating system 4 may include one or more measuring devices (not shown), e.g. a

displacement measuring device (e.g. using a camera) and/or a pressure measuring device (e.g. for measuring a pressure of a hydraulic operating fluid, e.g. of a mechanical force generator or jack 5).

In an embodiment, the method further comprises using active heave compensation, in particular during the releasing.

It has been found that transporting, in particular releasing, the offshore structure can be more stable and/or well-controlled with the use of active heave compensation.

To this end, e.g. the lifting device 10 may include a system for active heave compensation. Relevant general systems and methods for active heave compensation will be known to the skilled person.

Above described embodiments may include a transport apparatus 1, in particular a vessel or a vehicle, wherein the transport apparatus 1 is configured to receive an offshore structure 2 and to form a slip joint JT with a slip joint section 9 of a received offshore structure 2.

In embodiments, the transport apparatus is provided with a vibration generator 3 for vibrating the transport apparatus 1 and an offshore structure 2 received on the transport apparatus 1 with respect to each other, in particular for reducing the slip joint force of the slip joint JT.

In embodiments, the transport apparatus is provided with a separation system 4, for example including one or more jacks and/or other force generators 5, configured to exert a separating force FS between the offshore structure 2 and the transport apparatus 1.

Above described embodiments may include an offshore structure 2, in particular including a wind turbine 2 and/or one or more wind turbine components 14, 15, wherein the offshore structure 2 has a slip joint section 9 configured to form a slip joint JT with a slip joint section 8 of a transport apparatus 1, e.g. an above described transport apparatus, in particular for fixing the offshore structure 2 to the transport apparatus 1.

In embodiments, the offshore structure is provided with a vibration generator 3 for vibrating a transport apparatus 1 on which the offshore structure 2 is received and the offshore structure 2 with respect to each other, in particular for reducing the slip joint force of the slip joint JT.

In embodiments, the offshore structure is provided with a separation system 4, for example including one or more mechanical force generators 5, configured to exert a separating force FS between a transport apparatus 1 and the offshore structure 2.

The embodiments as disclosed are shown by way of example only and should not be construed as limiting the scope of the disclosure. Many variations are possible within the scope of the invention as defined by the claims.

For example: the system may be configured to form more than one slip joint per offshore structure, e.g. two or three or four slip joints per offshore structure, wherein the multiple slip joints may be formed simultaneously, brought to a releasable state simultaneously, and/or released simultaneously. In this way, for example a jacket or a topside having for example three or four legs may be transported with the described advantages.

The vibration generator can be configured to generate vibrations of various durations and magnitudes for reducing the respective slip joint force, e.g. depending on the detailed configuration of the respective slip joint.

The vibration device can be configured for example to generate mutual acceleration, e.g. by providing at least one impulse to the slip joint, e.g. to the offshore structure, e.g. using an impact or hammer device, or the-like.

The transport device can be provided with a propulsion system, and/or it can be configured to be propelled by an external propulsion force.

The transport device can be a barge, for example. A received offshore structure may be additionally fastened to the transport apparatus using as such known fastening methods, e.g. using one or more nuts and bolts.

The offshore structure and/or the transport apparatus may include one or more, preferably respective, guiding means for guiding the offshore structure with respect to the transport apparatus during receiving and/or releasing of the offshore structure, for example to align the offshore structure with the transport apparatus.

A slip joint section 8 of a transport apparatus 1 can be configured in various ways. It may be an integral part of the transport apparatus 1, e.g. be made in one-piece with the transport apparatus 1, but that is not required.

A slip joint section 8 of a transport apparatus 1 may for example be a joint section that is welded and/or bolted to a support frame, deck and/or other section of the transport apparatus 1. The slip joint section 8 of the transport apparatus 1 may e.g. be made of steel, but that is not required. The slip joint section 8 of the transport apparatus 1 may also be a section that can be removed from the transport apparatus 1 after use (i.e. after us to provide a slip joint with an offshore structure 2 to be transported), e.g. for making the transport apparatus 1 available for another type of transport. These and other amendments, including but not limited to combinations of embodiments or parts thereof as disclosed are also considered to have been disclosed within the ambit of the claims.

List of reference signs

1.	Transport apparatus
2.	Offshore structure
3.	Vibration generator
4.	Separation system
5.	Mechanical force generator
6.	Clamping device
7.	Clamping element
8.	Slip joint section of transport apparatus
9.	Slip joint section of offshore structure
10.	Lifting device
11.	Loading location base structure
12.	Delivery location base structure
13.	Loading base separation system
14.	Pile
15.	Nacelle
16.	Loading base vibration generator
C.	Clamping direction
FS.	Separating force
FL.	Lifting device force
JD.	Slip joint formed by destination location base structure and offshore structure
JL.	Slip joint formed by loading location base structure and offshore structure
JT.	Slip joint formed by transport apparatus and offshore structure
R.	Receiving direction

Conclusies

1. Systeem voor het transporteren van een offshore-structuur, waarbij het systeem omvat:

- een transportinrichting (1), in het bijzonder een vaartuig of een voertuig, die is ingericht om een offshore-structuur (2) te ontvangen en om een slipverbinding (JT) te vormen met een slipverbindingssectie (9) van een ontvangen offshore-structuur (2),

waarbij het systeem is ingericht om een vrijgeefbare stand in te gaan vanuit een vasthoudstand, waarbij in de vrijgeefbare stand de slipverbindingskracht van de door de transportinrichting (1) en de offshore-structuur (2) gevormde slipverbinding (JT) kleiner is dan die kracht in de vasthoudstand.

2. Systeem volgens conclusie 1, waarbij in de vasthoudstand de offshore-structuur (2) wordt vastgehouden aan de transportinrichting (1), waarbij in de vrijgeefbare stand de offshore-structuur (2) vrijgeefbaar is van de transportinrichting (1), b.v. met gebruik van een hefmiddel.

3. Systeem volgens één van de voorgaande conclusies, waarbij het systeem verder omvat:

- een trillingsgenerator (3) voor het ten opzichte van elkaar trillen van de transportinrichting (1) en de offshore-structuur (2), in het bijzonder voor het verminderen van de slipverbindingskracht, waarbij de trilling bij voorkeur in hoofdzaak op één of meer vooraf bepaalde resonantiefrequenties wordt gegenereerd.

4. Systeem volgens één van de voorgaande conclusies, waarbij het systeem verder omvat:

- een scheidingssysteem (4), bijvoorbeeld omvattende één of meer mechanische krachtgeneratoren (5), b.v. krikken, ingericht om een scheidingskracht (FS) uit te oefenen tussen de offshore-structuur (2) en de transportinrichting (1).

5. Systeem volgens één van de voorgaande conclusies, waarbij het systeem, bij voorkeur de transportinrichting (1), in aanvulling op de slipverbinding (JT) een kleminrichting (6) omvat voor het aan elkaar klemmen van de offshore-structuur (2) en de transportinrichting (1),

waarbij in de vasthoudstand, vergeleken met de vrijgeefbare stand, de offshore-structuur (2) en de transportinrichting (1) in hoofdzaak aan elkaar geklemd worden door de kleminrichting (6),

waarbij de kleminrichting (6) bij voorkeur is ingericht om één of meer, bijvoorbeeld twee, klemelementen (7), te drukken, b.v. hydraulisch, bij voorkeur in respectieve één of meer klemrichtingen (C) die zich uitstrekken naar de transportinrichting (1) en/of de offshore-structuur (2) toe.

6. Systeem volgens één van de voorgaande conclusies, waarbij de transportinrichting (1) en de offshore-structuur (2) elk een sectie omvatten met een respectief hellend oppervlak (8, 9), bijvoorbeeld een kegelvormig oppervlak of een afgeknotte-kegelvormig oppervlak, bij voorkeur bij elkaar passende oppervlakken, waarbij de respectieve hellend-oppervlaksecties (8, 9) zijn ingericht om met elkaar de slipverbinding (JT) te vormen, in het bijzonder wanneer zij op elkaar gepositioneerd zijn.

7. Systeem volgens één van de voorgaande conclusies, waarbij de transportinrichting (1) is ingericht om de offshore-structuur (2) in een ontvangrichting (R) te ontvangen, in het bijzonder om de slipverbinding (JT) te vormen met de slipverbindingssectie (9) van de offshore-structuur (2),

waarbij de ontvangrichting (R) in hoofdzaak samenvalt met een richting van zwaartekracht die inwerkt op de offshore-structuur (2), waarbij de ontvangrichting (R) in het bijzonder een in hoofdzaak neerwaartse richting is.

8. Systeem volgens één van de voorgaande conclusies, waarbij het systeem verder omvat:

- een hefinrichting (10), b.v. een kraan of iets dergelijks, die is ingericht om de offshore-structuur (2) te heffen en bij voorkeur om de offshore-structuur (2) te positioneren, in het bijzonder ten opzichte van de transportinrichting (1) en/of ten opzichte van een andere structuur, b.v. een laadlocatiebasisstructuur (11) en/of een afleverlocatiebasisstructuur (12).

9. Systeem volgens één van de voorgaande conclusies, waarbij het systeem is ingericht voor het vanaf een laadlocatie transporteren van de offshore-structuur (2), waarbij het systeem verder omvat:

- een laadlocatiebasisstructuur (11), bijvoorbeeld een fundering, op de laadlocatie, waarbij de laadlocatiebasisstructuur (11) b.v. is ingericht om een slipverbinding (JL) te vormen met de offshore-structuur (2),

waarbij het systeem is ingericht om een laadbasisvrijgeefbare stand in te gaan vanuit een laadbasisvasthoudstand, waarbij in de laadbasisvrijgeefbare stand de slipverbindingskracht van een door de laadlocatiebasisstructuur (11) en de offshore-structuur (2) gevormde slipverbinding (JL) kleiner is dan die kracht in de laadbasisvasthoudstand.

10. Systeem volgens conclusie 9, waarbij het systeem omvat:

- een trillingsgenerator (3) voor het ten opzichte van elkaar trillen van de laadlocatiebasisstructuur (11) en de offshore-structuur (2), in het bijzonder voor het verminderen van de slipverbindingskracht van de door genoemde structuren gevormde slipverbinding (JL), waarbij de trilling bij voorkeur in hoofdzaak op één of meer vooraf bepaalde resonantiefrequenties wordt gegenereerd.

11. Systeem volgens één van de conclusies 9-10, waarbij het systeem verder omvat:

- een laadbasisscheidingssysteem (13), bijvoorbeeld omvattende één of meer mechanische krachtgeneratoren (5), ingericht om een scheidingskracht (FS) uit te oefenen tussen de offshore-structuur (2) en de laadlocatiebasisstructuur (11).

12. Systeem volgens één van de voorgaande conclusies, waarbij het systeem is ingericht voor het naar een afleverlocatie transporteren van de offshore-structuur (2), waarbij het systeem verder omvat:

- een afleverlocatiebasisstructuur (12), bijvoorbeeld een fundering, op de afleverlocatie, waarbij de afleverlocatiebasisstructuur (12) is ingericht om de offshore-structuur (2) te ontvangen en om een slipverbinding (JD) te vormen met de slipverbindingssectie (9) van de offshore-structuur (2).

13. Systeem volgens één van de voorgaande conclusies, waarbij de transportinrichting (1) is ingericht om een meervoudig aantal offshore-structuren (2) te ontvangen en om een respectieve slipverbinding (JT) te vormen met de slipverbindingssectie (9) van elke ontvangen offshore-structuur (2),

waarbij het systeem voor elke ontvangen offshore-structuur (2) is ingericht om een respectieve vrijgeefbare stand in te gaan vanuit een respectieve vasthoudstand, waarbij in de vrijgeefbare stand de slipverbindingskracht van een door de transportinrichting (1) en de offshore-structuur (2) gevormde slipverbinding (JT) kleiner is dan die kracht in de vasthoudstand.

14. Systeem volgens één van de voorgaande conclusies, waarbij de offshore-structuur (2) één of meer windturbines (2) en/of één of meer windturbine-onderdelen bevat, bijvoorbeeld een mast (14) en/of een gondel (15).

15. Systeem volgens één van de voorgaande conclusies, waarbij de transportinrichting (1) is ingericht om een offshore-structuur (2) te ontvangen en om een meervoudig aantal slipverbindingen (JT) te vormen met slipverbindingssecties (9) van een ontvangen offshore-structuur (2),

waarbij het systeem is ingericht om een vrijgeefbare stand in te gaan vanuit een vasthoudstand, waarbij in de vrijgeefbare stand de slipverbindingskracht van elke door de transportinrichting (1) en de offshore-structuur (2) gevormde slipverbinding (JT) kleiner is dan de respectieve kracht in de vasthoudstand.

16. Een werkwijze voor het transporteren van een offshore-structuur, de werkwijze omvattende:

- het ontvangen van een offshore-structuur (2) op een transportinrichting (1) en het vormen van een slipverbinding (JT) tussen de transportinrichting (1) en de ontvangen offshore-structuur (2);

- het verminderen van een slipverbindingskracht van de slipverbinding (JT); en
- het vrijgeven van de offshore-structuur (2) van de transportinrichting (1) na het verminderen van de slipverbindingskracht.

17. Een werkwijze volgens conclusie 16, waarbij de werkwijze verder omvat:

- het genereren van een trilling van de offshore-structuur (2) en/of de transportinrichting (1), bij voorkeur in hoofdzaak op één of meer vooraf bepaalde resonantiefrequenties, daarbij de slipverbindingskracht van de slipverbinding (JT) verminderend.

18. Een werkwijze volgens conclusie 16 of 17, waarbij de werkwijze verder omvat:

- het uitoefenen van een scheidingskracht (FS) tussen de offshore-structuur (2) en de transportinrichting (1).

19. Een werkwijze volgens conclusie 17 en 18, waarbij de scheidingskracht (FS) wordt uitgeoefend voordat de trilling wordt gegenereerd.

20. Een werkwijze volgens conclusie 17 en één van de conclusies 18-19, waarbij de scheidingskracht (FS) wordt uitgeoefend terwijl de trilling wordt gegenereerd.

21. Een werkwijze volgens één van de conclusies 17-20, waarbij de werkwijze verder omvat:

- het meten van een verplaatsing van de offshore-structuur (2) ten opzichte van de transportinrichting (1) en/of het meten van een druk tussen de offshore-structuur (2) en de transportinrichting (1); en
- het van de transportinrichting (1) vrijgeven van de offshore-structuur (2) afhankelijk van de gemeten verplaatsing en/of druk.

22. Een werkwijze volgens één van de conclusies 17-21, waarbij de werkwijze verder omvat: het gebruiken van actieve deiningscompensatie, in het bijzonder tijdens het vrijgeven.

23. Een transportinrichting (1) van een systeem volgens één van de conclusies 1-15, in het bijzonder een vaartuig of een voertuig, waarbij de transportinrichting (1) is ingericht om een offshore-structuur (2) te ontvangen en om een slipverbinding (JT) te vormen met een slipverbindingssectie (9) van een ontvangen offshore-structuur (2).

24. Een transportinrichting volgens conclusie 23, voorzien van een trillingsgenerator (3) voor het ten opzichte van elkaar trillen van de transportinrichting (1) en een op de transportinrichting (1) ontvangen offshore-structuur (2), in het bijzonder voor het verminderen van de slipverbindingskracht van de slipverbinding (JT).

25. Een transportinrichting volgens één van de conclusies 23-24, voorzien van een scheidingssysteem (4), bijvoorbeeld omvattende één of meer mechanische krachtgeneratoren (5), ingericht om een scheidingskracht (FS) uit te oefenen tussen de offshore-structuur (2) en de transportinrichting (1).

26. Een offshore-structuur van een systeem volgens één van de conclusies 1-15, in het bijzonder omvattende een windturbine (2) en/of één of meer windturbine-onderdelen (14, 15) en/of één of meer veelledige offshore-structuren, waarbij de offshore-structuur (2) ten minste één slipverbindingssectie (9) heeft die is ingericht om een slipverbinding (JT) te vormen met een respectieve slipverbindingssectie (8) van een transportinrichting (1), b.v. een transportinrichting volgens één van de conclusies 23-25, in het bijzonder voor het vasthouden van de offshore-structuur (2) aan de transportinrichting (1).

27. Een offshore-structuur volgens conclusie 26, voorzien van een trillingsgenerator (3) voor het ten opzichte van elkaar trillen van een transportinrichting (1) waarop de offshore-structuur (2) is ontvangen en de offshore-structuur (2), in het bijzonder voor het verminderen van de slipverbindingskracht van de slipverbinding (JT).

28. Een offshore-structuur volgens één van de conclusies 26-27, voorzien van een scheidingssysteem (4), bijvoorbeeld omvattende één of meer mechanische krachtgeneratoren (5), ingericht om een scheidingskracht (FS) uit te oefenen tussen een transportinrichting (1) en de offshore-structuur (2).

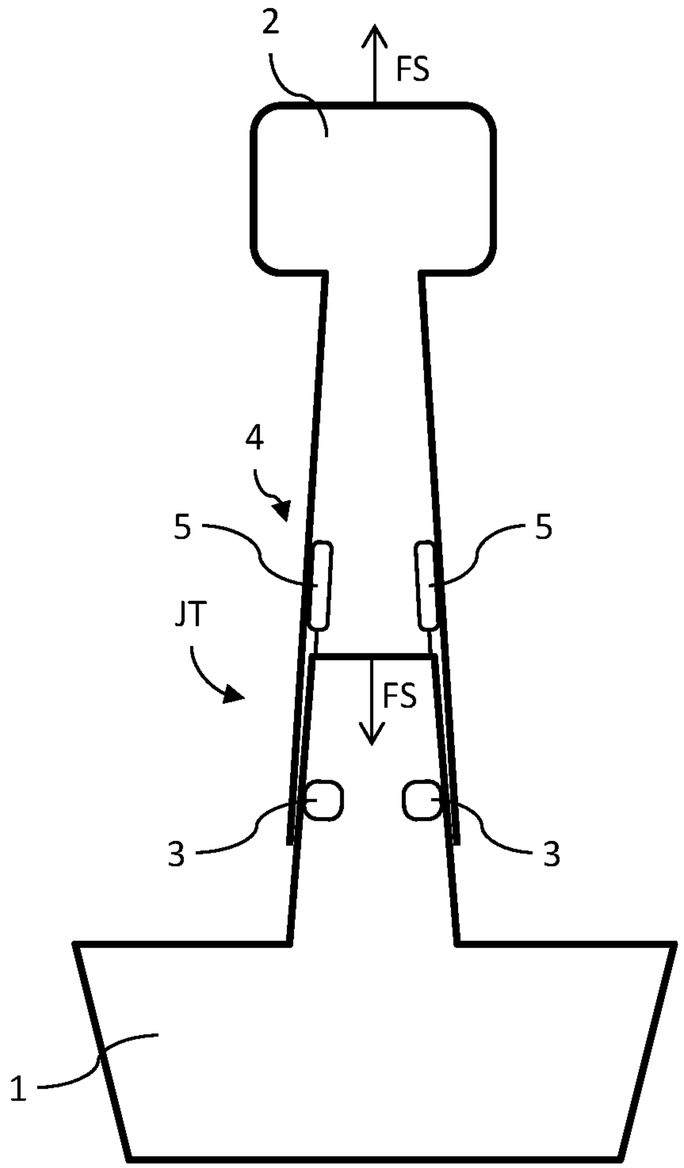

Fig. 1a

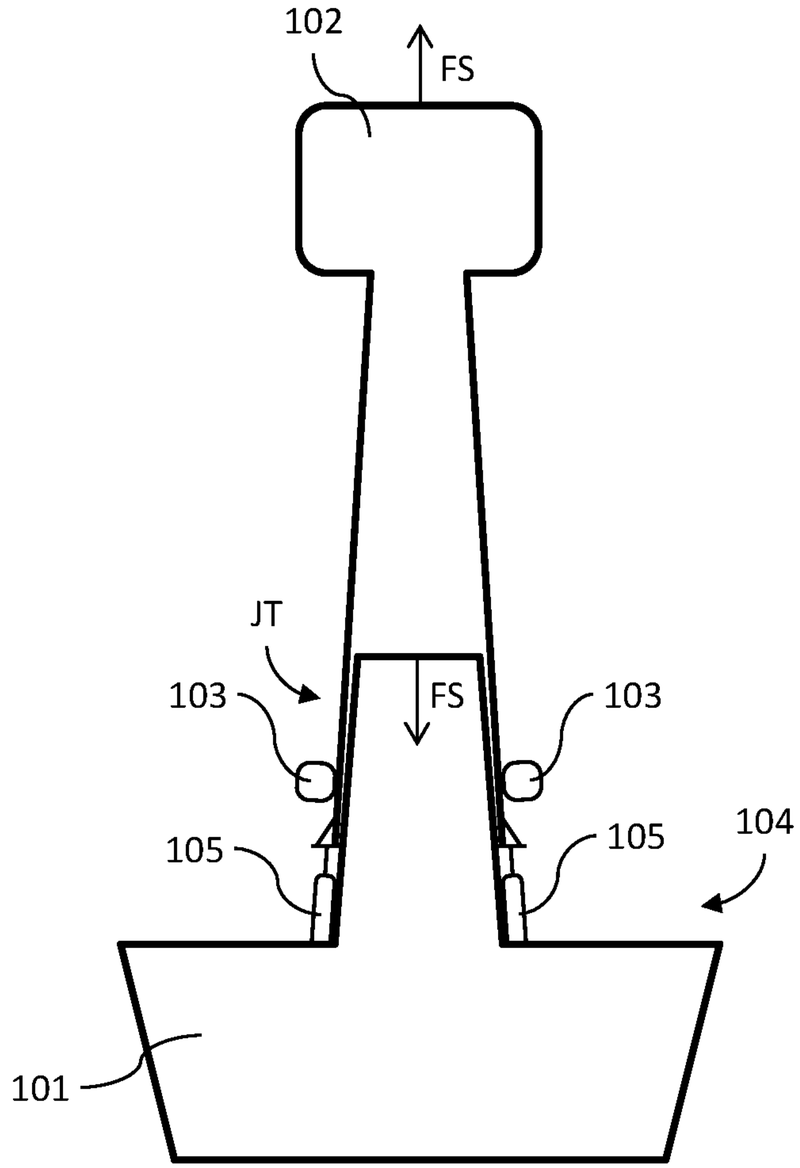

Fig. 1b

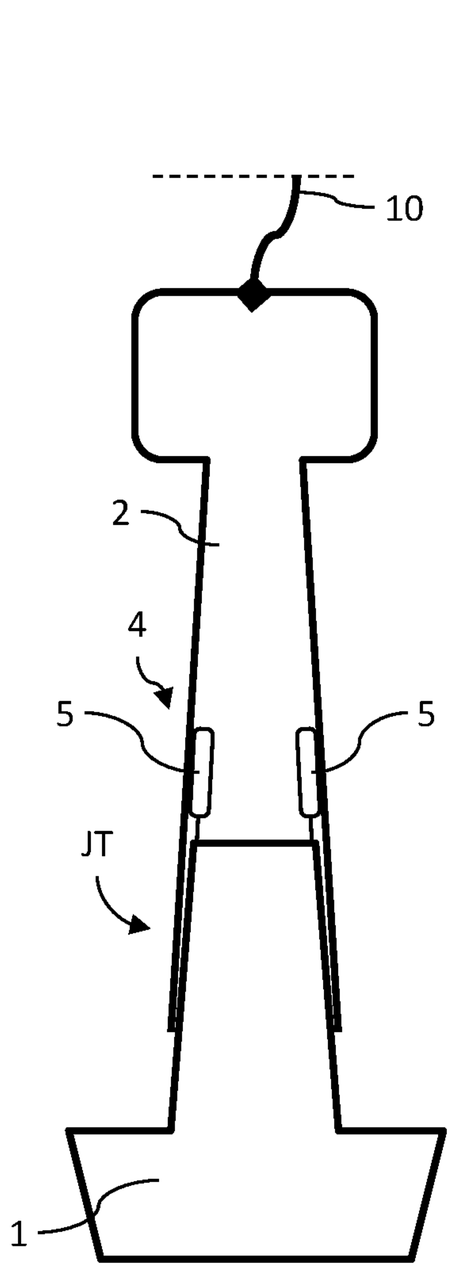

Fig. 2a

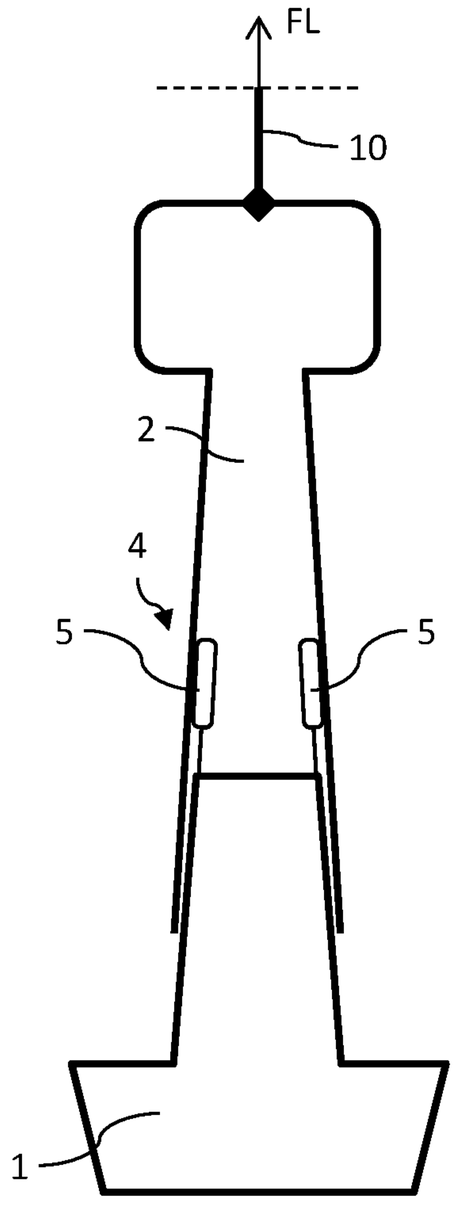

Fig. 2b

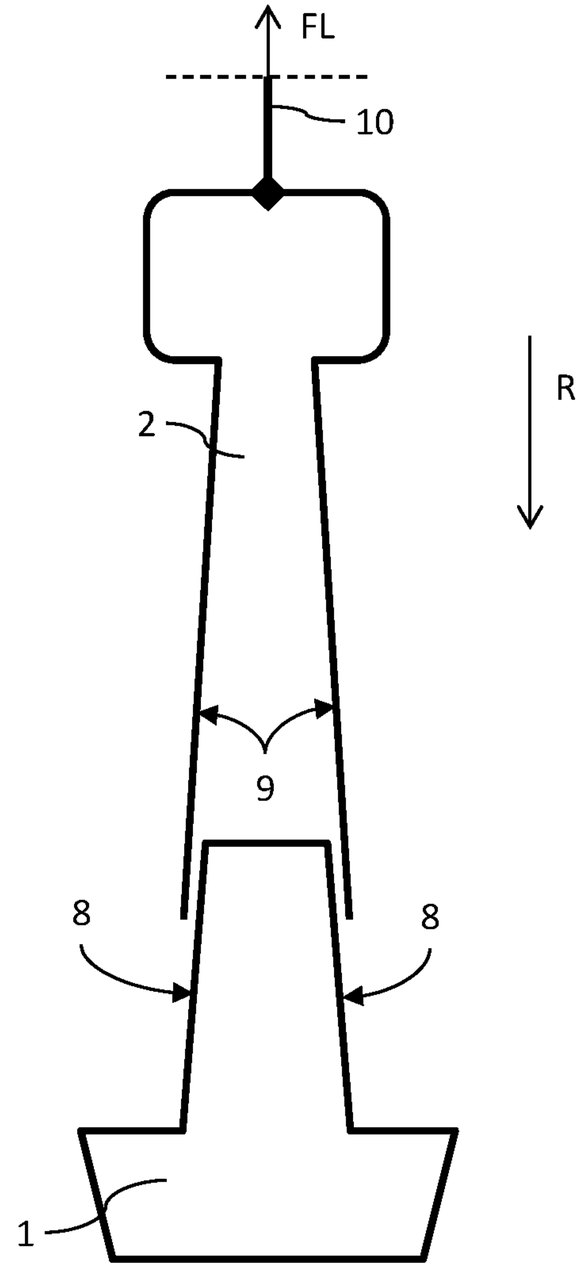

Fig. 2c

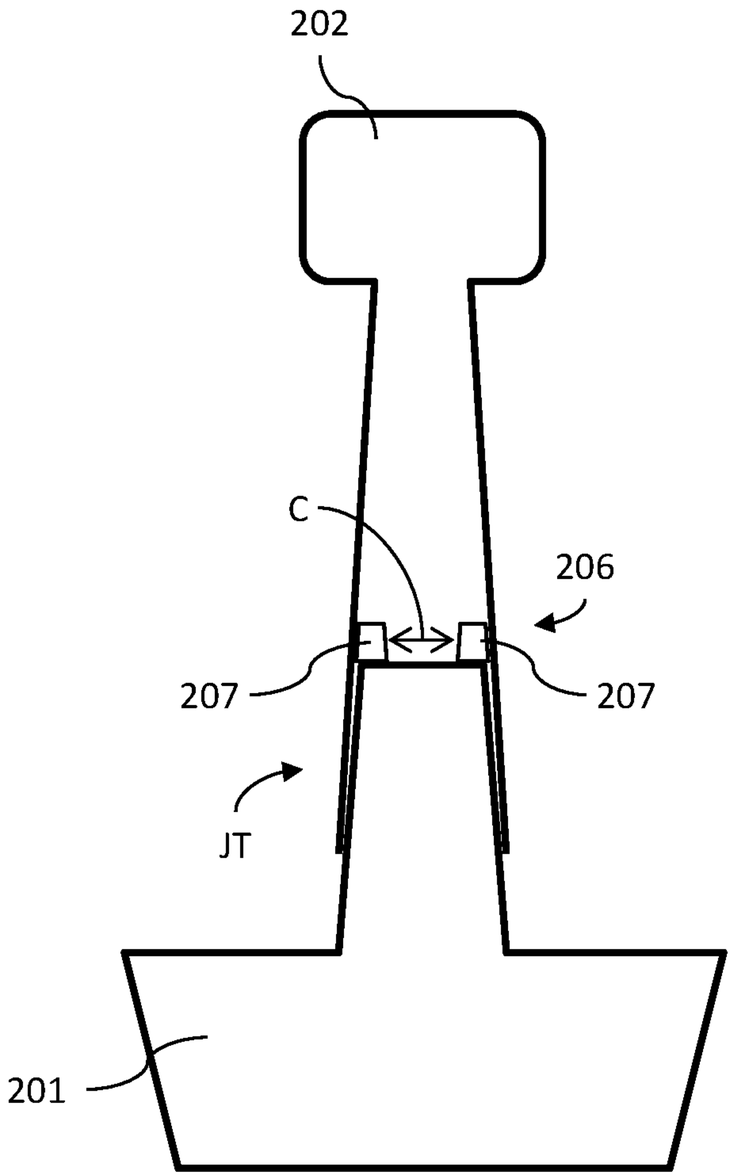

Fig. 3a

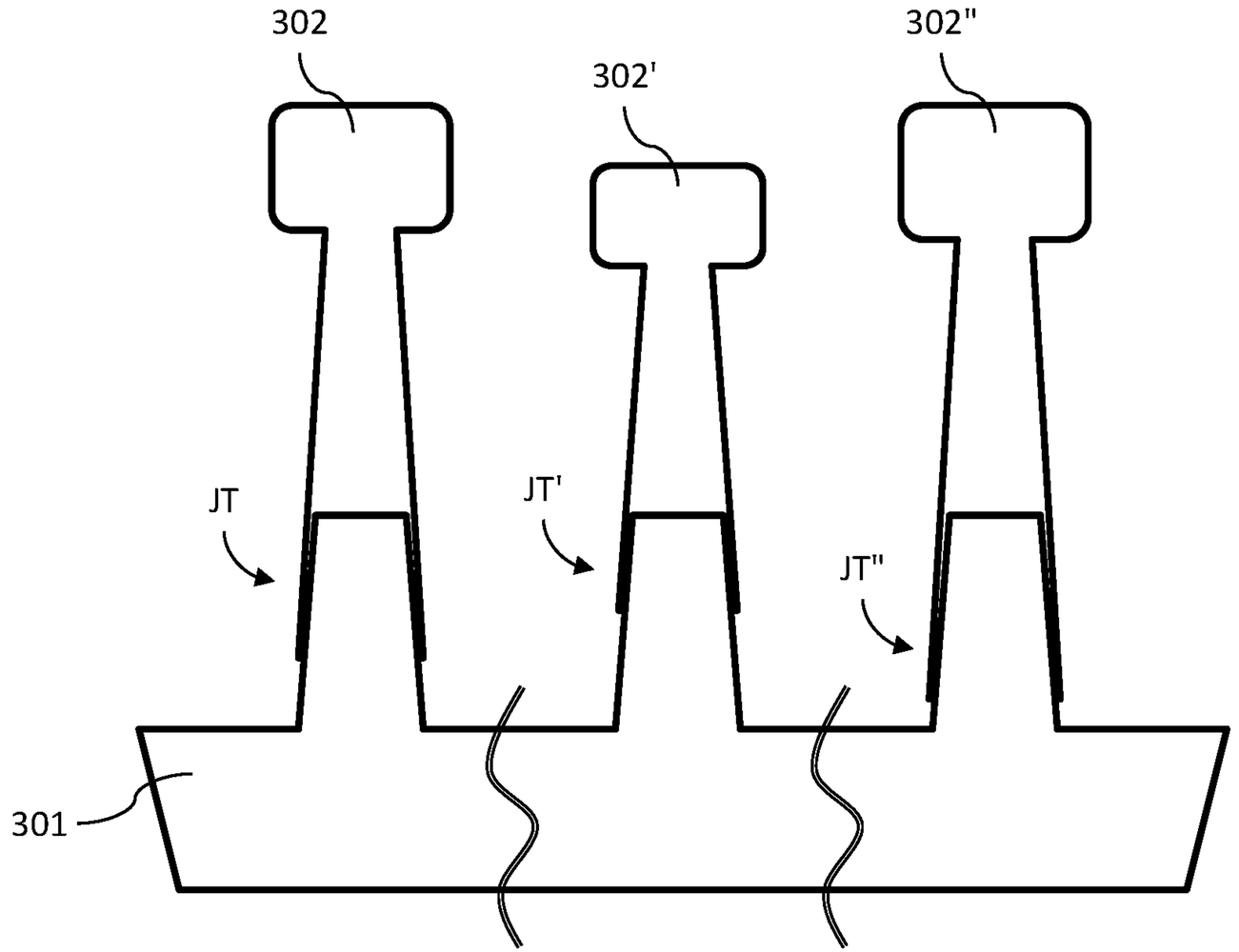

Fig. 3b

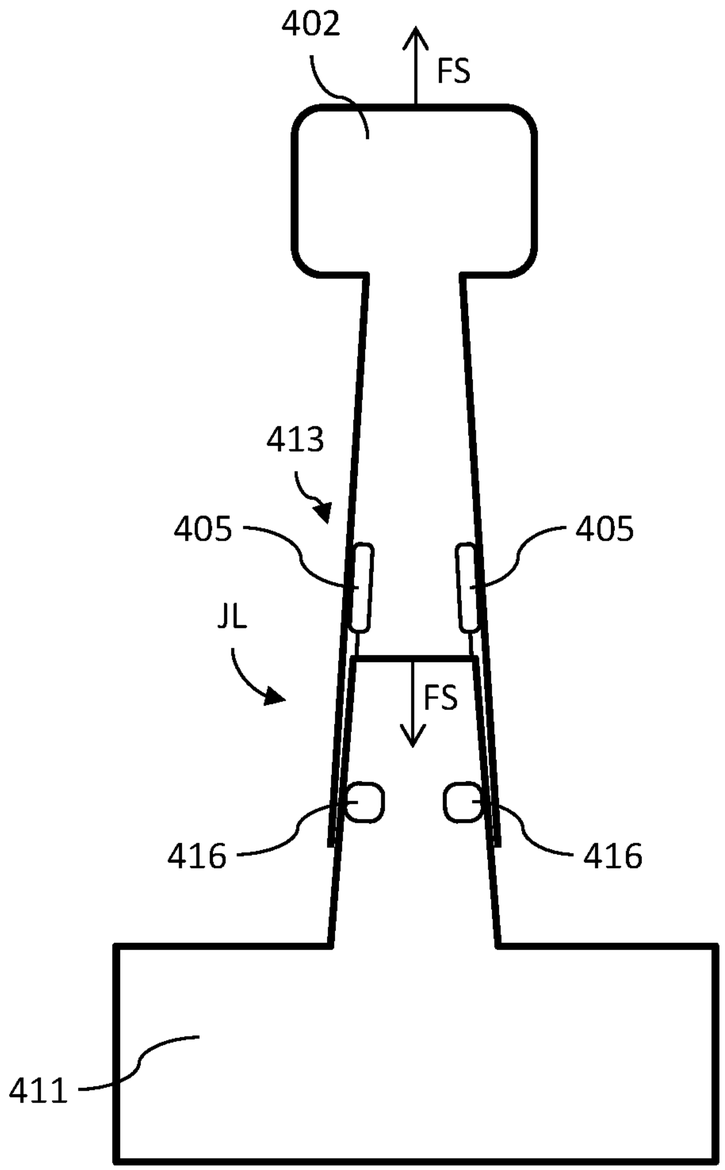

Fig. 4a

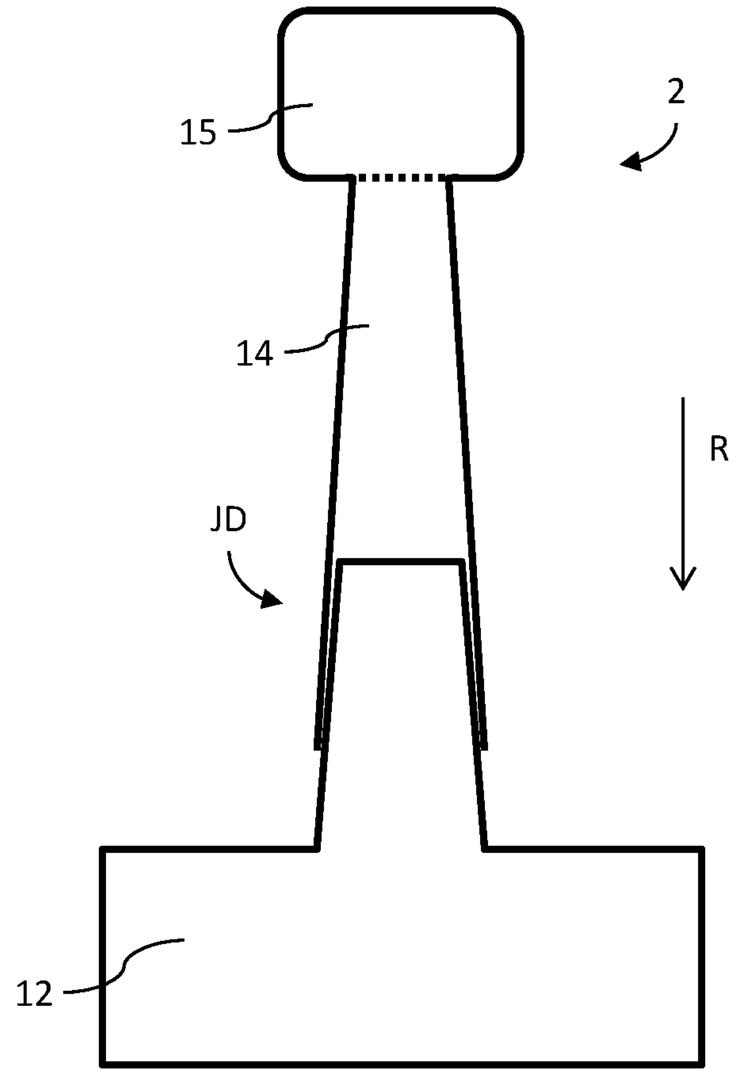

Fig. 4b

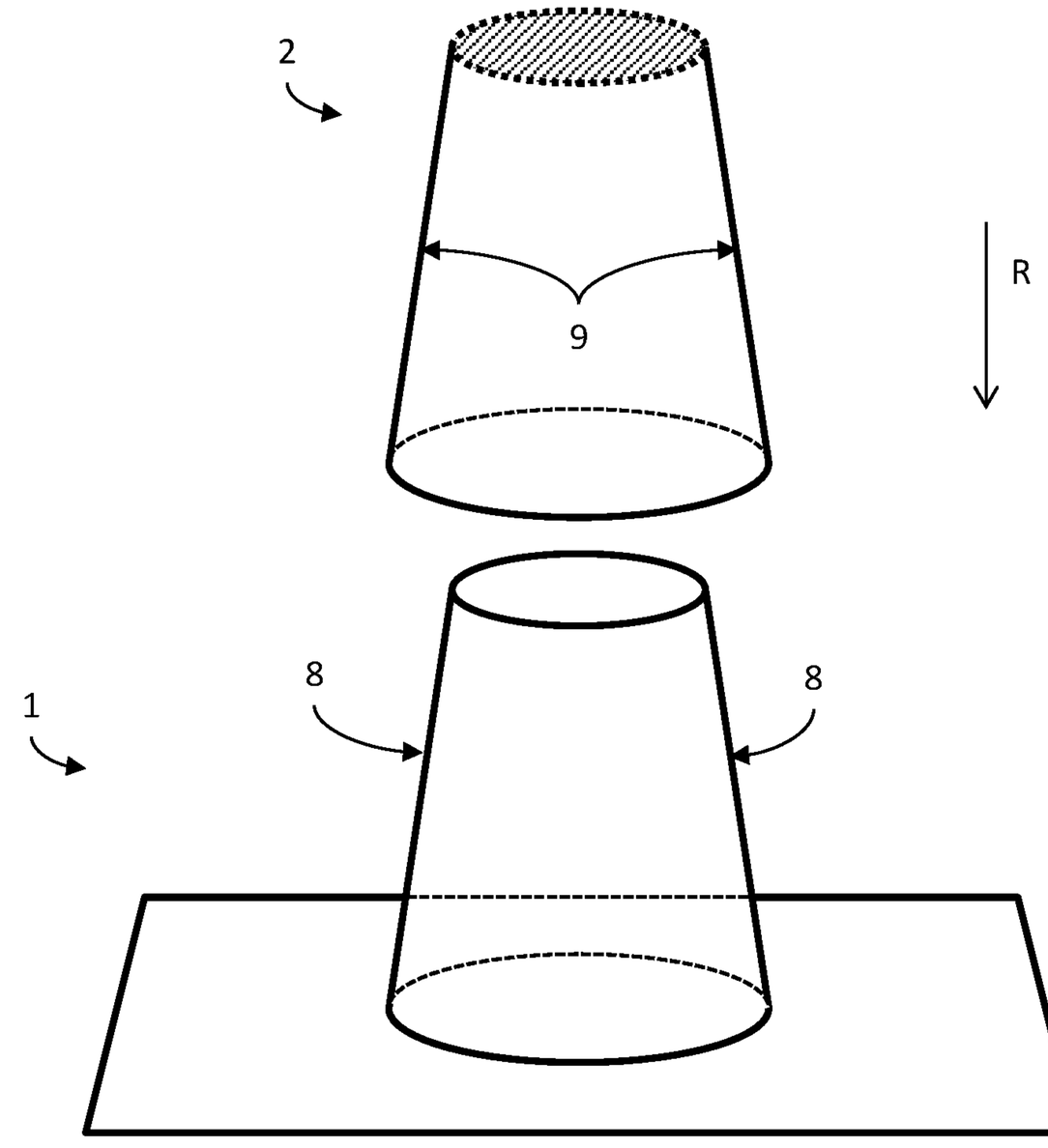

Fig. 5

SAMENWERKINGSVERDRAG (PCT)

RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

IDENTIFICATIE VAN DE NATIONALE AANVRAGE	KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE
	P123711NL00
Nederlands aanvraag nr. **2023699**	Indieningsdatum **23-08-2019**
	Ingeroepen voorrangsdatum
Aanvrager (Naam) **Delft Offshore Turbine B.V.**	
Datum van het verzoek voor een onderzoek van internationaal type **21-12-2019**	Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr. **SN75133**

I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)

Volgens de internationale classificatie (IPC)

Zie onderzoeksrapport

II. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimumdocumentatie

Classificatiesysteem	Classificatiesymbolen
IPC	**Zie onderzoeksrapport**

Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

III.	☐	**GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES**	(opmerkingen op aanvullingsblad)
IV.	☐	**GEBREK AAN EENHEID VAN UITVINDING**	(opmerkingen op aanvullingsblad)

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2023699

A. CLASSIFICATIE VAN HET ONDERWERP
INV. B63B35/00 B63B77/10 F03D13/40
ADD.

Volgens de Internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC.

B. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte miminum documentatie (classificatie gevolgd door classificatiesymbolen)
B63B E02C E02B F03D

Onderzochte andere documentatie dan de mimimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden)
EPO-Internal, WPI Data

C. VAN BELANG GEACHTE DOCUMENTEN

Categorie °	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
X	GB 2 454 585 A (FREYSSINET [FR]) 13 mei 2009 (2009-05-13)	1,2,4-8, 13-16, 18, 21-23, 25,26,28
Y	* bladzijde 7, regel 1 - regel 13 *	9-12
A	* bladzijde 11, regel 4 - regel 6; figuren 1-3,7 *	3,17,19, 20,24,27

Y	WO 2018/070868 A1 (DELFT OFFSHORE TURBINE B V) 19 april 2018 (2018-04-19) * figuren *	9-11

Y	WO 2014/204372 A1 (VINGKRAFT AB [SE]) 24 december 2014 (2014-12-24) * bladzijde 14, regel 19 - bladzijde 15, regel 2; figuren 5a, 5b *	12

	-/--	

[X] Verdere documenten worden vermeld in het vervolg van vak C.

[X] Leden van dezelfde octrooifamilie zijn vermeld in een bijlage

° Speciale categorieën van aangehaalde documenten

"A" niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft

"D" in de octrooiaanvrage vermeld

"E" eerdere octrooi(aanvrage), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven

"L" om andere redenen vermelde literatuur

"O" niet-schriftelijke stand van de techniek

"P" tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur

"T" na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvrage, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding

"X" de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur

"Y" de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht

"&" lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid	Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type
7 april 2020	
Naam en adres van de instantie European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	De bevoegde ambtenaar Schmitter, Thierry

1

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2023699

C.(Vervolg). VAN BELANG GEACHTE DOCUMENTEN

Categorie °	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
X	WO 2016/063210 A1 (GEOSEA N V [BE]) 28 april 2016 (2016-04-28) * bladzijde 9, regel 14 - regel 33; figuren 6,7 * -----	1,2,4-6, 8,9,12, 14-16, 18,23, 25,26,28
A	EP 2 905 217 A1 (IBERDROLA INGENIERÍA Y CONSTRUCCIÓN S A U [ES]) 12 augustus 2015 (2015-08-12) * figuren * -----	1-28

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Informatie over leden van dezelfde octrooifamilie

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2023699

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
GB 2454585 A	13-05-2009	FR 2923454 A1	15-05-2009
		GB 2454585 A	13-05-2009
		GB 2465517 A	26-05-2010
		US 2009191002 A1	30-07-2009
WO 2018070868 A1	19-04-2018	AU 2017343328 A1	23-05-2019
		EP 3523536 A1	14-08-2019
		US 2020040541 A1	06-02-2020
		WO 2018070868 A1	19-04-2018
WO 2014204372 A1	24-12-2014	GEEN	
WO 2016063210 A1	28-04-2016	EP 3209548 A1	30-08-2017
		PT 3209548 T	07-01-2020
		WO 2016063210 A1	28-04-2016
EP 2905217 A1	12-08-2015	EP 2905217 A1	12-08-2015
		ES 2453766 A1	08-04-2014
		JP 6360060 B2	18-07-2018
		JP 2015530315 A	15-10-2015
		PT 2905217 T	11-05-2017
		US 2017120993 A1	04-05-2017
		WO 2014057156 A1	17-04-2014

WRITTEN OPINION

File No.	Filing date *(day/month/year)*	Priority date *(day/month/year)*	Application No.
SN75133	23.08.2019		NL2023699
International Patent Classification (IPC) INV. B63B35/00 B63B77/10 F03D13/40			
Applicant Delft Offshore Turbine B.V.			

This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the application
- ☒ Box No. VIII Certain observations on the application

	Examiner
	Schmitter, Thierry

Application number

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Box No. I Basis of this opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ on paper

   ☐ in electronic form

   c. time of filing/furnishing:

   ☐ contained in the application as filed.

   ☐ filed together with the application in electronic form.

   ☐ furnished subsequently for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty	Yes:	Claims	3, 10, 11, 13, 17, 19-22, 24, 27
	No:	Claims	1, 2, 4-9, 12, 14-16, 18, 23, 25, 26, 28
Inventive step	Yes:	Claims	3, 17, 19, 20, 24, 27
	No:	Claims	1, 2, 4-16, 18, 21-23, 25, 26, 28
Industrial applicability	Yes:	Claims	1-28
	No:	Claims	

2. Citations and explanations

see separate sheet

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Box No. VIII Certain observations on the application

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following document:

D1 GB 2 454 585 A (FREYSSINET [FR]) 13 mei 2009 (2009-05-13)

D2 WO 2018/070868 A1 (DELFT OFFSHORE TURBINE B V) 19 april 2018 (2018-04-19)

D3 WO 2014/204372 A1 (VINGKRAFT AB [SE]) 24 december 2014 (2014-12-24)

D4 WO 2016/063210 A1 (GEOSEA N V [BE]) 28 april 2016 (2016-04-28)

The present application does not meet the criteria of patentability, because the subject-matter of claim 1 is not new.

D1 discloses in the wording of claim 1 (in Dutch) a *Systeem voor het transporteren van een offshore-structuur, waarbij het systeem omvat:*

- een transportinrichting (2), in het bijzonder een vaartuig of een voertuig, die is ingericht om een offshore-structuur (1) te ontvangen en om een slipverbinding (see figs, 1, 2) te vormen met een slipverbindingssectie (3) van een ontvangen offshore-structuur (1),

waarbij het systeem is ingericht om een vrijgeefbare stand in te gaan vanuit een vasthoudstand, waarbij in de vrijgeefbare stand de slipverbindingskracht van de door de transportinrichting (2) en de offshore-structuur (1) gevormde slipverbinding (see figs, 1, 2) kleiner is dan die kracht (7) in de vasthoudstand (7).

It is to be noted that due to the broad formulation of claim 1, all features of claim 1 are also disclosed by D4.

D1 also discloses all features of corresponding method claim 16 (in Dutch): *Een werkwijze voor het transporteren van een offshore-structuur, de werkwijze omvattende:*

- het ontvangen van een offshore-structuur (1) op een transportinrichting (2) en het vormen van een slipverbinding (see figs, 1, 2) tussen de transportinrichting (2) en de ontvangen offshore-structuur (1);

- het verminderen van een slipverbindingskracht (7) van de slipverbinding (see figs, 1, 2); en

- het vrijgeven van de offshore-structuur (1) van de transportinrichting (2) na het verminderen van de slipverbindingskracht (7).

Dependent claims 2, 4-15, 18, 21-23, 25, 26, 28 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of novelty and/or inventive step, see:

D1 disclosing features of claims 2, 4-8, 14, 18, 23, 25, 26, 28, therefore those claims are not novel.

D2 disclosing the features of claims 9-11 as providing the same advantages as in the present application, the skilled person would therefore regard it as a normal /design / option to include these features in the system described in D1 in order to solve the problem posed. Those claims are therefore not inventive.

D3 disclosing the features of claim 12 as providing the same advantages as in the present application, the skilled person would therefore regard it as a normal /design / option to include this feature in the system described in D1 in order to solve the problem posed. This claim is therefore not inventive.

The combination of the features of dependent claims 3, 17, 19, 20, 24, 27 is neither known from, nor rendered obvious by, the available prior art. The reasons are as follows:

A system comprising a vibration generator to separate the offshore structure from its support on the transport vessel enables to reduce the force exerted to lift the offshore structure from its support.

D1 proposes to reduce the clamping forces holding the offshore structure within the floating elements.

In general, a more precise definition in claim 1 of the transport system in combination with the offshore structure could overcome the above-mentioned objection of lack of novelty. In particular, specifying that the slip joint connection (JT) between the offshore structure and the transport system is achieved under influence of the self weight of the offshore structure could lead to an allowable claim 1. The same reasoning applies to the corresponding method claim 16.

The relevant background art disclosed in D1, D3 could be mentioned mentioned in the description.

Re Item VIII

The extensive use of the terms "in het bijzonder", "bijvoorbeeld, b.v.", "bij voorkeur" throughout the claims renders the definition and scope of the claims vague and unclear and leaves the reader in doubt as to the necessity of the technical feature to which it refers, thereby rendering the definition of the subject-matter of said claim unclear.